DETERMINANTS AND MEASUREMENT OF FOOD INSECURITY IN NIGERIA: SOME EMPIRICAL POLICY GUIDE

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Abstract

This study aims at identifying and analyzing food security measures in Borno State, Nigeria. A multi-stage sampling technique was applied on 1,200 households. Cost-of-Calories (COC) method and *Logit* model are used as analytical techniques for the study. Based on the recommended daily energy levels of 2,250 kcal, food insecurity line (s) for the households is N23, 700.12 or US $176.87 per adult equivalent per year. Over 58% of the sample households are therefore food insecure. Major determinants of this food insecurity factors are, household size, gender, educational level, farm size and type of household farm enterprise. Policy measures directed towards the provision of better family planning should be given adequate attention and priority by the Government in addition to improved access to education, credit facility and agricultural extension services by rural households.

Keywords: Determinants, Food Security and Policy Guide.

I Introduction

The Federal Government of Nigeria prepared and adopted in 2001 a new national Rural Development Strategy (RDS). Its aim is to improve livelihoods and food security through a process of community-based agriculture and rural development. The strategy advocates a community-driven development (CDD) approach, which ensures the active participation of the beneficiaries and Local Governments at all levels of decision-making. It is within this development framework that the Canadian International Development Agency (CIDA) approved in September 2003 funding to the agricultural and rural development sector by supporting in Borno State, Nigeria,

the proposal for *Promoting Sustainable Agriculture in Borno State, Nigeria (PROSAB).*

The Project is being implemented in the agro ecological zones of the Southern Guinea, Northern Guinea and Sudan Savannas of Borno State, Nigeria. The goal of the project is to improve food security and reduce environmental degradation. The purpose is to improve sustainable agricultural production through the transfer of improved agricultural technologies and management practices, improved market access, and enhance a more enabling policy environment.

2. Study objectives

The objectives of this study are to:

i) identify and analyse the food security measures of project beneficiaries; and

ii) prepare check list of rural security measures for assessing food security status in the LIFDC.

3. Study area and sampling technique

The study is carried out in Borno State, located in northeast Nigeria covering an area of 69,435 km^2. It has 3.64 million people 2004[1] distributed into four agro-ecological zones – southern and northern Guinea Savanna, Sudan Savanna, and the sahel

The data were obtained through a household survey conducted between June and August 2004. The main instruments for data collection were well-structured questionnaires administered on households.

One thousand two hundred households were selected for the study through a multi-stage sampling approach. First, four Local Government Areas (LGAs) were selected and from the four LGAs, thirty communities were purposively selected.

Finally, 1,200 households were selected the thirty communities by randomized sampling design.

4. Analytical technique

Cost-of-calories (COC) and logit model are the analytical techniques used for the study. This method has been applied to several studies, whose main focus was on food security (Greer and Thorbecke, 1984; Hassan and Babu, 1991; Makinde, 2000). Therefore, following their approach, the food insecurity line is given as:

$$LnX=a+bC \quad (1)$$

Where X is the adult equivalent food expenditure (in Naira) and C is the actual calorie consumption per adult equivalent of a household (in kilocal). The calorie content of the recommended minimum daily nutrients level (L) (FAO, 1982; Food Basket, 1995) was used to determine the food insecurity line Z using the equation:

$$S=e^{(a+bL)} \quad (2)$$

Where:

S= the cost of buying the minimum calorie intake (food insecurity line); a and b= parameter estimates from equation 1; L= recommended minimum daily energy (calorie) level[1]

Based on the S calculated, households were classified as food secured or food insecure, depending on which side of the line they fell. Due to differences in household compositions in terms of age and sex, there was a need to calculate the levels of expenditure required by households with different compositions. One of the easiest ways to achieve this was to divide the household expenditure by household

[1] The FAO recommended minimum daily energy requirement per adult equivalent is 2250kcal

size to get the per capita expenditure as used by the World Bank (1996) and several other studies. The household expenditure was decomposed on per adult equivalent.

Empirical model for the determinants of food insecurity

A Logit model was used to examine the determinants of household food insecurity, which is specified as:

$$Y_1 = g(I_1) \ldots\ldots. \quad (3)$$

$$I_i = b_0 = \sum_{j=1}^{n} b_j X_{ji} \ldots\ldots.. \quad (4)$$

Where,

Y_i is the observed response for the ith observation (i.e. the binary variable, Y_i=0 for food secure household and Y_i =1 for a food insecure household). I_i is an underlying and unobserved stimulus index for the i^{th} observation (conceptually, there is a critical threshold (I_i^*) for each household; if $I_i < I_i^*$ the household is observed to be food secure, if $I_i \geq I_i^*$ the household is observed to be food insecure). g is the functional relationship between the field observations (Y_i) and the stimulus index (I_i) which determines the probability of being food secure.

The logit model assumes that the underlying stimulus index (I_i^*) is a random variable, which predicts the probability of being food insecure. Therefore, for the ith observation (a household):

$$I_i = \text{In} \frac{P}{1-P_i} = b_0 + \sum_{j=1}^{n} \text{bj}\, X_{ji} \ldots\ldots\ldots.. \quad (5)$$

The relative effect of each explanatory variable (X_{ji}) on the probability of being food

insecure is measured by differentiating with respect to $X_{ji,}$ using the quotient rule (Green and Ng'ong'ola 1993):

$$\frac{dP_j}{dX_{ji}} = \left[\frac{e^{Ii}}{(1+e^{Ii})^2}\right]\left[\frac{I_i}{X_{ji}}\right] \quad \text{(6)}$$

Where,

Pi = the probability of an i^{th} household being food insecure

Xi=Vector of explanatory variables which are defined below:

AGE= Age of head of household (Years); FARMINC= Farm income of a household per annum (₦)[3]; FARMSZ= Farm size of a household (ha); HHSZ= Household size of a farmer; FAMEX= Farming experience (years); COOP =Co-operative membership; (D=1, if yes; D=0, otherwise); EDUC= Level of education of a farmer (years);DIST = Distance to input source (km); GEND=Gender of head of household (D = 1 for; male, D = 0 for female)[4]; DIVER=Diversification index (Using Herfindhal index); ASSETS=Total value of household disposable assets (₦); FARMEN=Household production enterprise (D = 1 if farm enterprises alone, otherwise D = 0); COOP= Membership of cooperative societies D = 1 if yes, otherwise D = 0); CREDIT=Household head's access to credit facilities (D = 1 if yes, otherwise D = 0)

CDR= Child dependency ratio; EXTAG=Household head's access to extension agents (D = 1 if yes, otherwise D = 0); EXCOM=Extent of produce commercialization (proportion of farm produce sold); REMIT=Total value of

[2] One dollar is equivalent to ₦134.00

3 D in the description of variables stands for dummy

remittances received per adult equivalent per annum by household (₦); HLAB=Hired labour (mandays); FLAB= Family labour (mandays)

The diversification extent (DIVER) was measured using Herfindal index defined as:

$$DIVER = \sum_{i=1}^{n} R_i^2 \quad \ldots\ldots\ldots\ldots\ldots \quad (7)$$

Where,

$$R_i = \frac{A_i}{\sum_{i=1}^{n} A_i} \quad \ldots\ldots\ldots \quad (8)$$

A_i = share of farm revenue from enterprise i cultivated by the household.

n = number of enterprises owned by household.

5. Results and Discussions

The summary statistics of Food insecurity measures among the households are presented in Table 1. Based on the recommended daily energy levels (L) of 2250 Kcal, the food insecurity line (S) for the households is found to be ₦ 63.71 per day per adult equivalent (₦1975.01 per month per adult equivalent). On an annual basis, this is equivalent to ₦ 23700.12 per adult equivalent. From the food insecurity line, it was shown that 58% of the sampled households are food insecure by headcount (H). Furthermore, the aggregate income gap (G) of –375.74 indicates the amount (₦375.74) by which the food insecure households are away from meeting their monthly basic food requirements.

Table 1: Summary statistics and food insecurity measures among sampled households

Variable	Value
Cost-of-calories equation	Constant= 4.154 (0.534)
	Slope coefficient=0.0019 (0.0004)
FAO recommended daily energy levels (L)	2250 Kcal
Food insecurity line *Z*: cost of the minimum energy requirements per adult equivalent	₦ 63.71 per day
	₦1975.01 per month
	₦ 23700.12 per year
Head count (H)	0.58
Aggregate income gap (G)	-375.74

Figures in parenthesis are t-values

Source: Calculations from OLS estimates and cost-of-calories equation.

Determinants of Household Food Insecurity

The results of the Logit regression are presented in Table 2.

Table 2: Result of the Logit function for Household Food Insecurity Status

Variable	Parameter Estimate	t-value
Constant	2.388	1.373
HHSZ	-0.014**	-2.031
GEND	0.946*	2.097
EDUC	-0.8957**	-3.226
CDR	-0.003	-0.054
RFETE	1.317	1.367
FARMSZ	-0.1184*	-1.899
CREDIT	-0.009	-0.403
FARMEN	1.025*	1.743
FLAB	-0.471	-0.345
HLAB	0.018	0.088
PERCUL	0.651	1.56
RQPQC	-0.220**	-3.766
DIVER	-0.234	-1.396
EXCOM	0.261**	2.946
EDUCEX	0.034**	3.860
EXTAG	-0.1308**	-2.623
COOP	-0.034**	-3.928
ASSETS	-0.0E-04**	-4.396
REMIT	-0.5E-04 **	-0.086

Household size (HHSZ): The coefficient of the variable is significant at 1% and carries a negative sign. This shows that household with large sizes had higher possibility of being food insecure than those with smaller size and vice versa in the project area. The larger the number of less active adults (e.g. old or unemployed) and children is, the higher the burden of the active members in meeting the cost of minimum household nutrition would be and, hence, the higher the level of food insecurity, and vice versa.

Gender of the head of household (GEND): The coefficient is significant at 5% and shows a positive relationship with household's food insecurity status. Households headed by female have higher probability of being food insecure in the project area.

Educational level of head of household (EDUC): The coefficient of this variable is significant at 1% and carries a negative sign suggesting that the higher the educational level of a head of household is, the more food secure the household and vice versa. This is expected because such households are assumed to have better food management techniques that will ensure equitable and all round supply of food.

Farm size (FARMSZ): The coefficient of the variable is significant and exhibits a negative relationship with the food insecurity status of the household, showing that households with larger farm sizes are more food secure than those with smaller sizes and vice versa.

Type of household enterprises (FARMEN): Households who are into farming alone had higher probability of food insecurity than those that have diversified from farming into some other non-farm enterprises and vice versa. This is plausible because households that have other sources of income in addition to farming are more resilient in times of food crisis that those that are into farming alone.

Ratio of quantity produced to the ratio of quantity consumed (RQPQC): The coefficient is significant at 1% and shows a negative correlation with food insecurity. This shows that the higher the ratio is, the lower the probability of food insecurity and vice versa.

Extent of agricultural output commercialization (EXCOM): The coefficient of the variable is significant at 1% and exhibits a positive correlation to food insecurity suggesting that the higher the extent of commercialization the higher the probability of food insecurity and vice versa. This is contrary to a priori expectation because most of the household produce at a scale meant for home consumption and are forced to sell when a need arises, thus depleting the stock for home consumption and thereby exposing the household to food insecurity.

Expenditure on education (EDUCEX): The coefficient of the variable is significant and carries a positive sign, suggesting that the higher a household's expenditure is on education, the higher the probability of food insecurity and vice versa. This is plausible as education of children is a priority area, which the households could deny itself some comfort in the short-run. Households sometimes sell out of their food reserve to provide for this need and as such expose themselves to food shortages.

Household's access to extension agent (EXTAG): The coefficient of the variable is significant at 1% and has a negative relationship with the food insecurity status of households. This implies that households that had access to extension agents have higher probability of being food secure than those that did not have access to extension agent and vice versa. This is because access to extension agents enhances the chances of households having access to better crop production techniques,

improved input as well as other production incentives and these go to affect their output vis-à-vis their food security status.

Household heads' membership of cooperative societies (COOP): The coefficient of the variable is significant at 1% and carries a negative sign, implying that households whose heads were members of cooperative or other farmers organizations had higher probability of being food secure than those whose heads were. This can be closely linked to the beneficial effects of their memberships in terms of production and other welfare enhancing services that these cooperative or other farmers' associations offer.

Value of household assets (ASSETS): Household assets holding is considered as one of the measures of household resilience, which cushion the effects of adverse circumstances such as crop failure, drought, etc on household food security. It is believed that some of the assets could be disposed of in terms of pressure. The coefficient of the variable was significant and carries a negative sign, suggesting that the higher the value of household assets is, the lower the probability of food insecurity.

6 Policy Recommendations

The following policy implications and recommendations are suggested for reduction in food insecurity.

Policy measures directed towards the provision of better family planning to reduce household size should be given adequate attention and priority by the government. Education that encompasses all aspects of training and which brings about attitudinal changes is important for households in the project area. Also, strategies for an effective community participation in the design of concepts and

messages aimed at imparting knowledge about family planning to the households are recommended.

Second, there is the need for policy, which shall promote formal education as a means of enhancing efficiency in food crop production over the long-term period. In the short-term, informal education could be effective, especially when targeted at farmers who have had limited formal educational opportunities.

A policy which provides adequately trained and equipped extension workers for disseminating improved agricultural technologies has the potential of raising efficiency in food crop production, which enhances food security.

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