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RURAL HOUSEHOLD PERCEPTION AND RESPONSE STRATEGIES TO SEASONAL FOOD SHORTAGES IN THE NORTHERN GUINEA SAVANNA OF NIGERIA

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ABSTRACT

Farming households in the Savanna belt of Nigeria usually experience incidence of hunger 2-3 months after harvest. The food shortage experienced by the households becomes harsh by January /February and the shortage becomes severe by March /June. This cycle of seasonal food shortage by farming households keeps occurring yearly. This paper therefore, investigated the farming household perception and response strategies to the seasonal food shortages in the Northern Guinea Savanna of Nigeria. The study was carried out in four villages randomly selected from two Local Government Areas in Kaduna and Katsina States. A total of 230 farming households were interviewed. The double-hurdle model was employed in the analysis. The result showed that more than 70 percent of households experience severe food shortage and the factors that influenced household perception of food shortage are different from factors that influence the household response strategies to food shortage.

Keywords: Double-Hurdle, Household, Food Shortage, Perception, Response Strategy

INTRODUCTION

The 1996 World Food Summit (WFS) brought to centre stage in the development debate the issue of hunger and food insecurity as both cause and effect of poverty and slow growth. In the wake of this new push, reducing hunger and food insecurity also became one of the Millennium Development Goals (MDGs), bringing with it the necessity for individual countries to measure progress in achieving the proposed targets (Migotto, Davis, Carletto, & Beegle, 2007). The conceptualization of food security has evolved over time, partly preceding and partly paralleling similar evolutions in poverty. Since the World Food Conference (WFC) of 1974, food security paradigms have shifted from the global and national level to the household and individual level; from a 'food first' to a 'livelihood' perspective and from objective indicators to subjective perceptions (Maxwell, 1996).

In many parts of Nigeria, food production has not kept pace with population requirement (Ibrahim, Uba-Eze, Oyewole, & Onuk, 2009). According to FOS (1999), per capita food production has fallen at an average annual rate of one per cent (1%) or more over the period of 16 years successively. The percentage of Nigerian households that are not food secured has risen from 18 percent (18%) in 1986 to 40 percent (40%) by 1998 (NNPC, 2001).

Farming households in the Savanna belt of Nigeria usually experience incidence of hunger 2-3 months after harvest. These households according to Damisa *et al*., (2011) hardly produce to meet domestic food demand, yet they sell most of their farm produce at harvest time specifically around October-December to pay back loans collected and equally meet with other pressing domestic obligations. The food shortage experienced by the households becomes harsh by January /February and the shortage becomes severe by March /June. This cycle of seasonal food shortage by farming households

keeps occurring yearly. This year (2011), however, as a result of flooding and drought in some parts of the Savanna, the hungry season became more pronounced from the previous month of September and by now the coping strategies adopted by households show growing desperation.

Moreover, the lack of practice of sustainable agriculture has increased the woes of the farming households. Agriculture in Nigeria is still at the rudimentary stage despite a number of interventions. Majority of the farmers are still tied to traditional crude implements and producing at the subsistence level. They cultivate their farm land with the same crop types year in year out with inadequate cultivation management. The end result is that, farm lands are impoverished producing at very poor capacity. Farming households therefore find it difficult to produce to meet with domestic with demand, thereby making worse the hunger of the farming households. This paper therefore, examined the state of food security and response strategies of the rural farming households to food shortages in the Northern Guinea Savanna of Nigeria.

METHODOLOGY

***Study area*:** The study was carried out in Tudun Tsohuwa, Turunku (Kaduna State), Jiba and Dandume (Katsina State) villages in the Northern Guinea Savanna of Nigeria. The average rainfall distribution is 1524 mm /year which favour cultivation of food crops and animals. The cropping pattern is in sole and mixed cropping. The major crops grown are: maize, sorghum, millet, rice, cowpea, yams, cassava, ginger, potatoes, vegetables and tree crops such as mango, citrus, guava and sugar cane and banana. Livestock types include: cattle, sheep, goat, rabbit, poultry and swine.

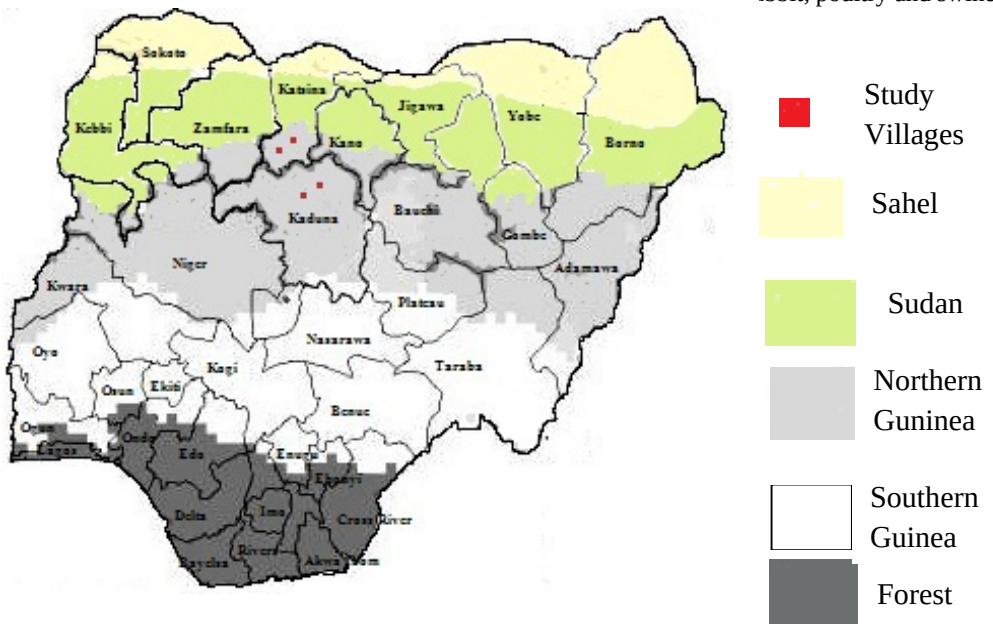

Fig 1: Map of Nigeria Showing the Study Area

***Data collection*:** Data collection for this study was obtained from household heads through the administration of questionnaire on 230 respondents randomly selected in the four villages. The data collected included socio-economic characteristics, perception of food shortages and coping strategies.

ANALYTICAL TECHNIQUE

CONCEPTUAL FRAMEWORK AND MODEL SPECIFICATION

The study is based on cross sectional data. As is typical of such data, some households have no observed response to food shortage. The application of the standard regression analysis can be misleading under this condition. Zero observations on perception of food shortage of the household may arise for a number of reasons. The household head may not perceive food shortage (participant) because of carefree attitude of certain individuals to weighing and resolving issues, inability to perceive and indecision attitude on perception indices. Alternatively, some household heads may be perceivers of food shortage in their respective households (potential perceivers) who chose not to respond at the current level of available food in their households. For most of cross-sectional consumption data zero consumption is one problem for any modelling effort to address.

One approach would be to use the Tobit model. However, a disadvantage of that model is that all zero observations on response strategies undertaken to combat the food shortage in the household are interpreted as corner solutions, i.e. the household is assumed to perceive the problem of food shortage (participation) but chooses not to respond at the current level of exogenous variables. A further restriction of the Tobit is that both the decision to perceive food shortage in the household and the level of response strategies undertaken to combat the household food shortage given the level of perception are determined by the same variables, and that a variable that influences the probability of the level of perception also influences the level of response strategies undertaken.

An alternative is to model as two separate decisions for the household: (i) whether or not to participate in ensuring household food security and (ii) the response strategies adopted by the participant in overcoming the perceived food shortage. There are two main reasons for separating these decisions. First, due to social or psychological drives, the household head may prefer not to engage in any response strategy whatever the values of exogenous variables. Second, a household head may be a potential perceiver of food shortage in the household but for certain levels of relevant variables, decide not to respond. The former represents abstention, the latter a corner solution.

Several studies have used binary choice models in determining perception and the response decisions where the perception and the response resulting from the perception were viewed as a single step process. In this study however, perception and response decisions their perception. Therefore perception and response are viewed as separate hurdles that needed to be crossed. As such, the double hurdle model was employed in the analysis of the data. The double hurdle model has been widely applied in agricultural technology adoption studies (Coady, 1995; Ghadim, Burton, & Pannell, 1999; Damisa, Abdulsalam & Ugbabe, 2007; Shiferaw, Kebede, & You, 2008) as well as consumer demand and market participation studies (Blaylock and Blissard, 1992; Garcia and Labeaga, 1996; Burton *et al*., 2000; Damisa and Hassan, 2009 and Komarek, 2010). There is however, paucity in literature in the application of the double hurdle model in perception and response studies.

The double-hurdle model was originally proposed by Cragg (1971) and it assumes that two separate hurdles must be crossed before a positive level of consumption can be observed. In the context of the household perception and response strategies analysis, the first hurdle involves the decision of whether or not the household is food secured (participation

decision). It is reasonable to assume that the choice to perceive food shortage in household by the household head is not only an economic decision, but also influenced by social and demographic factors which are independent of the number /type of response strategies adopted. The second hurdle concerns the type /number of response strategy to choose (response decision). A different latent variable is used to model each decision process. The Tobit model was employed to analyse the two hurdles. Following Matshe and Young (2004), the explicit expression of the models are as follows:

First Hurdle (Perception) Equation

$$Y_{i1}^{**} = Z_i^{/}\alpha + \nu_i \quad \text{..... (1)}$$

$$Y_{i1}^{*} = \begin{cases} 0 \ \text{ if } \ Y_{i1}^{**} \le K_1 \\ 1 \ \text{ if } \ K_1 < Y_{i1}^{**} < K_2 \\ 2 \ \text{ if } \ K_2 < Y_{i1}^{**} < K_3 \\ 3 \ \text{ if } \ Y_{i1}^{**} > K_3 \end{cases} \qquad (i = 1,2,3,\cdots,n)$$

Second Hurdle (Response) Equation

$$Y_{i2}^{**} = X_1'\beta + \mu_i \quad \text{.....(2)}$$

$$Y_{i2}^{*} = \begin{cases} 0 \ \text{ if } \ Y_{i2}^{**} \le P_1 \\ 1 \ \text{ if } \ P_1 < Y_{i2}^{**} < P_2 \\ 2 \ \text{ if } \ P_2 < Y_{i2}^{**} < P_3 \\ \vdots \quad \vdots \quad \vdots \quad \vdots \quad \vdots \\ 7 \ \text{ if } \ P_7 < Y_{i2}^{**} < P_8 \\ 8 \ \text{ if } \ Y_{i2}^{**} > K_3 \end{cases} \qquad (i = 1,2,3,\cdots,n)$$

Observed Equation

$$Y_i = Y_{i1}^{*} * Y_{i2}^{*} \quad \text{.....(3)}$$

where Y_{i1}^{*} is a latent variable describing the household's decision to assess the household food shortage, Y_{i2}^{*} is a latent variable describing the household response strategies to overcoming the food shortage, Y_i is the observed dependent variable (household response strategies to perceived food shortage). A positive level of food response Y_i is therefore observed only if the household is a potential perceiver of food shortage ($Y_{i1}^{*} \neq 0$) and actually chose a strategy to overcome the food shortage ($Y_{i2}^{*} \neq 0$). Z_i is a vector of variables explaining the perception decision, X_i is a vector of

.variables explaining the response decision, v_i and μ_i are the respective error terms assumed to be independent and normally distributed as $v_i \sim N(0,1)$ and $\mu_i \sim N(0,\sigma^2)$. The model is estimated using maximum likelihood estimation procedures. Table 1 shows the description and measurement of variables employed in the double-hurdle model estimation.

Table 1 : Variable Descriptions

Variable	**Description**
Percep	Respondent's perception. Value = 1 if the respondent perceived the level of food shortage is low, = 2 if the respondent perceived the level of food shortage in the household is mild (moderate), =3 if the level of food shortage is high in the household and = 0 otherwise (i.e if the respondent could not perceive any food shortage in the household).
Strat	It is the rank value of the response strategies adopted by the household head or any household member in overcoming the household food shortage. The value =1 if the household head or any member of the family obtained food gift from other households; =2, if livestock and other household assets were sold by the household; =3 if meals were skipped by any member of the household, =4 if the household adopted off farm activities as a strategy, =5 if the rank takes the values of any two combinations of 1-4, =6 if the rank takes on the values any 3 combinations of 1-4, =7 if the rank takes on the values of all combinations of 1-4.
Age	Age of the respondent in years
HSize	Number of dependents on the respondent
FSize	Size of the respondent farm (ha)
FOutput	Total farm produce (Naira)
Edu	Number of years spent in a formal education by the household head
FShort	Number of months a household member is food inadequate

RESULTS AND DISCUSSION

Household Primary Sources of Food

Table 2 shows the sources of food available to farmers. 46% of the farmers solely depend on their own produce. The rest respondents rely on purchase of food from the market.

Table 2: Primary Sources of Food for the Household

Source	Frequency	Percentage
Own harvest	106	46
Purchase	39	17
Own harvest and purchase	85	37
Total	230	100

Perception of Food Shortage in the Area

Table 3 shows the level of perception of household food shortage in the area. The household perception of food adequacy refers to the process by which information on food adequacy /shortage in the household transform into psychological awareness of adequacy flack of it in the household at certain periods of the year. According to the respondents, a household experience food shortage if at least a member of the household goes without food at any time of the year.

Table 3: Farmers' Level of Perception of Food Shortage

Level	Estimated Number of Months the Household is Food Inadequate /Year	Frequencies	Percentage
High	> 4	67	29
Mild	3-4	74	32
Low	1-2	46	20
No	< 1	43	19
Total		230	100

The table shows that only 19% of the sampled respondents do not experience food shortage. These are households that either produce enough to meet with domestic demands or are able to augment the shortage from other sources. 20% of the households experience low food shortage. These are households where at least a member goes without food for at most two months before the next harvest. Households with mild food shortage experience food shortage between 3-4 months before the next harvest whereas members of households with high food shortage experience hunger for more than 4 months before the next harvest by the said household.

Causes of Household Food Shortage

Household heads were asked to state the causes of food shortage in their respective households. The result was displayed in Table 4.

Table 4: Causes of Household Food Shortage

Cause	Frequency	Percentage
Weather vagaries	108	47
Low income level	225	98
Poor soil fertility	198	86
High cost of production input	99	43
Total*	630	274

*The total frequency is more than observed sample size due to multiple responses.

Low income level (98%) and Poor soil fertility (86%) constituted the highest causes of household food shortage. Weather vagaries also contribute to the household food shortage. The farmers have lost the ability to predict when to plant. High cost of farm input particularly high cost of fertilizers have forced the farmers to apply quantities below the recommended package, eventually leading to poor harvests and consequently impoverishing the farmers in the long run.

Farmers Response Strategies to Food Shortage

Table 5 shows various response strategies employed by farmers during the periods of food shortage. Twelve per cent of the farmers indicated that friends and relations were their sources of food during the period of food shortage. Friends and relatives were in solidarity to their brothers and neighbour and were ready to donate from their little reserves.

Table 5: Farmers Response Strategies to Food Shortage

Strategy	Frequency	Percentage
Food gift /borrowing (relations and friends)	131	57
Skip meals	222	97
Selling of livestock and other household assets	198	86
Off-farm activities	87	38
Total*	638	277

*Total frequency is above the sample size due to multiple responses.

A greater percentage (97%), reported that they skip meals, especially lunch. This implies reduction in meals per day in the affected household from 3 square meals to 2 or even 1. 86% others reported selling of livestock and other belongings. 57% of the respondents obtain either food gift or borrow from relations and friends. And 38% stated that they often engage in off-farm activities to raise money to buy food during the food shortage period.

Factors Influencing Farmers' Perception and Response Strategies to Household Food Shortage

Table 6 shows the estimates of the double hurdle regression model. The results indicated that the factors that influence the smallholder farmer perception on food shortage might not necessarily influence the farmer's response strategies to food shortage and where it does, not by the same magnitude and direction. For instance, age, education and non-farm activities variables were found to significantly influence the farmer's perception, however, only the household size and cooperative membership variables did not influence the response strategies significantly.

Table 6: Estimates of Double Hurdle Model

Variable	**First Hurdle Equation (Perception)**	**Second Hurdle Equation (Response Strategy)**
Constant	1.984**	3.222*
Age	2.007**	2.081 **
HSize	1.641	1.231
FSize	1.180	2.718*
FOutput	-3.577*	4.164*
Educ	-1.981**	2.022**
Coop	-1.501	1.351
OFarm	1.4l3	1.972**
Percep		3.813*
Loglikelihood	-11.112	-33.552
Sigma	0.318	0.254
Squared Correlation between Observed and Expected Values	0.801	0.893

*p <0.01
**P<0.05

The farm size of the respondent was directly related to the perception and response strategies of the household to food shortage. This implies that increase in the farm size will also increase the household perception of food shortage to a more positive value. This is contrary to a priori expectation. Traditionally, the soil fertility redemptive measures have been through land-fallow practices, clearing new land areas or crop rotation. However, with increasing land constraints in most areas as result of population increase, fallow periods have drastically declined. As a result, the traditional farming systems that farmers have previously employed to sustain their productivity can no longer work effectively (Yaro et al., 1997).

The farm output variable (FOutput) was the most important variable that significantly influenced the first and second hurdles ($P < 0.01$). This was in line with research expectations. The farm output is an important factor in determining the extent of food reserves in the household. Households with large food reserves were not expected to perceive food shortages and as such would not respond to a problem that was not.

The education variable (Educ) was found to significantly influence both hurdles indirectly ($P < 0.05$). The implication of the indirect relationship with perception was that the more educated households were more able to perceive and respond to food shortages. They were more able to take decisions that surmount the weather vagaries and poor soil fertility.

The perception variable is also very significant ($P < 0.01$) in influencing the household to respond to food shortage. The more the household is able to perceive food shortage, the more the household will get prepared for response strategies. Older farmers were more able to perceive and prepare for food shortage. This may possibly be because they are more experienced and more responsible toward the welfare of the household.

The off-farm activities (OFarm) variable was insignificantly negatively related with the household's perception of food shortage; however, the variable had a significant positive relationship with the household's response to food shortage in the household. This implies that the households employ off-farm activities as means of overcoming food shortages. The income generated from the off-farm activities empowers the household to purchase food crops for the household instead of forcing the household to skip meals or even going to friends and relatives to ask for food.

The household size variable (HSize) and cooperative membership variable (Coop) did not have a statistically significant relationship with the two hurdles. The household size (HSize) variable had a direct relationship with the first and second hurdles but it was not significant at any of the hurdles. This was contrary to a priori expectations. It was expected that larger households particularly those with a large percentage of juveniles will deplete household food reserves faster than smaller households. As such, the household size variable was expected to influence the first or second hurdle if not, both hurdles. Cooperatives were supposed to train and render other forms of welfare assistance to their members. The insignificance of this variable could mean that the cooperatives were not functioning properly.

CONCLUSION

This study showed that factors that influence households to perceive food shortage do not necessarily influence the households to choose a response strategy. The most important factor that influences both perception and response strategy is farm output. The households complained majorly of poor soil fertility. This is in addition to the problems of weather vagaries and high cost of input particularly fertilizer. These issues raised by the farming households cannot be overlooked because the issues have serious consequences for agricultural development and sustainability in the country.

High soil degradation resulting from erosion and nutrient depletion pose a threat to the food security of the farming household in Nigeria. With the farm land frontier shrinking due to exploding population pressure, future growth in food crop production is heavily dependent on yield increases rather than area expansion. Food crop production will have to increase in such a way that future production capacity of the natural resource is enhanced through conservative and sustainable use of such a natural resource. The improvement of soil fertility management among the farming households is therefore critical machinery in dealing with the problem of food shortages in the country.

The problems of weather vagaries and poor input availability cannot be ignored if agricultural development and sustainability is to hold. Farming households complain of not knowing when to plant due to changes and duration in seasonality particularly the rainfall season. The establishment of meteorological stations in parts of the country to give advice to farming households will help to reduce risk involved with climate change. There is equally the need to train the farming households on soil fertility management practices.

Finally, policy makers and researchers must device means of making farm input readily available to the farming households and equally device means of training the farming households to overcome the problems of poor soil fertility and weather vagaries. This will help to improve on the farm output, thereby conquering the seasonal food shortage experienced by the farming households.

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