Determinants of Change and Household Responses to Food Insecurity: Empirical Evidence from Nigeria

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Abstract

Limited economic and physical capacities as well as environmental and economic shocks have constrained the ability of many Nigerian households to feed themselves adequately. This has resulted in these households being faced with food shortages; and they have to adopt various consumption-related strategies to mitigate the effect of the shortfalls. Using the 2010/2011 Nigeria LSMS-ISA survey data and the reduced consumption coping strategy index (RCCSI), this paper examines the determinants of change in food (in)security of Nigerian households in the two major farming periods. Results show that there is a significant difference in the food insecurity status of households in the two periods. The likelihood of change in the food security status were determined by sex of the household head, farmland holdings, nature of livelihood, shocks associated with land loss, and climate change events. Coping strategies in the two periods were dietary change strategies and the rationing strategies. However, the frequency of use of these strategies is higher in the post-planting period and more among female-headed households. The use of high-yielding climate-resistant crops and reduction in post-harvest losses through processing and improved storage facilities are advocated.

Keywords: Food Security, Food Consumption Score, Reduced Consumption Coping Strategy Index, Post-harvest, Post-planting

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Introduction

Food insecurity is defined as access by all people at all times to enough food for an active, healthy life (World Bank, 1986). Elaborating on the World Bank's definition of food security, FAO (1996) noted that in addition to access to enough food, food security must encompass access to preferred food. This definition thus indicates that an individual or household is food secure if only such entity is able to acquire and consume in a sustainable manner nutritionally adequate, safe and preferred food through socially acceptable means to guarantee wellbeing. When an individual or population lacks, or is potentially vulnerable due to the absence of one or more factors outlined in these definitions, the individual or population is said to be food insecure (John et al, 2013). The literature suggests that households particularly those in developing countries, are vulnerable or food insecure due to limited economic and physical capacities as well as environmental and economic shocks. Because households are vulnerable, a presently food secure household is not guaranteed the same status in the future. As such, Jeronim, et al (2010) argue that the notion of food security is a dynamic rather than a static phenomenon.

Household food insecurity has been classified as either chronic or transitory. Chronic food insecurity signifies persistent food crisis caused by the continual inability of households to acquire needed food, either through market purchases or through own production (Khatri-Chatri and Maharjan, 2006). On the other hand, transitory food insecurity is a temporary decline in a household's access to needed food due to instability in food prices, production or income. It signifies a short time inadequacy in households' food access, which obligates the vulnerable households to cope in order to bridge their food consumption gap. Whether chronic or transitory, food crisis remains a great concern to developing countries particularly, in sub-Saharan Africa which has a significant share in the World's population. According to the Population Reference Bureau report (2010), out of the World's population of 7.137 billion, 1.030 billion (15%) are in Africa. FAO (2010) indicates that out of about 925 million people worldwide still suffering from chronic hunger, 235 million of them (25%) are from sub-Sahara Africa. This trend is also shown by the Global Hunger Index (GHI) report of 2013 (von Grebmer et al, 2013) which indicates that hunger level in Africa generally is alarming with sub-Saharan Africa recording the second highest regional GHI after South Asia. Because of the global concern to curb this crisis, global resolution in the form of the Millennium Development Goal (MDG) has been targeted to reduce by half, the amount of people who suffer from acute starvation and who earn less than $1 per day by the year 2015 (FAO, 2006).

In Nigeria, significant gains have been made in the reduction of hunger as indicated by the drop in the country's GHI from 16.3 in 2005 to 15 in 2013 (von Grebmer et al, 2013). However, this is still far above the safe and comfortable level of below 5 indicating that food insecurity is still prevalent in the country. As noted by Abimbola and Kayode (2013), a large proportion of Nigeria households are still food insecure despite the several efforts by successive governments to achieve food security through setting up of various agricultural development institutions, programmes and projects. Low household agricultural productivity and associated low income have resulted in persistent food insecurity particularly in the rural and low income urban households. From the foregoing, it is evident that Nigeria households are far from being food secure.

It is a common believe that households may be more food secure during the harvest period than in the planting season. This is because after harvest, most farming households have enough food from their own production and commodity prices are generally low. Abimbola and Kayode (2013) however noted that due to inadequate processing and storage facilities, and the challenge of meeting other household needs, these households usually end up selling their excess produce at low price during the harvest period. Immediately after this farming period, food stocks are depleted and most households rely on market purchases since they do not have enough to subsist on the year round. For non-farming households, their food purchasing power is very high during the harvest period and continuously declines as the lean period sets in. This leads to inconsistent food availability in the household thus contributes to food insecurity during the periods.

Several studies on Nigeria household food insecurity (Dare et al, 2013; Abimbola and Kayode, 2013; Adebayo, 2012; Olagunji et al, 2012; Victoria and Benjamin, 2012; Orewa and Iyangbe, 2010; Idrisa et al, 2008; Babatunde et al, 2007 and Aromolaran, 2004, among others), focus on case studies and mainly on various indicators of food security which FAO (2003) grouped as undernourishment (per capita dietary food energy supply), food intake (actual household food consumption), nutritional status (anthropometric measures) and access proxied by wealth status (total consumption, expenditure or income). A major shortcoming of these indicators is the non-inclusion of the vulnerability aspect of food security, which Maxwell (1996) notes is the most important element of the definition of food security. Dare et al (2013) opine that though several studies on household food security have been conducted in Nigeria, more detailed analyses at the household level are still needed especially those that provide an understanding of the types of coping strategies adopted by households to tackle the problems of food shortages. Because of the need to shed more light on the implications of food insecurity on households' welfare and ways of promoting household food security, Abimbola and Kayode (2013) stated that changes in the food security status of households over time should be closely monitored with explanation given for the change.

This study contributes to the growing literature on household food insecurity by addressing these knowledge gaps through the assessment of the determinants of change in food insecurity of Nigerian households between two (post-planting and post-harvest) farming periods. The households' food insecurity status is captured by a reduced consumption coping strategy index for each farming period, and the difference in the index between the two periods represents the change in the level of household's food insecurity. It also assesses the nature of consumption coping strategies used by households in the two farming periods with a view to providing suggestions for increased sustainability of household food supply and better targeting policies.

The rest of this paper is organized as follows: In section 2, we discuss the concept of vulnerability to food insecurity. In section 3, we present the data and the estimation method. Section 4 presents the results and discussion, and section 5 concludes the paper.

2. Concept of vulnerability to food insecurity

The widely recognized definition of food security as given by the World Bank (1986) is "the condition in which all have access to sufficient food for active, healthy life". This provides a standard for further definitions from individuals and organizations. However, these many definitions all agree that the key defining characteristic of household food security is secure access at all time to sufficient food. As a working definition in this study, food security is "a

situation in which all people, at all times, have physical, social, and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" (F.A.O., 2002). This definition identifies the pillars of food security as availability, access, stability of access and utilization. As Webb et al (2006) noted, these dimensions are inherently hierarchical, with availability necessary but not sufficient to ensure access and access, necessary but not sufficient for effective utilization. The availability of food therefore does not translate to food security of households except when they become accessible to individuals in sufficient and sustained quantity, nutritionally acceptable standards, and in good sanitary conditions to guarantee their general wellbeing. Anything short of this signifies food insecurity. At the household level, Philip and Tailor (1990) state that food insecurity exists when members of a household have inadequate diet for part or all of the year or face the possibility of an inadequate diet in the future.

Food availability at household level is achieved when sufficient quantities of food are consistently available to all individuals within the household. The availability of such food can be achieved through household production, market purchases, or food assistance.

Food access is guaranteed when households and all individuals within them have adequate resources to obtain appropriate foods for nutritious diet. Access can be through physical means to reach the food, economic means (buy the food) or social means (socially acceptable standing). Access depends on household income, distribution of income within the household, and on the price of food.

Stability of access (or secure access to enough food) is ensured when households and all individuals within have adequate and preferred food *at all times* to maintain a healthy living. It affects the availability, access and utilization dimensions of food security. Households should not risk losing access to food as a consequence of sudden shocks (eg an economic or climatic crisis) or cyclical events (eg seasonal food insecurity).

Food utilization measures whether a person will be able to derive sufficient daily nutrition from the available and accessible food. It entails the proper biological use of food, requiring a diet providing sufficient energy and essential nutrients, potable water, and adequate sanitation. It depends to a great extent on knowledge within the household of food storage and processing techniques, basic principles of nutrition and proper child care, and illness management.

The stability of access dimension of food security is reflected in the "*at all times*" language which denotes that at no time should a household or its members face food inadequacy situation. According to Babatunde et al (2008), stability dimension of food security shows that there is need to understand both the current and future food security status at different point in time; and any adopted framework must capture the temporal dynamics of food security. The vulnerability framework has been widely accepted in literature to capture this dynamics.

Vulnerability is a function of exposure to risks/shocks and the resilience to these risks which threaten household's food security (availability, access and utilization) (Babatunde et al, 2008). Besides natural disasters that can alter the food security status of households and usually make them vulnerable to food insecurity, socio-economic characteristics of households can also influence the food security status of households (John et al (2013). They further argue that since human beings have less control over natural occurrences, focusing on socio economic characteristics of households will provide better alternative in addressing food security

challenges. However, Khatri-Chetri and Maharjan (2006) maintain that a high level of exposure to risk of natural disasters and lack of ability or means to cope with them affect to a very great extent the food security status of households. These are indications that both factors (risks and households' socio-economic characteristics) are important determinants of vulnerability to food insecurity.

Vulnerability is determined by accumulation of events through time. The probability of households becoming food insecure in the future is a function of their present socioeconomic conditions, the risk factors prevalent within the given period and their capacity to manage the risks (Babatunde et al, 2008). The present household food situation is also a function of past events and conditions. What happened yesterday is reflected in today's status and what happened today influences tomorrow's status. This implies that the observed food insecurity status of the households during the post-planting period is a reflection of the various events during the preceding post-harvest period, and their status in post-harvest period is a reflection of the preceding post-planting events. This is what Jeronim et al (2010) describe as recursive process. The post-planting and the post-harvest food insecurity status both determine the overall food insecurity situation over the period of time, given that household status in each period is mutually independent. The dynamic and forward-looking characteristics of the vulnerability to food insecurity is captured by the assessment of households' food security status at the present with the expectation of the future.

In this vulnerability framework, households have two-period lifetime consisting of the past, t_o (post-planting period) and the present, t_1 (post-harvest period). Between the past and the present ($t_1 - t_0$) are a number of events or risk factors which manifest themselves and determine, depending on the households' coping strategies, the present (post-harvest) food security status. During the post planting period, the food insecurity status of the households as measured by the consumption coping strategy index is determine by the prevailing socioeconomic characteristics of the households at that period, and the previous risk events the households were exposed to. Over time, this status improves or deteriorates depending on the nature and level of the shocks (natural, economic, political, and social) the household is exposed to, and the responses or coping strategies (consumption, expenditure, income and migration) the household is able to adopt to ameliorate the impacts of the shocks.

Migotto et al (2006) identify five groups of measures of food insecurity to include measures of undernourishment, food intake, nutritional status, wealth status (total consumption, expenditures or income), and vulnerability (share of income spent on food and various coping strategy indices). The measure of undernourishment is estimated by the per capita dietary food energy supply. This estimate is derived from aggregate food supply and measures household food availability concept of food security. The food intake measures account for the food actually consumed at the individual or household level; and the measures of nutritional status are the anthropometric measures that assess food utilization. The wealth status measures account for the access concept of food security and are measured by total consumption, expenditures or income. The last measures capture the vulnerability concept of food security through qualitative or "self-assessment" indicators of food security. Notable indicators of vulnerability measures are the share of income spent on food and the various coping strategy indices.

3. Data, analytical techniques, model specification, and data analysis

3.1. Data

This study uses data from the World Bank sponsored Living Standards Measurement Study-Integrated Surveys Agriculture (LSMS-ISA), which is a national survey on household welfare in Nigeria. The data represents 5000 households panels across the 36 states in Nigeria and the Federal Capital Territory (FCT), which were surveyed twice, first in 2010 to collect post-planting (lean season) data and in 2011 to collect postharvest data. The data, collected by the National Bureau of Statistics (NBS), is representative at the national level and provides information on of key socio-economic, food-related consumption coping strategies, economic shocks variables across the six zones in the country.

3.2. Analytical techniques

3.2.1. Reduced consumption coping strategy index (RCCSI)

The coping strategy index (CSI) measures frequency and severity of a household's coping strategies for dealing with shortfalls in food supply. Its uniqueness as a measure of household food insecurity lies in its ability to query household behaviours directly and factor in the severity of different behaviours (Maxwell et al, 2008). It is calculated by combining the means of scoring the relative frequency with the severity of the various coping strategies used by households during food deficiency period. The relative frequency is measured by determining how many days per week a household had to rely on various coping strategies and the perceived severity of behaviour is usually determined by community members in focus groups. Weighted scores are combined into an index that reflects current and perceived future food security status (CARE/WFP, 2003; Maxwell et al, 1999).

Several studies have shown that there are set of behavioural responses to food insecurity that can be employed by any household, anywhere and this reflects accurately the food insecurity status of the households. These responses have universal severity weighting that can be applied across different context to establish the reduced coping strategy index, which Maxwell, et al (2008) note reflects the food security situation accurately as the full index. The reduced consumption coping strategy index (RCCSI) is a variant of the coping strategy index calculated based on the five standard consumption coping strategies: eating less preferred food, borrowing food/money from friends and relatives, limiting portions at meal time, limiting adult intake, and reducing the number of meals per day, with their universal severity weighting. This index facilitates the comparison of food insecurity across various strata by normalizing the behaviours and severity scores that are used to create the index. The RCCSI score denotes that the higher the value of the RCCSI score is, the higher the level of food insecurity, and vice versa.

Using responses to the question on seven day recall of household behavioural consumption responses to food shortages, a reduced consumption coping index (RCCSI) was constructed for each household in each farming period. Based on the change in the index between the two periods, three categories of households were identified namely; those whose food security status improved (lower RCCSI in post-harvest), those whose food security status worsened (higher RCCSI in post-harvest), and those with no change in their food security status (RCCSI neither increased nor decreased). Thus, giving multiple discrete outcomes of food (in) security status of the households.

3.2.2. Model specification

In order to estimate a model with multiple discrete outcomes and explanatory variables that are attributes of individuals, a multinomial probit analysis was adopted. This model assumes that the outcomes with a cumulative normal distribution, are not independently and identically distributed; and allows for analysis of multiple, unordered outcomes. It also enables the estimation of the model without the Independence of Irrelevant Alternatives assumption usually associated with the logit model (McFadden, 1984); and appropriate for the estimation of probability that a certain characteristic is present or absent in the data, for instance, occurrence of food insecurity (Scaramozzino, 2006). In the model proposed here, the dependent variable is the change in the reduced consumption coping strategy index, ΔRCCSI, which represents the change in the food insecurity status of the households between the periods of post-planting and post-harvest. The dependent variable is grouped based on the nature of change of the index at the post-harvest period and it is assumed to be dependent on the households' observable characteristics and incidence of shocks (covariate and idiosyncratic).

To account for any heteroscedastic and normality problems that may arise, this study specifies the Huber-White sandwich estimator. Before the empirical estimation of the multinomial probit model, the independent variables were scrutinized for possible presence of multicollinearity which is a common problem with cross-section datasets. Variables found to be correlated were excluded from the analysis.

Consider a household, *y* whose food insecurity outcome, *i* may fall within any of the defined set, k=1, 2, 3 of categories or outcomes, namely those whose food security status improved (lower RCCSI in post-harvest=1), those whose food security status worsened (higher RCCSI in post-harvest=2), and those with no change in their food security status (RCCSI neither increased nor decreased=3). Let $\Delta RCCSI_{iy}$ indicate the category of the change in the household's food insecurity status, which we assume depends on a vector of fixed household characteristics, X_h, as depicted in the socio-economic characteristics of the household, and on a vector of shocks: covariate, X_c and idiosyncratic, X_s experienced by the household. Assuming a simple linear dependence, the change in each household's food insecurity status can be expressed as a random variable consisting of the sum of an observable or systematic part, V_{ij} plus an error term ε_{ij} with zero mean and a certain distribution:

$$\Delta RCCSI_{iy} = V_{iy} + \varepsilon_{iy} \text{ ---------- (1)}$$

The error term, ε_{iy}, represents other factors such as measurement errors, differences between individuals, the individuals' erroneous perceptions of food insecurity, and the randomness inherent in human nature (Munizaga et al, 2000). The deterministic part, V_{iy} represents the vectors of fixed household characteristics, X_{iyh} and the covariate, X_{iyc} and idiosyncratic, X_{iys} shocks experienced by the households in the years before the post-harvest period.

Equation (1) can then be explicitly written as:

$$\Delta RCCSI_{iy} = V_{iy} + \varepsilon_{iy} = \alpha + \beta_i \sum X_{jyh} + \delta_i \sum X_{iyc} + \gamma_i \sum X_{iys} + \varepsilon_{iy} \text{ .....(2)}$$

Because the multinomial probit model assumes the errors are distributed multivariate normal, with mean zero (0) and

Covariance matrix $\sum = \begin{bmatrix} \sigma_1^2 & \sigma_{12} & . & \sigma_{1n} \\ \sigma_{12} & \sigma_2^2 & . & . \\ . & . & . & . \\ \sigma_{1n} & . & . & \sigma_1^2 \end{bmatrix}$, the probability of household being in category k=1 can be written as:

$\Pr(k=1|\beta_i, \delta_i,, \gamma_i, X_{jyh}, X_{iyc}, X_{iys}, \sum^*) =$

$$\int_{-\infty}^{\beta_1^* X_1^* + \delta_1^* X_{1_c}^* + \Upsilon_1^* X_1^*} \dots\dots \int_{-\infty}^{\beta_1^* X_{k+1_h}^* + \delta_1^* X_{k+1c}^* + \Upsilon_1^* X_{k+1s}^*} f(\mathcal{E}_{i1}^*, \dots\dots \mathcal{E}_{ik+1}^*) \partial_{i1}^*, \dots\dots \partial_{ik+1}^*$$

Where *f*(.) is the probability density fuction of the multivariate normal distribution.

4. Results and Discussion

Results of the data analysis are presented in this section. We utilized household level information to investigate food-related coping strategies, gender and seasonal responses to food shortages, food consumption score and nature of food (in) security changes, and the determinants of change in the households' food (in) security level.

4.1. Food-related consumption coping strategies

The frequency of use of each strategy in each season is presented in Tables 1. The post-planting season refers to the period after cultivation season which is generally characterized by few food baskets in the households, low income especially for households who are not seriously involved in non-farm income generating activities, and increase in expenditures occasioned by a rise in labour demand for farm activities. The post-harvest season, which is the off season, that directly follows the period after harvesting time is usually marked by increased household food basket, selling of farm produce and consequently, improved income earnings, and low farm labour demand.

From the table, it is clear that variations exist in the frequency of use of each coping strategy in both seasons. In the post-planting period, most households depend on such coping strategies as limiting the variety of food eaten (24.29%), relying on less preferred food (21.07%), limiting portion size at meal times (20.28%), and reducing number of meals eaten in a day (18.38%), which they use 1 - 2 days per week. On the whole, 37.53%, 37.14%, 30.28%, and 28.30% of the respondents predominantly rely on less preferred food, limit the variety of food eaten, limit portion size at meal times, and reduce number of meals eaten in a day respectively for at least once in a week during the post-planting period. Although the trend is similar in the post-harvest period, the proportion of households that use these strategies is lower. For instance, 29.19%, 26.91%, 18.63% and 16.41% of the respondents rely on less preferred food, limit the variety of food eaten, limit portion size at meal times, and reduce number of meals eaten in a day respectively for at least once per week during the post-harvest period. There are also similar reduction in the use of the other coping strategies. The reduction in the number of households using these strategies justifies better food condition during this period.

However, the record of less than 50% change (reduction) in the use of most of the strategies, especially the less severe strategies in the post-harvest period implies that mild to moderate food insecurity still exist in households during the post-harvest period. Very few (less than 10%) households use the most severe strategies such as borrow food, or rely on help from

friend or relative; have no food of any kind in your household; go to sleep at night hungry because there is not enough food; and go whole day and night without eating anything in both seasons. Interestingly, the percentage reduction in these strategies during the post-harvest period is greater than 50%, which is a reflection of almost non severe food insecurity cases.

Table 1: Frequency of use of coping strategies by households disaggregated by season

	Number of days per week							
	Post-planting				Post-harvest			
FCCS used	**Never**	**1 – 2**	**3 – 6**	**7**	**Never**	**1 – 2**	**3 – 6**	**7**
lesspreffood	62.47	21.07	13.60	2.86	70.81	17.48	9.37	2.34
limsizeatmealtimes	69.72	20.28	8.72	1.28	81.37	12.56	5.31	0.76
rednomealseatenday	71.70	18.38	7.87	2.06	83.59	11.25	4.36	0.80
resconsumptionbyadults	82.67	12.12	4.75	0.46	91.30	6.00	2.30	0.40
borrowfoodorrelyhelp	90.74	6.73	2.41	0.13	97.41	1.85	0.64	0.11
limitvarietyfoodeaten	62.86	24.29	11.17	1.69	73.09	17.79	7.79	1.37
havenofoodanykind	91.98	6.33	1.61	0.08	96.69	2.61	0.64	0.06
gosleepatnighthungry	91.61	6.71	1.66	0.02	97.03	2.46	0.49	0.02
gowholedaynight	96.09	3.21	0.67	0.02	98.71	1.04	0.23	0.02

Source: Authors calculation from the World Bank 2010/2011 LSMS-ISA data
Note: Figures in percentages

4.2 Household type and season differentiated household consumption coping strategies

The matrix in Table 2 below is used to examine the food-based consumption coping strategies adopted by different households in different agricultural seasons. As expected, the result indicates that fewer households use the coping strategies in the post-harvest than in the post-planting period. However, male-headed households showed significance difference in the use of these strategies in both seasons than female-headed households. For instance, while there is a significant reduction in the number of male-headed households that use these strategies during post-harvest period, the proportion of female-headed households who had significant reduction in the use of the coping strategies were observed for few strategies. These strategies are limiting portion size at meal times; reducing the number of meals eaten in a day; having no food of any kind in the household; going to sleep at night hungry because there is not enough food; and going whole day and night without eating anything (quantity). Thus for female-headed households, there is no notable change (decrease) in such strategies as relying on less preferred food; restricting consumption by adults in order for small children to eat; borrowing food, or relying on help from friends or relatives; and limiting the variety of food eaten in both seasons.

Generally, it is evident that food insecurity exists in all households in both seasons, but higher frequency of use of the coping strategies and the non-significant seasonal difference among female-headed households in the use of some of the coping strategies like borrowing food and restricting consumption is an indication that they are more likely to be vulnerable and food insecure even in post-harvest periods than the male-headed households. If this category of household is food insecure in the harvest period when they are expected to rely on household production or purchases at lower prices, it points not only to probable poor harvest but also to

their low income position. Thus, they may be chronically food insecure and may not be able to improve on their situation without external assistance.

Table 2: Nature of food consumption coping strategies disaggregated by household type and season

Consumption coping strategies used/food security dimension	**Household type/Season**					
	Female-headed			**Male-headed**		
	Total	PP	PH	**Total**	PP	PH
Rely on less preferred food *(acceptability)*	0.043 (0.059)	1.037 (0.061)	0.994 (0.061)	0.221* (0.025)	0.779 (0.023)	0.557 (0.020)
Limit portion size at meal times *(quantity)*	0.225* (0.055)	0.832 (0.054)	0.606 (0.048)	0.212* (0.018)	0.504 (0.017)	0.292 (0.135)
Reduce number of meals eaten in a day *(quantity)*	0.249* (0.059)	0.801 (0.056)	0.553 (0.045)	0.266* (0.020)	0.522 (0.019)	0.256 (0.013)
Restrict consumption by adults in order for small children to eat *(quantity)*	0.060 (0.038)	0.322 (0.032)	0.262 (0.032)	0.152* (0.014)	0.291 (0.013)	0.139 (0.01)
Borrow food, or rely on help from friend or relative *(quantity)*	0.027 (0.024)	0.131 (0.018)	0.103 (0.022)	0.120* (0.009)	0.154 (0.009)	0.033 (0.005)
Limit the variety of food eaten *(quality/diversity)*	0.092 (0.058)	1.010 (0.060)	0.919 (0.058)	0.208* (0.020)	0.643 (0.019)	0.434 (0.017)
Have no food of any kind in your household *(quantity)*	0.063** (0.026)	0.174 (0.021)	0.111 (0.020)	0.068* (0.007)	0.109 (0.008)	0.039 (0.005)
Go to sleep at night hungry because there is not enough food *(sufficiency)*	0.096* (0.023)	0.169 (0.023)	0.072 (0.013)	0.078* (0.007)	0.113 (0.007)	0.035 (0.004)
Go whole day and night without eating anything *(quantity)*	0.052* (0.013)	0.067 (0.013)	0.015 (0.005)	0.033* (0.006)	0.053 (0.005)	0.020 (0.003)

Source: Author's calculation from the World Bank 2010/2011 LSMS-ISA data
Note: * significant at 1%; ** significant at 5%; food security dimension in italics; and Standard errors in parentheses

4.3 Household seasonal food security changes

The nature of the relationship between food consumption score and changes in the reduced food consumption coping strategy index of households was determined using the Pearson's correlation matrix. The relationship though weak (-0.0340) is negatively signed as expected and statistically significant at p=0.05 level. Similar result was obtained by Maxwell et al (2011). The weak correlation may be attributed to the nature of consumption coping strategies adopted to construct the index. These strategies are considered less severe coping behaviours.

The negative correlation as expected is based on the inverse relationship between the food consumption score (FCS) and the reduced consumption coping strategy index (RCCSI). Higher FCS indicates greater food security while high RCCSI implies greater food insecurity. The use of the food consumption score and the change in the consumption coping strategy index in the determination of the proportion of households' net food (in) security change is based on vast literature which advocate for proper identification of households using multiple indicators.

The result of the cross tabulation of household's FCS and RCCSI is presented in Table 3. The nature of change and food consumption score (FCS) of households indicates the food (in) security position of the household in the post-harvest period. The FCS is based on dietary diversity, food frequency and the relative nutritional importance of different food groups, and serves as proxy for current food security while the reduced CCSI is based on frequency and severity of the strategies adopted. Though female-headed households (37%) recorded a slight increase in food security than the males (35%) during the post-harvest period, it is evident from Table 3 that more (23.10%) of female-headed households experienced a decrease in food security in the post-harvest period compared to about 14% of the male-headed households. Based on individual food consumption score category, Table 3 also shows that about 29% and 31% of the female-headed and male-headed households respectively though still have poor diet (low dietary diversity and food frequency), had an improvement in its food security status in the post-harvest period. Still in that category, those female-headed households whose status worsened in post-harvest were about 43% as compared to male-headed households with only about 9%. About 45% of the female-headed households within the borderline of food consumption improved in their food security as compared to the male-headed households (33.46%) in the same category. Another result of concern is those in the acceptable diet category. Twenty-four per cent (24%) of female-headed households who had a decrease in their food security status in post-harvest still remained in the acceptable food consumption score category compared to 14% male-headed households. This trend indicates that the female-headed households are highly vulnerable to factors that predispose them to change in food security status than their male counterparts.

Table 3: Household food security changes from post-planting to postharvest by food consumption score and household type

Food Consumption score category	**Household type/Nature of change**					
	Female-headed household			**Male-headed household**		
	Increased	Decreased	Unchanged	Increased	Decreased	Unchanged
Poor	28.57	42.86	28.57	31.01	8.86	60.13
Borderline	45.19	13.46	41.35	33.46	13.77	52.77
Acceptable	36.12	23.95	39.92	35.18	14.15	50.68
Total	**37.23**	**23.10**	**39.67**	**34.77**	**13.87**	**51.36**

Source: Authors calculation from the World Bank 2010/2011 LSMS-ISA data
Note: Figures are percentages

4.4. Determinants of change in food security status

For the purpose of this study, the nature of food (in) security change in the post-harvest period: increased, decreased and unchanged food security was used as the dependent variable. The included independent variables used in the model are presented in Table 4 below.

Table 4 shows the summary statistics and the expected hypothetical sign of the explanatory variables used in the multinomial probit model.

Variable	Code	Mean	Min	Max
Nature of food (in) security change	RCCSIchange	2.1442 (0.9094)	1	3
Post-harvest reduced coping strategy index	phRCCSI	2.2506	0	46
Post-planting reduced coping strategy index	ppRCCSI	3.8384	0	52
Household experienced climate-related (flood and drought) shocks (-)	climdf_shock (dummy)	0.1667 (0.3728)	0	1
Household experience illness of income earning member (-)	illness_shock (dummy)	0.0820 (0.2745)	0	1
Household experience loss of farm land (-)	land_shock (dummy)	0.0144 (0.1193)	0	1
Sex of household head (-/+)	hhsex (dummy)	0.8513 (0.3558)	0	1
Household head literacy status (+)	hhwr (dummy)	0.6276 (0.4835)	0	1
Number of farm plots own by household (+)	lnplotown (continuous)	2.0462 (1.2620)	1	10
Household head livelihood category (Agric or Non-agric) (+)	livelihood (dummy)	0.4454 (0.4971)	0	1

Note: Values in brackets below the mean values are standard deviation.

The result of the multinomial probit regression are presented in Table 5. Columns 2 and 3 presents the coefficient estimates while columns 4 and 5 show the marginal effects of the change equation. In this case, the base category is no change in food security status in both seasons from which to compare all other food security groups.

Table 5: Multinomial Probit Regression Results for Determinants of Households' Food (in) Security Change.

Variables	Coefficient estimates		Marginal effects of coefficient estimates	
	Category 1	**Category 2**	**Pr(RCCSIchange == category 1)**	**Pr(RCCSIchange == category 2)**
climdf_shock	-0.234 (0.151)	0.200 (0.166)	-0.087 (0.038)**	0.065 (0.033)***
land_shock	-1.401 (0.725)***	0.152 (0.566)	-0.313 (0.084)*	0.143 (0.143)
illness_shock	0.170 (0.255)	0.379 (0.278)	0.009 (0.067)	0.064 (0.058)
hhsex	-0.504 (0.184)*	-0.763 (0.200)*	-0.061 (0.048)	-0.112 (0.042)*
hhwr	-0.113 (0.125)	-0.046 (0.143)	-0.029 (0.033)	0.002 (0.026)
lnplotown	0.289 (0.113)*	0.345 (0.128)*	0.052 (0.030)***	0.041 (0.023)***
livelihood	0.043 (0.126)	0.320 (0.147)**	-0.017 (0.034)	0.058 (0.025)**
Constant	0.254 (0.206)	-0.499 (0.228)**	-	-

Note: Category 1: Household food security increased in post-harvest period
Category 2: Household food security decreased in post-harvest period
Base category: Household had no change in food security level in both seasons.
Values in bracket are the robust standard errors
Number of households: 932
Wald chi2 (14) = 43.22
Prob > chi2 =0.000*
Log pseudolikelihood = -941.685
***sig at 10%; **sig at 5%; *sig at 1%

The result above shows that the model fits the data relatively well as indicated by the regression statistics. Though the included independent variables show different levels of significance in the different outcomes, the discussions below are based on the marginal effect estimates that significantly determine the change in the food (in) security status of the households.

As expected, climate change variables (drought and flood) have negative impact on the probability of household experiencing increased food security status in the post-harvest period. The estimate indicates that as the incidence of climate change factors (drought and flood) increases by a unit, the probability of households experiencing increased food security in post-harvest decreases by about 0.087unit or 8.7%. Estimate in column 5 also confirms the negative influence of these factors on food security. It indicates that a unit increase in these variables leads to 0.065 unit (6.5%) increase in the probability of household experiencing a decrease post-harvest food security status. Both farm and non-farm households depend on agriculture which is the primary source of food and which has been observed to be highly susceptible to climate change events. Devereux (2007) observes that drought and flood undermine farm yield and harvest, reduce household food availability and agricultural income, and consequently threatens household food security. There is therefore need to strengthen climate-related risk management strategies at the household level for improve food security.

The result further shows that households that experience loss of land are less likely to experience increased food security status in the post-harvest period. This is confirmed by its significant marginal effect estimate which shows that a unit increase in land loss decreases the probability of household to have an increased post-harvest food security by about 0.31 unit (31%). This agrees with the findings of several studies quoted in Maxwell and Weibe (1998). They note that a reduction in or loss of access to land in agrarian society leads .directly to a reduction in income and access to food. The loss of land could be in different forms including loss of ownership and or use right. As a significant asset, which is not only useful for farm production but assures security of livelihood and serves as safety net in crisis period, its loss especially during the planting period will negate the ability of households to have any produce during the harvest season. With about 75% of Nigerian households engaged in agriculture and land as a vital production input, it implies that loss of land, especially agricultural land will result to loss of livelihood for many households, reduction in farm produce available to both rural and urban consumers, general increase in food prices and decrease in household's purchasing power. As such, the loss (either ownership or use right) of land will negatively affect household food availability and access and consequently, its food security status.

The marginal effect estimates for land holding show mixed results. As indicated, increase in household land holding could lead to either an increase or decrease in household food security status in post-harvest season depending on the use and productivity of the lands. As indicated by the marginal effect estimate for category 1 model, a unit increase in land ownership favours about 0.05 unit (5%) increase in household food security status in post-harvest season. Increase in household land ownership could translate to increased agricultural production especially for farming households, increase access to natural resources like forest products and better return to investment through rent and thus, increase in household's access to food and income. Chapoto et al (2011) from their study in Zambia and Jeronim et al (2010) note that accumulation of agricultural assets, such as land and livestock constitute a stock of resources that serve to generate sustained high levels of income, cushion households from shocks; and consequently decreases the risk of food insecurity. However, this is not possible if acquired lands are not of good quality for farming purposes and/or used productively. Rather, household experiences little or no return, and reduction in available income if such land is purchased. This could lead to decreased household food security even when household acquires more land asset. Since land ownership can only translate to food security if productively used, it implies that steps such as sustainable land management practices that enhance land productivity even in the face of climatic shocks will encourage increase food production and food security at household level.

Based on the marginal effect model, the sex of the household head has a negatively significant effect on the probability of households' decreased food security status in post-harvest period. It thus indicates that the probability of a male-headed household experiencing increased food security in the post-harvest is about 11.2% (0.112) higher than the female-headed household. This result is consistent with the findings of Dare et al (2013), Olagunji et al (2012) and Babatunde et al (2008). This is not surprising considering gender disparity in access and control of productive resources which tend to favour the male folk, and consequently increase in their crop output, off-farm income and total household income. Hence, male compare to female-headed households are more likely to be food secure and less vulnerable. It therefore implies that female-targeted interventions such as input subsidies, weather-based insurance, and

investment in processing and storage facilities will empower female-headed households and ensure improvement in their food security status in both seasons.

The positive and statistically significant estimate of livelihood variable in the category 2 marginal effect model is an indication that households that are basically dependent on agriculture are more likely to experience a decrease in their post-harvest food security status. Quantitatively, the probability of a household experiencing a decrease post-harvest food security status is 5.8% (0.058 unit) higher among agriculture than non-agriculture dependent households. Thus households whose livelihood depend largely on agriculture, which is itself very vulnerable to climate extremes, are faced with dwindling farm income and food availability and therefore unstable food security status. The result therefore shows the importance of household livelihood diversification especially to non-farm areas to ensure better food security status.

Conclusion and recommendation

This paper uses a cross-sectional data from 5000 households across the 36 states in Nigeria and the Federal Capital Territory (FCT) collected during the 2010/2011 post-planting and post-harvest seasons, and a reduce food consumption coping strategy index to examine the determinants of change in food (in)security status of Nigerian households in the two major farming periods. The study highlights the dynamics in the food (in) security status of households, and the roles of shocks, sex and asset on this dynamics. The results indicate that most households fair better in terms of food availability and access during the post-harvest season. It therefore implies that interventions that improve productivity and/or minimize crop losses during post-planting and reduce post-harvest losses will greatly reduce chronic food insecurity among households. Enhancing farmers' access to climate-resistant crop varieties, inorganic fertilizer input, and investment in food processing infrastructure are measures that can enhance increased productivity and reduce post-harvest losses. Given that female-headed households are more food insecure than the male-headed households, gender-focused interventions are likely to address food insecurity situations in both households.

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