Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.6, No.24, 2015

Correlates of Food Insecurity Transition and its Determinants among Farming Households in North Central, Nigeria.

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Abstract
This study analysed the Correlates of food insecurity transition and its determinants among farming households in North Central, Nigeria. The data were collected over two-time period from 291 rural households from September to December 2013, during food crops harvesting season (HS) and from April to June 2014, during food crops planting season (PS). Data were analysed using Marcov probability chain, Tobit and Probit regression models. Results showed that there were movements into and out of FI during the two seasons. However, more rural households 72% moved into FI during PS. In the long-run, 86% of households would transit to FI during PS. Probit Regression analysis revealed that household size, educational status of head, age, asset ownership, remittances, occupational status of head, access to credit and access to extension services were factors that significantly determined these movements.
Keywords: Correlates of food insecurity, Food insecurity transition, Marcov Probability Chain, Tobit regression model, Probit regression model

1 INTRODUCTION

In 1996, World leaders met in Rome for the second World Food Summit (WFS) to discuss ways to end hunger and to challenge the global community to cut in half by the year 2015, the number of undernourished people worldwide (800 million), of whom 250 million are severely malnourished children. This goal was reiterated in the United Nations Millennium Declaration in September 2000. To achieve the goal, the number of undernourished people was to be reduced by at least 20 million every year between 1996 and 2015. However, the trend of the decline in the number of the undernourished (an average of 8 million each year), as observed by Food and Agriculture Organization (FAO, 2008), is grossly inadequate to meet the 1996 World Food Summit target (Okuneye, 2002). For the period of 1996-1998, FAO estimated that out of the 826 million undernourished people in the world, 792 million were in the developing nations, while 34 million were from the developed nations. It is to underscore the magnitude of the problem of food insecurity that the United Nations under the aegis of Food and Agriculture Organization (FAO) set aside annually 16th October, as the World Food Day, to sensitize the people of the world to increase their food production and eradicate food poverty and malnutrition.

However, recent findings from the National Living Standard Survey (NLSS) in 2004 revealed that about 37 percent Nigerians were food insecure (World Bank, 2005). Because of this problem, the country has to rely on food importation for survival; hence food imports have continued to rise in Nigeria. It rose from N3.47 billion in 1990 to N113.63 billion in 2002 and then to N348 billion in 2007 (Okunmadewa, 2003 and Okuneye, 2002, Daily Trust, Tuesday, March, 2008).This shows that our food production is lagging behind the demand for food by Nigerians. The constraints encountered in achieving an end to hunger which is the main goal of the 1996 World Food Summit by Nigeria include the high incidence of farming and post-harvest food losses due to pests and diseases, environmental degradation, debt burden and problems associated with these problems. The main goal of food security is for individuals to be able to obtain adequate food needed at all times, and to be able to utilize the food to meet the body's need. Because of multi-faceted nature of food security, the World Bank (1986) identified four pillars underpinning food security: these are food availability, food accessibility, food utilization and food stability. From this concept it can be inferred that food security is not just a production issue alone but the combination of the other three pillars. Food availability for the farm household means ensuring sufficient food is available for them through own production. However, due to inadequate storage facilities and pressing needs, they mostly end up selling excess produce during the harvesting period and sometimes rely on market purchases during the planting season. These households become vulnerable to food insecurity when income is not available to purchase food to meet the immediate food need particularly during the planting season. The household is therefore thrown into a temporal dimension of food insecurity referred to as 'transitory or current food insecurity'. This phenomenon of food consumption varying according to season is prominent among farming households in Nigeria (Obamiro, 2005). Transitory food insecurity can be due to seasonal factors such as seasonal trends in food production and prices, wage rates or unexpected external events such as natural disasters (Obamiro, 2005). These seasonal trends in food prices and wage rates have important implications on the food security status of Nigerian poor household, who according to the findings from the National Living Standard Survey (NLSS) in 2004 spend up to 90 percent of their income on food (World Bank, 2005). Transitory food insecurity can lead to chronic food insecurity when

a population has a long-term inability to acquire sufficient food.

Statistics from the National Bureau of Statistics (NBS, 2007) indicated that poverty incidence in Nigeria rose from 28.1 percent in 1980 to 54.4 percent in 2004.With the estimated population figure of 140 million, this translated to 74 million Nigerians below poverty line. While 63 percent of this figure lives in the rural areas, 43 percent of the total population of the south west, Nigeria, is poor (NBS, 2007). Similarly, Okunmadewa (2001) revealed that one major characteristic of the farming populace of Nigeria is food insecurity. Ayantoye et al., (2011) concluded that majority of household who slide into food insecurity were headed by low educated persons who engaged in farming as primary occupation, this call for an improving access to education particularly the identified food insecure households. Omotesho et al., (2011) concluded that a household that tend to be poor as it size increases. Otaha (2013) revealed that gender inequality causes hunger and poverty. Amaza et al., (2006) explained further that the major determinants of food insecurity factors were household size, gender, educational level farm size and type, household enterprise. Olagunju et al., (2012) also discovered in their findings that the factors influencing household food insecurity were family size, annual income, amount of credit received, age of household head and livestock owned.

Fawehinmi and Adeniyi (2014) discovered that age had negative effect on the food security status as the household size increases and has the household head advances in age, the tendency for such households to become food insecure increases. Kirkpatrick and Tarasuk (2008), summarized that household food insecurity constrains food selection, but whether the dietary compromises associated with this problem heighten the sick of nutrient in adequacies is unclear. Matheson et al (2002) discovered that food insecurity is a critical variable for available children's nutritional status. The main focus has shifted from global and national to household and individual food insecurity and from food availability to food accessibility and the security of access (Maxwell and Smith, 1996). The study sets out to analyse the correlates of food insecurity transition and its determinants among farming households in North Central, Nigeria.

2.0 Theoretical Framework

2.1. Correlates of Food Insecurity Status

The correlates of food insecurity status are usually analyzed through Tobit regression model. This model permits the use of both discrete and continuous dependent variables which capture whether or not a rural household is food insecure and the intensity of food insecurity as well (Agbola et al, 2005). This model would be employed to estimate the correlates of food insecurity status among rural households in the study area. The dependent variable would be a hybrid of discrete and continuous variables. This will reveal the impact of the explanatory variables on the probability of a household to be food insecure and the effect of the marginal changes in the explanatory variables on the food insecurity status of the household. The model is expressed following Cox (1972) and Mc Donald and Moffitt (1980) and adapted by Omonona (2001).

2.2 FOOD INSECURITY TRANSITION

Food insecurity transition matrix from food secure to food insecure and vice-versa among the population under consideration was investigated using Baulch and MMcCulloch (1998). The study modified measures of dynamics of poverty transitions in rural Pakistan with the works of Nord *et al* (1999) and Ribar and Hamrick (2003) in understanding the transition matrix and for ease of data interpretation. Knowledge of correlates of food insecurity status can be useful in targeting anti-food insecurity intervention but typically shed little light on the specific events and processes which "causes" households to become food insecure. It is therefore important to explore the dynamics of food insecurity status in order to understand the correlates and causes of movements into and out of food insecurity situations (London and Scott, 2005)

From any food insecurity transition matrix, it becomes easy to calculate the simple probabilities of entering and exiting food insecurity between two periods. For example the simple probability of exiting food insecurity is simply the number of households exiting food insecurity divided by the number of households who were food insecure in the previous period. To understand the relationship between entry and exit probabilities and the incidence of food insecure, it is helpful to consider the simple first-order Markov model.

Where: S_1 = denotes food insecure and S_2 = denotes food secure**,** $S_1 - S_1$ = stationary state (food insecure), $S_2 - S_2$ = stationary state (food secure), $S_1 - S_2$ = transition state (exiting food insecure), $S_2 - S_1$ = transition state (entering food insecure) from this matric, the probability of moving into food insecurity and existing food insecurity between the two periods was calculated using the Markov Chain process of determining the long rung equilibrium.

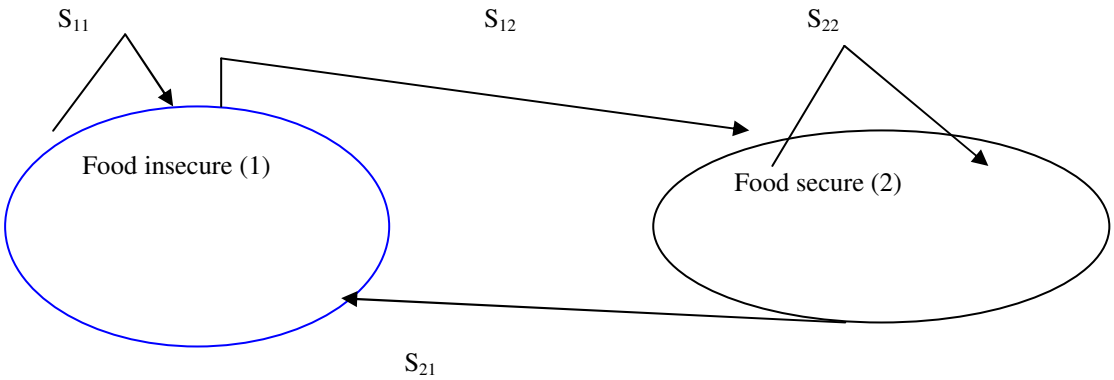

Figure 2.1: Transitory Markov Model

Table 1: First – Order Markov Model of Food Insecurity Transitions

	(PS)		
	Food secure	Food insecure	Total
(HS)			
Food secure	n_{11}	n_{12}	N_1
Food insecure	n_{21}	n_{22}	N_2
Total	N_1	N_2	

In Table 1 n11 and n22 represent the stationary states of food security and food insecurity respectively. These households remained in their status on and off seasons. While, n12 represents the transitional states of food insecurity, that is, those households that have moved into food insecurity during the two seasons, n21 represents the transitional states of food security, that is, those households that have exited food insecurity during the two seasons.N1 and N2 represent row total for food secure and food insecure respectively while N1 and N2 represent column total for food secure households and food insecure households respectively. The item in the transition matrix above are converted into probability values of moving into and exiting food insecurity by dividing each item by the corresponding row total to give the transition probability matrix below:

$$\begin{pmatrix} X_{11} & X_{12} \\ X_{21} & X_{22} \end{pmatrix}$$

Also, the vector of initial probability P (o) was obtained by dividing each column total by the grand total. Thereafter, we tried to see the proportion of households that will be in each category in the subsequent periods by using

$$P(K) = P(O)\,P^K \quad \ldots\ldots (2.1)$$

Where k is the time period in years.
The long term equilibrium was derived from

$$EP = E \quad \ldots\ldots (2.2)$$

AS

$$(E_1, E_2)\begin{pmatrix} X_{11} & X_{12} \\ X_{21} & X_{22} \end{pmatrix} = (E_1, E_2) \quad \ldots\ldots (2.3)$$

The solution to the above matrix produced e1, e2, which are the proportion of households that will be food secure, and food insecure at equilibrium or in the long run

Where e1 = equilibrium state for food secure
e2 = equilibrium state for food insecure

2.3 Estimation of factors influencing food insecurity transitions

Estimation of factors influencing food security transitions are best captured by using either Logit or Probit model (Baulch and McCulloch, 1998). This study used both Logit and Probit models for data analysis in determining factors that affect food insecurity transitions and then picked the model that best fitted and interpreted the data collected.

3 RESEACH METHODOLOGY

Area of Study

This study was carried out in the North central Nigeria. The zone is one of the six geo political zones that the country is divided into. It comprises Nasarawa, Plateau, Benue, Kogi, Niger and Kwara states. Based on the contiguity and homogeneity nature of the zone, the study area was further divided into three sub groups of two states each viz: Nasarawa/Plateau; Kogi/Kwara; Niger /Benue States. It was on this criterion that Kwara/Kogi states sub group was purposively selected for the study. Kwara State was created on February 3rd, 1976 with its capital in Ilorin. The State is bounded in the North by Niger State, in the South by Osun and Ondo States, in the East by Kogi State and in the West by Oyo State. Kwara State shares an International boundary with the Republic of Benin. The 2006 national population census estimated the state population as 2,591,555 .The state is made up of 16 Local Government Areas (LGAs). Similarly, Kogi state was created on August 27, 1991, out of the old Kwara and Niger states, with its capital in Lokoja. The 2006 provisional population figures put the State at 3,278,487 with an average of 172,000 farm families. It is located between Latitude $7^0 48^1$ North and Longitude $6^0 43'$ East of Greenwich Meridian and sharing boundaries with Kwara, Ondo, Ekiti, Niger, Benue, Nasarawa, Anambra, Enugu, Edo as well as Federal Capital Territory It has 16 Local Government Areas.

Both primary and secondary data were used for this study. Data were collected in two periods, during the harvesting season of 2013 and the planting season of 2014. The harvesting season is a period between September and December when harvesting of food crops is normally at peak and so food crops are surplus and of low prices during this period, while the planting season is a period between April and June when farmers prepare their land for planting and planting of food crops normally takes place. This period is usually heralded by food scarcity and higher food prices; it is farmers' lean period. The primary data were collected through the aid of

a well-structured questionnaire, administered on rural households in the area of study. Data collected include those on socio-economics and demographic characteristics of the households and their food consumption expenditure.

A Multi-stage random sampling method was adopted in the selection of respondents. In the first stage, Kwara and Kogi states were selected among the six states in the North Central geo-political zone based on the homogeneity and contiguity nature of the two states. The second stage involved the random selection of two LGAs each from the three senatorial districts (the Central, the Southern and Northern areas) in Kwara and Kogi states. The third stage involved the random selection of villages (1-4) depending on the number of the villages in each LGA. The delineation of Kwara and Kogi states into villages and towns in 2006 by the Nigeria Population Commission (NPC) was adopted for this study. The study, however, excludes cosmopolitan areas since the study is strictly rural. The proportionality factor used in the selection of the villages is stated as:

$$X_I = {}^N/N*15 \quad \ldots\ldots (3.1)$$

Where Xi = number of villages to be sampled, n = number of villages in the particular Local Government Area, N= total number of villages in all the Local Government Areas. At the fourth stage, the number of households from each village was selected using another proportionality factor such that the number of households selected from each village is proportionate to the total number of households in all the villages. The proportionality factor is stated as follows:

$$X_J = {}^P/P*150 \quad \ldots\ldots (3.2)$$

Where xj = the number of households to be sampled from each village
p = the number of households in each village
P=the sum of the number of households in the 30 villages selected

This led to 15 villages being proportionately selected in each of Kwara and Kogi States respectively based on the number of villages in the study area. And 150 respondents (these sample sizes were successfully drawn and responses were satisfactory) each for the two states to give a total of 300 sample size. However 291 households were tracked in the second phase of data collection. It is therefore these 291 households that were used for subsequent analysis. It is however, noted that these households were visited at least two times. Data were collected on household size, farm size, and years of farming experience, occupational status, outputs taken for home consumption, volume of outputs sold, revenue and household expenditure on food among others.

3.3 Method of Data Analysis

Markov Transitional Modeling for Correlates of Food Insecurity Status

Tobit regression model was used to estimate the correlates of food insecurity status among rural households in the study area, which is the second objective. It is given by:

$Y_{IJ} = ßXI + EI$ ..... (1)

$Y_{IJ} = Z\text{-}Y_{IJ}/Z$ ..... (2)

Where Yij = 0 for Yi ≥Z and Yij › 0 for Yi‹Z, Xi = Vector of explanatory variables, ß = Vector of respective parameters, ei = independently distributed error term, Yij= Food insecurity gap, Z = Food insecurity line, Yi = per adult equivalent food expenditure. The independent variables, which are the socio–economic and demographic variables that determine food insecurity status of household according to Agbola et al 2005, Obamiro 2005 and Olayemi 1996, are captured as: X1 = Household size, X2 =Household head Primary education dummy (D =1 if Household head has primary education, 0 if otherwise 0), X3 = Household head Secondary education dummy (D =1 if Household head has secondary education, 0 if otherwise, X4 = Household head Tertiary education dummy (D =1 if Household head has tertiary education, 0 if otherwise 0, X5 = Age of household head (year), X6 = Marital status of the household head (D=1if married, 0 if otherwise), X7 = Gender of the household head (D=1 if male, 0 if otherwise), X8 = Years of farming experience, X9 = Dependency ratio = No. of non working members/No. of working members, X10= Farm size in hectares, X11= Access to extension services (1 if yes, 0 if otherwise), X12= Access to credit facilities (1 if yes, 0 if otherwise), X13= Occupations status of the head (D=1 if household head is into farming as primary occupation, 0 if otherwise), X14= Access to Remittance (D=1 if household has access to remittance, 0 if otherwise), X15= Land Ownership D=1 if household own land, 0 if otherwise)

Food Insecurity Transitions Modeling

To investigate food insecurity transition matrix from food secure to food insecure and vice-versa among the population under consideration. The approach employed by Baulch and McCulloch (1998), to measure the dynamics of poverty transitions in rural Pakistan was modified and adopted along with the works of Nord *et al* (1999), Ribar and Hamrick (2003) and London and Scott (2005) in understanding the transition matrix and for ease of data interpretation. The items in the transition matrix as shown in simple first-order Markov model in Table 1 were converted into probability values of entering and exiting food insecurity by dividing each item by the corresponding row total to give the transition probability matrix below:

$$\begin{pmatrix} X_{11} & X_{12} \\ X_{21} & X_{22} \end{pmatrix}$$

Also, the vector of initial probability P (o) was obtained by dividing each column total by the grand total.

Thereafter, we tried to see the proportion of households that will be in each category in the subsequent periods by using

$$P(K) = P(O)\, P^{K} \quad \text{.....(3.3)}$$

Where k is the time period in seasons.

The long term equilibrium (when the proportion of households entering food insecurity equals the proportion exiting it) was obtained by using

$$EP = E \quad \text{.....(3.4)}$$

AS

$$(E_1, E_2) \begin{pmatrix} X_{11} & X_{12} \\ X_{21} & X_{22} \end{pmatrix} = (E_1, E_2) \quad \text{.....(3.5)}$$

The solution to the above matrix produced e1, e2, which are the proportion of households that will be food secure, and food insecure at equilibrium in the long run.

Where e1 = probability of households that will be food secure at equilibrium

e2 = probability of households that will be food insecure at equilibrium

Determinants of Food Insecurity Transitions

To examine the determinants of food insecurity transitions, a probit model was used to determine the factors influencing entering or exiting food insecurity.

$Y_{IJ} = B_O + B_I X_I + E_I$………………………………………………………… ………….(3.6)

Where: Yij = the dependent variable for the various food insecurity transitions

i=1….. 291, j=1……….4 categories of food insecurity transitions, Yij = f(X1, X8……….X15)

The four categories of food insecurity transitions are as stated below: Y11 =1 if remaining food secure, 0 if otherwise,Y12 =1 if moving into food insecure, 0 if otherwise, Y13 =1 if exiting food insecure, 0 if otherwise, Y14 = if always staying food insecure, 0 if otherwise, bo = constant term

Xi = the independent variables. The independent variables, which are the socio – economic and demographic variables, are capture as: X1 = Household size, X2 = Primary education dummy (d =1 if household head has primary education 0 if otherwise), X3 = secondary education dummy (d

=1 if Household head has secondary education, 0 if otherwise, X4 = Tertiary education dummy (D =1 if Household head has tertiary education, 0 if otherwise, X5 = Age of household head (year), X6 = Marital status of the household head (D=1if married, 0 if otherwise), X7 = Gender of the household head (D=1 if male, 0 if otherwise), X8 = Years of farming experience (years), X9 = Dependency ratio, X10= Farm size (ha), X11=Access to extension services (1 if yes, 0 if otherwise), X12 = Access to credit facilities (1 if yes, 0 if otherwise), X13= Occupations status of the head (D=1 if household head is into farming as primary occupation, 0 if otherwise), X14= Access to Remittance (D=1 if household has access to remittance, 0 if otherwise), X15= Land Ownership D=1 if household own land, 0 if otherwise)

RESULTS AND DISCUSSIONS

The results of the investigation of Correlates of food insecurity transitions and factors influencing them were also presented.

4.1 Correlates of Food Insecurity Status

In estimating the determinants of the food insecurity status among rural households during the HS and during PS Tobit Model as specified in the methodology was used. The regression parameters were estimated using the Maximum Likelihood Estimate (MLE) technique.

4.1 Correlates of Food Insecurity status among Rural Households during the Harvesting Season (HS)

In estimating the determinants, censured regression model made of 15 variables were specified as stated in Table 2. The result showed that sigma (σ) was 0.4037 with a t-value of 14.161, hence sigma is statistically significant. This indicated that the model has a good fit to the data. Out of the 15 explanatory variables included in the model, 6 of them had significant coefficients – these were household size (X_1), primary education (X_2), tertiary education (X_4), age of the household head (X_5), farming as primary occupation (X_{13}) and land ownership (X_{15}). Household size had a coefficient of 0.0631. The positive coefficient of household size indicated that a unit increase in household size had the likelihood of increasing food insecurity by 6.3 percent at $p<0.01$.This finding is in agreement with Alber (2003) that the likelihood of household food insecurity increases with household size. Also, the negative coefficients -0.1103,-0.0327 and -0.0926 of primary, secondary and tertiary respectively of levels of educational attainment showed that the likelihood of household to be food insecured decreases with educational attainment of the household head. Although secondary education attainment was not significant, primary and tertiary educational attainment were however significant at $p<0.1$ and $p<0.05$ respectively. This is in agreement with Ribar and Hamrick (2003) that attainment of education decrease the likelihood of household food insecurity. The reason may be because increase in educational attainment increases the chances of the households' heads to earn extra income from other activities apart from farming. Also, educational attainment is also associated with smaller family size thereby reducing the number of dependants.

The analysis revealed further that age of the household head had positive coefficient of (0.1602) at $p<0.1$. This showed that an increase in the age of the household head increase the likelihood of household to be food insecured by 16 percent. This agrees with a priori expectation. The result of the analysis equally showed that households who engaged in farming as primary occupation had positive coefficient of 0.2545 at $p<0.1$. This indicated engagement in farming as primary occupation has a likelihood to increase household food insecurity by 25 percent (Table 2). This finding is in agreement with the findings of Agbola et al (2004) and Obamiro et al (2005). Similarly, the negative coefficient of assets ownership (-0.2930) indicated that land ownership decreases the likelihood of households to be food insecure during HS by 29.3 percent at $p<0.01$.This findings is in agreement with World Bank (2002) that assets ownership decreases the probability of household food insecurity as extra income is earned to meet food needs

Table 2: Maximum Likelihood Estimate of the Tobit Regression for Food Insecurity during HS

Variable		Coefficient	Standard Error
Constant		-0.0473	0.0609
Household Size	(X_1)	0.0631	0.0051***
Primary Education	(X_2)	-0.1103	0.0602*
Secondary Education	(X_3)	-0.0327	0.0323
Tertiary Education	(X_4)	-0.0926	0.0429**
Age	(X_5)	0.1602	0.0877*
Marital Status	(X_6)	0.0037	0.0108
Gender	(X_7)	0.0062	0.0079
Farming Experience	(X_8)	0.1020	0.1249
Dependency Ratio	(X_9)	0.0007	0.0011
Farm Size	(X_{10})	-0.0002	0.0010
Access to Extension.	(X_{11})	-0.0089	0.0187
Access to Credit	(X_{12})	-0.0129	0.0783
Occupational Status	(X_{13})	0.2545	0.1359*
Access to Remittance	(X_{14})	0.0163	0.0251
Land Ownership	(X_{15})	-0.2930	0.0228***
Chisqure=49562.701		DF=453	P=0.00

Source: Field Survey, 2014
***-denotes significance at 1%, ** at 5% and * at 10%

4.2 Correlates of Food Insecurity status among Rural Households during the Planting Season (PS)

The result showed that sigma (σ) was 0.4413 with a t-value of 14.430, hence sigma was statistically significant. This indicated that the model had good fit to the data. Out of the 15 variables specified as shown in Table 3, six were significant at various levels of significance. The variables that significantly explain the changes in food insecurity during PS were household size (X_1), secondary education (X_3) and tertiary education (X_4), age of the household head (X_5) dependency ratio (X_9) and farming as primary occupation (X_{13}). This means that during PS, an increase in the size of the household will increase the probability of the household to be food insecure by 6.8 percent at $p<0.01$. This is in agreement with a priori expectation (Alber, 2003). The negative and significant coefficients of the levels of educational attainment of the household head (except primary) indicated that households' heads attainment of secondary and tertiary levels of educational attainment reduces the probability of being food insecure by 10.2 and 19.7 percent respectively at $p<0.1$. This is in agreement with Ribar and Hamrick (2003) that attainment of education decrease the likelihood of household food insecurity. This may not be unconnected with the fact that as educational status of the heads of households increases, their adoption and use of new improved farming inputs and practices provided by the extensions services increases, thereby raising their income and consequently reducing food insecurity. Higher education increases the likelihood of getting other paid jobs other than farming and equally regulates indiscriminate child birth that

would have led to an increase in the dependency ratio of such a household (Omonona, 2001).

Also an increase in the age of the households' heads will lead to a high likelihood of food insecurity by 1.17 percent at p<0.05 .This is in accordance with a priori expectation Agbola et al (2005). An increase in dependency ratio will increase the probability of the household to be food insecure by 1.5 percent at p<0.1. This result is in tune with the findings of Riber and Hamrick (2003), London and Scott (2005) that households with higher number of children under the age of 18 years or higher number of dependants in their households are more likely to be food insecure.

Table 3: Maximum Likelihood Estimate of the Tobit Regression For Food Insecurity during the PS

Variable		Coefficient	Standard Error
Constant		0.1147	0.1499
Household Size	(X_1)	0.0681	0.0071***
Primary Education	(X_2)	-0.0078	0.0286
Secondary Education	(X_3)	-0.1022	0.0595*
Tertiary Education	(X_4)	-0.1974	0.1201 *
Age	(X_5)	0.0117	0.0050 **
Marital Status	(X_6)	0.0032	0.0459
Gender	(X_7)	0.0983	0.1157
Farming Experience	(X_8)	0.0057	0.0062
Dependency Ratio	(X_9)	0.0148	0.0085*
Farm Size	(X_{10})	-0.0042	0.005
Access to Extension.	(X_{11})	-0.0004	0.0574
Access to Credit	(X_{12})	0.0197	0.4463
Occupational Status	(X_{13})	0.0275	0.0113**
Access to Remittance	(X_{14})	0.0213	0.2212
Land Ownership	(X_{15})	0 .0359	0.3910
Chisqure=68916		DF=453	P=0.00

Source: Computer Printout of Tobit Regression
***-denotes significance at 1%, ** at 5% and * at 10%

The result further revealed that those households whose heads had farming as primary occupation will have their probability to be food insecure increased by 2.8 percent p<0.05. This result is in line with Mc Kay and Lawson (2002), that households whose heads engaged in agricultural occupation were more vulnerable to food insecurity.

4.3 Food Insecurity Transitions and Its Correlates

4.3.1 Food Insecurity Transitions

Table 4 showed the result of the transition matrix and their probabilities. The result is in line with the

works of Ribar and Hamrick (2003) and Christana et al (2005) that households move in and out of poverty and food insecurity. It revealed that 28.8 percent of those who were food secure during HS remained food secured during PS, while 71.8 percent of those who were food secure during HS transitioned to food insecurity during PS. Similarly, 13.1 percent of those who were food insecured during HS transitioned to food secured during PS, while 86.8 percent of those who were food insecured during HS remained food insecured during PS. Further analysis of the probability transition matrix revealed that at the short run, the probability that a rural household in the study area will be food secured is 22.2 percent, while the probability that rural households will be food insecured in the short run in the North Central, Nigeria is 77.7 percent (Table 4).

At equilibrium, that is, in the long run, the probability that the household will be food secured is 13.89 percent, while the probability that rural household will transit to food insecured in the North Central, Nigeria is 86.1 (Table 4). This result showed that many households would slide into food insecured during the planting season in the study area in the nearest future.

Table 4: Food Insecurity Transition Matrix of households in the study area

		Planting Season(PS)
	Food Secured	Food Insecured
Harvesting Season(HS		
Food Secured	49 (0.2882)	121 (0.7118)
Food Insecured	16 (0.1311)	105 (0.8678)
Total	**65**	**226**

Figures in parenthesis are probability Transition matrix
Source: Computed From Field Surveys, 2014HS and PS

4.3.2 Estimation of Factors Influencing Food Insecurity Transitions in the South Western, Nigeria

This section presents the results of the determinants of food insecurity transition among rural households in North Central, Nigeria. This was done using probit Model as specified in the methodology. The regression parameters were estimated using the Maximum Likelihood Estimate (MLE) technique. The software package used is the LIMDEP Version 7. Four regressions were estimated for the four categories of food insecurity transitions observed among the rural households in the study area.

4.3.2.1 Determinants of Household Entering Food Insecurity

It should be noted that a positive sign of a coefficient indicated that an increase in the variable tend to increase the likelihood of the household moving into food insecurity. Similarly, a negative sign of a coefficient decreases the likelihood of the household moving into food insecurity. Out of the 15 variables, 8 significantly determine the probability of a household transition from food security to food insecurity in the area of study. These were household size (X_1), the three educational status categories (X_2, X_3, X_4), Age of the household head (X_5), access to credit (X_{12}), farming as primary occupation (X_{13}) and ownership of land (X_{15}). Large household size had the likelihood to transits from food secure to food insecure by 12.4 percent at $p<0.01$. This agrees with Riber and Harmrick (2003) that the larger the household size the higher the probability of moving into food insecurity. This could be as a result of the fact that increased household size is synonymous with higher dependants that hardly contribute to the income of household. Also, the negative and significant coefficients 0.2635($p<0.1$), 0.0205($p<0.05$) and 0.1481($p<0.1$) respectively for primary, secondary and tertiary levels of educational attainment of the households heads indicated that households' heads attainment of any of the levels decrease the probability of moving into food insecurity by 26, 2 and 15 percent respectively for primary, secondary and tertiary educational attainment. This is in agreement with Ribar and Hamrick (2003) that the odd of moving into food insecurity decreases with increase in educational attainment of household head. An increase in the age of household head increases the probability of such a household transiting from food secure to food insecure by 1.5 percent at $p<0.1$. This is agreement with Ribar and Hamrick (2003), that household headed by older person is more likely to move into food insecurity.

This could be attributed to the fact that the ability to do hard and difficult work associated with rural livelihood activities of which farming is one decreases with increase in age. Access to credit had a coefficient of -0.0330, this indicated that access to credit reduces the probability of the household moving into food insecurity by 3 percent at $p<0.01$. This is so because loanable funds can be used to expand production through the purchase

and use of modern improved inputs and consequently improve the food security of such households. Households whose heads engaged in farming as primary occupation had the likelihood of transiting from food secure to food insecure by 5 percent at $p<0.1$. Land ownership reduces the probability of household moving into food insecurity by 0.8 percent at $p<0.01$.

Table 5: Maximum Likelihood Estimate of the Probit Regression of Household Entering Into Food Insecurity

Variable		Coefficient	Standard Error
Constant		-0.0654	0.2455
Household Size	(X_1)	0.1238	0.0426 * **
Primary Education	(X_2)	-0.2635	0.1580 *
Secondary Education	(X_3)	-0.0205	0.0109 **
Tertiary Education	(X_4)	-0.1481	0.0874 *
Age	(X_5)	0.0150	0.0078*
Marital Status	(X_6)	-0.0607	0.0821
Gender	(X_7)	0.0734	0.0591
Farming Experience	(X_8)	-0.0081	0.0164
Dependency Ratio	(X_9)	0.0019	0.0250
Farm Size	(X_{10})	-0.0010	0.0015
Access to Extension.	(X_{11})	-0.1745	0.2247
Access to Credit	(X_{12})	-0.0330	0.0111***
Occupational Status	(X_{13})	0.0529	0.0303*
Access to Remittance	(X_{14})	0.1347	0.7460
Land Ownership	(X_{15})	-0.0084	0.0031***
Chisqure=59648.692		DF=453	P=0.00

Source: Computer Printout of Probit Regression Field Survey, 2014
***-denotes significance at 1%, ** at 5% and * at 10%

4.3.2.2 Determinants of Household Exiting Food Insecurity

Table 6 showed that chi-square was significant. This indicated that the model had a good fit to the data. In addition, the relationship between exiting food insecurity and factors influencing it reveals that 8 out of the 15 explanatory variables specified significantly determine the probability of rural households existing food insecurity. These are household size (X_1), farming experience (X_8), farm size (X_{10}), household head access to extension service (X_{11}), household head access to credit facilities (X_{12}), households head engaging in farming as primary occupation(X_{13}), access to remittances (X_{14}) and land ownership(X_{15}).

The results of the analysis of the relationship between households exiting food insecurity and factors

that influence it showed that an increases in the household size (X_1) decreases the probability of household exiting food insecurity by 0.7 percent. An increase in the farming experience(X_8) of the household head decreases the probability of the household exiting food insecurity by 0.6 percent. Also, an increase in farm size(X_{10}) cultivated by the household increase the probability of the household exiting food insecurity by 7 percent. This result is in line with the findings of Jimoh (2004), that a unit increase in farm size of a household increases the probability of exiting poverty. This might be connected to a higher yield which consequently brings higher profit. Households who had access to extension services (X_{11}) and credit facilities (X_{12}) will have a high likelihood of exiting food insecurity by 13 and 6 percent respectively. This is in consonance with the findings of Jimoh (2004) that household head with access to formal credit facilities and extension services increase the chance of exiting poverty.

Farming as primary occupation has –0.1279 this shows that households whose heads engage in farming as primary occupation will have a low likelihood of exiting food insecurity by 6 percent (Table 4.19).This is in agreement with the a prior expectation. The reason may be attributed to the fact that their source of food and income is limited and are subject to the vagaries of weather. The result equally revealed that households access to remittance had positive and significant relationship to the probability of households exiting food insecurity this is in agreement with Riber and Harmrick (2003). Finally, the result showed that land ownership increases the probability of households exiting food insecurity by 87 percent.

Table 6: Maximum Likelihood Estimate of the Probit Regression of Households Exiting Food Insecurity

Variable		Coefficient	Standard Error
Constant		-0.0084	0.0859
Household Size	(X_1)	-0.0073	0.0034**
Primary Education	(X_2)	0.0175	0.0143
Secondary Education	(X_3)	0.0760	0.0646
Tertiary Education	(X_4)	-0.0606	0.0607
Age	(X_5)	-0.0169	0.0268
Marital Status	(X_6)	-0.0085	0.0155
Gender	(X_7)	-0.0109	0.0253
Farming Experience	(X_8)	0.0055	0.0033*
Dependency Ratio	(X_9)	-0.0073	0.0312
Farm Size	(X_{10})	0.2067	0.1257*
Access to Extension.	(X_{11})	0.1276	0.0444***
Access to Credit	(X_{12})	0.0616	0.0325*
Occupational Status	(X_{13})	-0.1279	0.0593**
Access to Remittance	(X_{14})	0.5969	0.0109***
Land Ownership	(X_{15})	0.8682	0.0112***
Chisqure=53034.884		DF=453	P=0.00

Source: Field Survey, 2014
***-denotes significance at 1%, ** at 5% and * at 10%

4.3.2.3 Determinants of a Household to be never Food insecure

The result in Table 7 showed that chi-square is significant. This indicated that the model had good fit to the data. The result showed that out of the 15 explanatory variables specified 6 significantly determined the probability of rural households to be never food insecure. It should be noted that a positive sign of a coefficient indicated that an increase in the variable tend to increase the likelihood of the household to be never food insecure .Similarly, a negative sign of a coefficient decreases the likelihood of the household to be never food insecure. The result further revealed that household size (X_1), household head to have attained tertiary education (X_4), dependency ratio (X_9), access to credit (X_{12}), household head engaging in farming as primary occupation

(X_{13}) and land ownership (X_{15}) significantly determined the probability of household to be never food insecure. The coefficient of household size was -0.0269.This showed that an increase in household size will decrease the probability of household to be never food insecure by 2.7 percent at ($p<0.1$); this implied that a high burden is imposed on a household with large members. This finding is in line with London and Scott 2005 that increases in household size reduces the probability of staying food secure. Attainment of tertiary education by the household head had coefficient of 0.0683 at ($p<0.01$). This indicated that attainment of tertiary education by the household head will increase the likelihood of the household to be never food insecure by 6.8 percent

The coefficient of household dependency ratio is -0.0130 at ($p<0.05$). This connotes that a unit increase in the dependency ratio will decrease the probability of household to be never food insecure by 1.3 percent. Access to credit facilities by a household head had coefficient of 0.0143 at ($p<0.05$).This means that access to credit facilities will increase the probability of such a household to be never food insecure by 1.4 percent Household head engaging in farming as primary occupation had coefficient of -0.0478 at ($p<0.01$). This means that household whose head engaged in farming as primary occupation will have a likelihood to be never food insecure by 4.7 percent. Land ownership by the household had coefficient of 0.3150. This showed that possession of land increases the probability of a household to never stay food insecure by 31.5 percent. This result is in consonance with a priori expectation that assets ownership increases the probability of never to be food insecure (Ribar and Hamrick 2003).

Table 8: Maximum Likelihood Estimate of the Probit Regression of Household to be never Food Insecure

Variable		Coefficient	Standard Error
Constant		0.0342	0.0557
Household Size	(X_1)	-0.0269	0.0162*
Primary Education	(X_2)	0.0460	0.0422
Secondary Education	(X_3)	0.0146	0.0157
Tertiary Education	(X_4)	0.0683	0.0257 ***
Age	(X_5)	0.0017	0.0021
Marital Status	(X_6)	-0.0074	0.0160
Gender	(X_7)	-0.0018	0.0095
Farming Experience	(X_8)	0.0020	0.0088
Dependency Ratio	(X_9)	-0.0130	0.0054 **
Farm Size	(X_{10})	0.0004	0.0006
Access to Extension.	(X_{11})	0.0227	0.0180
Access to Credit	(X_{12})	0.0143	0.0061**
Occupational Status	(X_{13})	-0.0473	0.0157***
Access to Remittance	(X_{14})	0.0159	0.0123
Land Ownership	(X_{15})	0.3150	0.0224***
Chisqure=59648.692		DF=453	P=0.00

Source: Field Survey, 2014
***-denotes significance at1%, ** at 5% and * at 10%

4.3.2.4 Determinants of Households to be always staying Food Insecure

The following variables significantly determined the probability of household to be always food insecure: household size (X_1), attainment of primary education by the household head (X_2), age of the household head (X_5), marital status of the head (X_6), farming experience (X_8), dependency ratio (X_9) and access to extension

services (X_{11}). The coefficient of household size was 0.0321. This showed that an increase in household size increases the probability of household to be always food insecure by 3.2 percent at ($p<0.01$). This is in agreement with a priori expectation (London and Scott, 2005). Also, attainment of primary education had coefficient of -0.3465. This indicated that attainment of primary education by the household head will reduce the likelihood of the household to be always food insecure by 34.7 percent at ($p<0.05$). The result is in line with Ribar and Hamrick (2003) that education decreases the odd of staying food insecure.

Age of the household head had coefficient of 0.0048.This means that increase in age of the household head increases the odd to be always staying food insecure by 0.48 percent at ($p<0.05$). This finding is in line with London and Scott (2005) that an increase in the age of the household head increases the likelihood of transiting into food insecurity. This implies that household heads above the active working age may likely be always food insecure. Marital status of the household head had coefficient of 0.0985. The direct relationship indicated that households headed by married person increases the probability to be always food insecure by 9.85 percent at ($p<0.1$). Similarly, the coefficient of farming experience was 0.2915.This indicated that an increase in the year of farming experience of the household head increases the probability to be always food insecure by 29.2 percent at ($p<0.05$). Dependency ratio of the household had coefficient of 0.0866. This indicated that an increase in the dependency ratio will increase the probability of the household to be always food insecure by 8.66 percent at ($p<0.05$). This is in line with Ribar and Hamrick (2003), that household with high number of children under the age of 18 years had higher likelihood of remaining food insecure. Household head accessibility to extension services had coefficient of -0.0833. This showed that household accessibility to extension services decreases the probability of the household to be always food insecure by 8.3 percent at ($p<0.1$). These findings corroborated the findings of Ayantoye et al, (2011).

Table 9: Maximum Likelihood Estimate of Probit Regression of Households to Always Staying Food Insecure

Variable		Coefficient	Standard Error
Constant		-0.6725	0.4946
Household Size	(X_1)	0.0321	0.0054***
Primary Education	(X_2)	-0.3465	0.1586 **
Secondary Education	(X_3)	-0.3035	0.3147
Tertiary Education	(X_4)	-0.0554	0.1341
Age	(X_5)	0.0048	0.0025 **
Marital Status	(X_6)	0.0985	0.0547 *
Gender	(X_7)	0.1204	0.1276
Farming Experience	(X_8)	0.2915	0.1336**
Dependency Ratio	(X_9)	0.0866	0.0341 **
Farm Size	(X_{10})	0.0005	0.0022
Access to Extension.	(X_{11})	-0.0833	0.0479*
Access to Credit	(X_{12})	0.1597	0.1385
Occupational Status	(X_{13})	-0.1381	0.2276
Access to Remittance	(X_{14})	0.0026	0.0180
Land Ownership	(X_{15})	0.0163	0.0122
Chisqure=59284.689		DF=453	P=0.00

Source: Field Survey, 2014
***-denotes significance at 1%, ** at 5% and * at 10%

5.0 CONCLUSION AND RECOMMENDATION

The study concluded that there is high level of food insecurity transitions in the study area particularly from food secure during HS to food insecure in PS. There is high level of chronic food insecurity (always staying food insecure) in the study area. In the long run many households will slide into food insecurity. The study further revealed that food insecurity transitions are influenced by household size, educational status, age, marital status, farming experience, farm size, dependency ratio, access to extension services, access to credit facilities and occupational status of the household head. Based on the findings of the study and the conclusion drawn the following recommendations are made in order to ensure food security among rural households in the study area. The identified chronically food insecure households (always food insecure) should be specifically targeted by the government for safety net such as provision of subsidized food crops, distribution of food crops as relief materials and special nutrition programme involving the provision of free meal for malnourished households. This also calls for an improving access to education particularly, the identified food insecure households. In addition, the Universal Basic Education (UBE) should be universal, sustained and extended to illiterate adults. .

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