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DETERMINANTS OF FOOD INSECURITY IN SOME RURAL FARMING HOUSEHOLD IN KATSINA STATE, NIGERIA

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Abstract

This study was carried out to identify the determinants of food security in some rural households in Katsina State. Primary data was used for the study which was collected from two communities each in the six local government areas of the state totaling three hundred and sixty rural farming households. Oral questionnaire were administered through random sampling and personal observation as well as interview which is purposive. Ordered probit model method was used as a tool of analysis. The data were analyzed using ordered probit model to ascertain food insecurity status of households. The results of analysis indicated that 25 variables were used in the study and 14 of them were significant. These are in three categories as highly significant, significant and mild respectively .Produce with a p-value of 0.003 (99, 7%), extension worker with a p-value of 0.004(99.6%) and also household consumption with a p-value 0.009(99%) are highly significant. However, household size also with a p-value of

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0.016(98.4%), marketing board with a p-value of 0.022(97.8%), fertiliser also with a p-value of 0.031(96.9%), assets with a p-value of 0.038(96.2%), marital status with a p-value of 0.039(96.1%), land characteristics has a p-value of 0.045(95.5%), planting rain has also a p-value of 0.047(95.3%) are equally significant.. Based on the results, the study recommended that all government programmes should be community oriented; household should be properly educated as a means of raising their productivity, efficiency as well as improving their nutritional awareness. Access to loan/credit facilities should be strengthened, underground water should be explored and exploited; virgin land should also be explored and allocated while also strategic food silos be constructed as well as provision of infrastructures.

General Introduction

Recent estimates put the number of hungry people in Nigeria at over 53 million, which is about 30 percent of the country's total population of roughly 150 million; and 52 percent live under the poverty line. These are matters of grave concern largely because Nigeria was self-sufficient in food production and was indeed a net exporter of food to other regions of the continent in the 1950s and1960s (Ayodeji, 2010). Things changed dramatically for the worse following the global economic crisis that hit developing countries beginning from the late 1970's onward. The discovery of crude oil and rising revenue from the country's petroleum sector encouraged official neglect of the agricultural sector and turned Nigeria into a net importer of food. By 2009 for example, the Federal Ministry of Agriculture estimated that Nigeria was spending over $3billion annually on food imports. Although, agriculture contributes 42 percent of the GDP, provides

employment and a means of livelihood for more than 60 percent of the productively engaged population, it receives less than 10 percent of the annual budgetary allocations (Ayodeji, 2010)). Underfunding in this regard is central to the crisis of food production, and food security in Nigeria.Beyond high prices of staple food items in Nigeria, drought and political situation in neighbouring countries like Chad, Cameroun and Niger seem to pose a threat to a state like Borno as they rely on the state for their food supplies

Current Situation Due to heavy rainfall and the release of water from several dams Nigeria experienced unusually widespread flooding from July to October. At the peak of the flooding, about 2.8 million people were displaced, particularly in areas along the Niger and Benue Rivers (fews.net/IPC 2013). Since then, most households have returned to their homes and have started rebuilding their livelihoods. Before the floods, national crop production levels (including cereals and tubers) were forecasted to be about two percent higher than 2011 levels (a bumper year) and about six percent higher than the five year average. However, the significant crop damage due to the floods eroded these good prospects, and instead crop production is expected to be below-Average with maize, yam , and cassava crops suffering the greatest damage Crop production and losses figures by the Ministry of Agriculture, National Agricultural Research and Extension Services, and State Agricultural Services suggest that national production of maize yams, and cassava was down approximately ten, thirteen and nine percent compared to last year and one, eight, and three percent compared to the five-year average, respectively.

In addition to crop damage, last year's floods disrupted other

household livelihood activities and income sources, making it more difficult for affected households to generate cash income to purchase food on the market. For example, over 1.2 million goats, 3.7 million poultry and 136,972 cattle were killed during the floods which have negatively impacted livestock incomes. In addition, 242,522 fishing households reported fishing production losses valued at NGN 245,244,960. Damage incurred to irrigation systems, dams, and fishing ridges have also negatively impacted ongoing dry season activities (irrigated agriculture and fishing). Finally, flood- related damage to transportation infrastructure (roads, bridges, etc.) has disrupted food flows and has increased transportation costs (fews.net/IPC 2013).

The objective of this study is to identify the determinants of household food insecurity in the study area.

Methodology

This study used the ordered probit model to analyze food-insecurity classes. The ordered probit model is appropriate for the identification of the relationship between a categorical dependent variable with the case of more than two ordinal outcomes and explanatory variables ***(Baum et al., 1989)***. Due to a special property, i.e. the ordered probit model discerns unequal differences between ordinal categories in the dependent variable; it captures the qualitative differences between food-insecurity classes, given a unit change in the explanatory variable (e.g., **O'Donnell and Connor, 1996, Duncan et al., 1998, Khattak and Targa, 2004,**)[2,3,4]. The standard ordered probit model is widely used to analyze discrete data of this variety and is built around a latent regression of the following form:

$\hat{y} = x'\beta + \varepsilon$ ---------- (1)

Where x and β are standard variable and parameter matrices, and ε is a vector matrix of normally distributed error terms. Obviously predicted stimulus ($\hat{y}$) is unobserved. I do, however, observe the following:

$y = 0$ (secure) if $\hat{y} \leq 0$ ----------

$y = 1$ (insecure) if $0 < \hat{y} \leq \mu 1$ ----------

$y = 2$ (very insecure) if $\mu 1 < \hat{y} \leq$ ---------- (2)

Where Y (i = 0, 1, 2) are the unobservable threshold parameters that will be estimated together with other parameters in the model. When an intercept coefficient is included in the model, Y iB is normalized to a zero value (Green, 2000) and hence only k-1 additional parameters are estimated with Xs. Like the models for binary data, the probabilities for each of the observed ordinal response which in this study had 3 responses (0, 1, 2).

From the slope parameter and threshold estimates, it is relatively straightforward to calculate probabilities of receiving the assigned observe responses (i.e. secure, insecure and very secure). Given the cumulative normal function $\varphi(\beta \square x)$, the probabilities can be shown as below:

Prob [y=0 or secure] = $\varphi(-\beta \square x)$ ----------

Prob [y=1 or insecure] = $\varphi[\mu 1 - \beta \square x] - \varphi(-\beta \square x)$ ----------

Prob [y=2 or very insecure] = $\varphi[\mu 2 - \beta \square x] - \varphi(\mu 1 - \beta \square x)$ ---------- (3)

where $\beta \square x$ is a set of specific values of x for the estimated coefficients (β) and the threshold values (μ's). The food insecurity data, y are related to the underlying latent variable y^{*}, through the threshold values. The threshold value is defined between which categorical responses are estimated the estimation of this model is

relatively simple; the likelihood function can be derived easily (McKelvey, 1975). Ordered probit estimation will give the threshold u and parameter β. The threshold u shows the range of normal distribution associated with the specific values of the response variable. The remaining parameters, β, represent the effect of change in explanatory variables on the underlying scale.

The empirical model in terms of the latent regression can be formulated as:

yi = β0 + β1 HHCONSUMPi + β2 HHSIZEi +β3 HHLSIZEi +β4 EDUCi + β5 GENDi + B6 MSTATUSi + B7 AGEi + β8 ASSETSi + β9 ASCREDITi + β10 LOWNERSHIPi + β11 LXTICSi + β12 CASHCROPSi + β13 FERTi + β14 CLIMATICEFFi + β15 GOODSMKTPRICEi + β16 PRODUCEi + β17 MARKETBODi + β18 VILLAMKTi + β19 REAFORLIVESi + β20 EXTENWORKi + β21 OUTPUTDECi + β22 WATERDIFFi +B23 GOODSMKT + B24 PLANTIGRAIN + B25 SOURCECOOKENE + ei ---------- (7)

Where yi is the observe response for ith observation. HHCONSUMP is household consumption in Nigerian currency; Naira (N), HHSIZE is size of the household (number of dependents in the household). HHLSIZE is size of household land. EDUC is level of education of household head (in years). GEND is gender of head of household (D = 1 for male and D = 0 for female). MSTATUS is marital status of household head. AGE is the age of the head of the household. An ASSET is total value of household disposable properties in Nigerian currency, Naira (N). ASCREDIT is household head's access to credit (D = 1 if yes and D = 0 if otherwise). LOWNERSHIP is land

ownership (D = 1 if owned and D = 0 if otherwise). LXTICS is the mode of natural hazard in a given locality. CASHCROPS is crops planted not mainly for consumptions (D= 1 if food crop only and D= 0 if otherwise). FERT is fertiliser usage (D= 1 if fertiliser is applied and D=0 if otherwise). CLIMATICEFF is climatic condition (D= 1 if positive and D=0 if otherwise). GOODSMKTPRICE is the option which fetches good market price. PRODUCE is the total output of an household in a given season. MARKETBOD is the existence of marketing board (D = 1 if exist and D= 0 if otherwise). VILLAMKT is the distance between village community and the market (km). REAFORLIVES is the reasons for rearing livestock. DISMKT is distance to the market (km). EXTENWORK is extension worker contribution (D=1 if meaningful and =0 if otherwise). OUTPUTDEC is the assessment of the household in terms of reduction in yield. WATERDIFF is water availability (D = 1 if easily accessible and D = 0 if otherwise).GOODSMKT is the mode of transporting goods to the market. PLANTIGRAIN is the time/period when crops are normally planted. SOURCECOOKENE is the source of cooking energy. It is assumed that ei is normally distributed across observations and is normalized with the mean and variance of zero and one.

The Data

The study was conducted in Katsina State. It lies between latitude 12o 391 and 10o481 north and longitude 8o551 and 9o101 East. The area is dry (500 to 550mm average annual rainfall distributed over 65 to 100 days) and the soils are generally light and sandy, poor in structure and organic content with low to moderate inherent fertility (Katsina State, 2004). Wind and water erosion are major problems and there is severe land degradation particularly of communal lands.

Strong population density of the order of 300 people per km2, causes a small size of holdings (2.1 ha on average, for an average family of seven (7) members). Upland farming of Sorghum, millet, cowpea, rice, maize, and groundnut are the primary agricultural activity. Temperatures are high before the rains, averaging a maximum of 39o C in April and declining to 14o C (Katsina State, 2004). There are no major rivers in Katsina State and drainage pattern is not prominent because the area is water-shed. A few rivers drain north of Niger, i.e. the Gada, Tagwe and Sabke. All the rivers in the state are seasonal, except for the Sabke River. Katsina State is predominantly an agricultural state with over 75% of the populace involved in one form of agriculture. However, some women engaged in off-farm activities such as processing and trading to generate income. The major livestock kept in the state include small ruminants (sheep and goats), cattle, poultry etc (Katsina Survey, 2004).

It has thirty-four local government areas with a total population of five million eight hundred and one thousand, five hundred and eighty-four (5801, 584). Population of the study area according to National Population Commission in 2006 was one million and eighty-one thousand, seven hundred and three (1,081,703). The sample consist of two selected communities from each local government namely Jibia, Kaita, Mashi, Maiadua, Zango and Baure LGAs, and within the communities, some randomly selected households (not less than 30). Primary data was sourced from households through the combination of interview along with administration of oral questionnaire and personal observation. The interview were purposive and by convenience results in the selection of an average of twenty participants (male and female head of household). The administration of oral questionnaire

and observation involved an average of thirty households from each community through sampling technique which results in three hundred and sixty (360) household responses being collected. Therefore, the data collected were analysed using ordered probit model.

Results and Discussions

Table 2 below indicated that the likelihood ratio chi- square (the goodness of fit) measured by the value of 73.79 with a p-value of 0.0000 showed that the choice of explanatory variables included in the ordered probit model explained the variation in decisions in food insecurity. In ordered probit model, if you don't specify which the base-outcome is, stata will consider that as the most frequent category (i.e. the category with the highest percent frequency). By default, stata will consider insecure category (in this research) as the base-outcome because it has the highest percent frequency. Food insecurity categories were labeled as 0 "secure" 1 "insecure" 2 "very insecure" respectively. In addition, the number of set of coefficient is two (2) that is the number of choices or alternatives minus one (1) (K-1). However, tabulation of food-insecurity (table below) indicated the following in terms of food-insecurity category as "secure" 23.53%, "insecure" 72.83% and very "insecure" 3.64% respectively.

Table 1: Tabulation of food-insecurity (0, 1 & 2)

	Freq.	Percent	Cum.
secure	84	23.53	23.53
insecure	260	72.83	96.36
very insecure	13	3.64	100.00
Total	357	100.00	

0 "secure" 1 "insecure" 2 "very insure"

Source: Calculated From Data; using stata

In order to find the determinants of food-insecurity at household level in Nigeria, we used food-insecurity as dependent variable and lxtics, plantigrain, fertliser, cashcrop, assets, waterdifficulty, marketbod, lownership, produce, goodmktprice, sourcecookene, hhconsump, goodsmkt, outputdecline, climaticeffect, extensionworker, hhlsize, hhsize, accesstoloan, realforlives, villamarket, gendr, age, educ, and mstatus as the tables indicated respectively.

In the tables below, we see the coefficients, their standard errors, z-tests and their associated p-values, and the 95% confidence interval of the coefficients. Produce, hhconsump and extensionworker are highly statistically significant.

The sign of the coefficient of produce of the household head shows a negative relationship with food-insecurity. This means that an increase in the produce of the household head decreases the likelihood for the household to become food-insecure. This is possible because as households produce increases (all things been equal) there will be flexibility in the eating habits of the household as well as more income from the sales of excess produce and subsequently raising the standard of living of the household through accumulating wealth and using better planning, the household have better chances to become food-secure. This result agrees with the prior expectation.

There is a negative sign on the coefficient of hhconsump (which is a proxy to income) means that food-insecurity decreases as a result of increase in household consumption or the household is less likely to be food-insecure. Income can be farming income as well as off farming income and especially the latter, which will be as a result of the head of the household being involved in it or his children

and in some instances well to do relations/close friends who send in money regularly in alleviating some domestic problems. This in many households serves as an additional source of income and its continuity leads to long time effect by way of improving the welfare of the households. This is consistent with Oluwatayo (2013) and Omotosho (2005), Ohajianya et al (2011)

The probit coefficient of the extension worker is negative and it follows that as a result of increase in extension session leads to decrease in food-insecurity. On priori expectation, more sessions between an extension worker and farmers lead to exposure on new research findings on the scientific, biological as well as cultural methods of disease/pest prevention and control. Furthermore, new improved varieties, breeding principles as well as new farming methods are disseminated through the extension worker who served as a link between the government, research institute as well as service centers and the farmers at large. All these will go a long way in boosting agricultural production and its attendant benefits. This agrees with Ohajianya et al (2011)

The land characteristics coefficient has a negative sign and implies that as a unit increases in land characteristics, there is also a proportionate decrease in food-insecurity as other factors remained constant. It equally means that ungraded land supports plants and animal growth, more especially aided by fertility status. This will bring in bumper harvest for the household as well as enough food to rear animals in terms of mixed farming. One should be cautious to interpret that graded and ungraded land influence the type of plants/ animals to be planted/ reared and the quantity/number of plants/ animals produce. Of course degraded lands often do not support

plant cultivation due to washing away of the top soil which normally supports growth.

Plantigrain coefficient of the variable (plantigrain) carries a positive sign suggesting that the higher the amount of plantigrain for a household, the higher the probability of food-insecurity and vice versa. This is so because planting in rain-fed situations involves planting when rain really establishes. Controlling the amount of rain is out of one's hand and in a worst situation could result in drought, flooding for the worst scenario and to a lesser extent stunted growth and low harvest. This situation is after the household had used the little resources at his disposal for land clearing, ridging, planting as well as weeding. In the shot and medium terms, this exposes the household to both internal and external shocks.

The coefficient of fertilizer variable is positive signifying that the higher the amount of fertilizer the higher the rate of food-insecurity and vice versa. Fertiliser is primarily supplied by government in its various forms and hardly available. There are some private individuals involved in its supply, yet it is hardly enough and if readily available highly politicized with a lot of bottlenecks in its acquisition. Acquiring fertilizer is a priority, for the household will do anything including depriving itself some privileges in the present situation. The households in some circumstances sell out their food reserves, animals, borrow and even buy at a hire-purchase. This could also lead to vulnerability in terms of extortions, assets and food shortages. It agrees with the work of Ohajianya et al (2011)

An asset is a discrete variable and its coefficient is positive meaning that the higher the value of household assets is, the lower the probability of food-insecurity. This suggest that household assets holding is

believed to be of great importance in terms of household resilience, which cushion the effects of adverse situations such as crop failure, drought, infestation etc on household food-security. It is true that some of the assets could be disposed off in time of extreme pressure.

It is a discrete variable (marketing board) and its coefficient sign is negative implying that when the number of market board increases, the probability of food-insecurity decreases. Marketing boards were established by government in several places in the country to cater for or to serve some specific purposes, for example stabilizing commodity prices in buying surplus produce from farmers to encourage them to continue producing; serving as an outlet of the produce to the outside world, sponsoring researches into specific area of crop plant production and above all re-sell the produce back to the household (public) in terms of need. This helps the household to have good price of their produce and at the same time buy it from the government at a subsidized price and subsequently more resources at their disposal.

The hhsize variable coefficient has a positive sign which posits that as the household size increases, the probability of food-insecurity also increases. As the household increases in size, more demands will be encountered in terms of more food intake, catering for children's education etc in the midst of in- expandable land. In the case of grown up male children who have reached a marriage in the household; part of the farmland is converted to a house. Furthermore, when a grown up female child reached marriage or somebody seeks her hand in marriage; in a cash trap situation a portion of the fixed farmland could be sold off for the marriage ceremony. In case of the death of the household head, the farmland becomes fragmented

and this coupled with the earlier factors give more room for food-insecurity to flourish. In short, the likely explanation is that in an area where households depend on less productive agricultural land, increasing household size results in increased demand for food. This demand, however, cannot be matched with the existing food supply so ultimately end up with food insecurity. This agrees with the works of Ohajianya (2011) and Oluwatayo (2013), Omotosho (2005) and Idrissa (2013)

Mstatus is a discrete variable and its coefficient is positive, it implies that as marital status increases; the probability of food-insecurity also increases. This is so because marriage has its own obligations in terms of committed responsibilities. The household head provides the basic necessities and when blessed with children, school bills, medication etc follow suit. In the study area, most household farmlands are fixed and any responsibilities which does not commensurate with the farmland capacity will result in deficit (i.e. will give room to food-insecurity.

Goodsmkt variable coefficient is positive, indicating that as the number of goodsmkt increases, the probability of food-insecurity increases. After a good harvest, the produce are either kept in the warehouse if any in the farm or carried home and kept in "rhumbu" for safe keeping. However, when the need arises to sell off the produce, one has several options to do that. This could be explained as households in the study area transport their produce to the market through animals, wheel barrow, motorcycles and to a lesser extent Lorries. There are a lot of wastages and loss of goods during the transition and subsequently a lot of resources is loss to the household which will expose it to food-insecurity.

Conclusion

The problem of food insecurity is pervasive in Nigeria, the study revealed that the factors that determined the likelihood of households to become food-insecure includes variables such as ltics, plantigrain, fertilizer, assets, marketbod, produce, goodsmkt, hhconsump, goodsmkt, extensionworker, hhsize, realforlives, villamarket, age, and mstatus. These variables are found to be very significant and important correlate which affects household food-insecurity favourably and among the variables; produce, hhconsump, extensionworker are found to have significantly higher correlates to food security situations. Furthermore, variables such as land characteristics, planting rain, fertiliser, assets, market board, household size, and marital status as well are significant, important correlates but a little lower in terms of significance level which equally affect household food-insecurity situations. Variables like goodsmkt, reason for livestock rearing, and the distance from village to market are mild in their significance and are at the boarder-line for food-insecurity situation.

Table 2: Results of Ordered Logit, Ordered Probit and Marginal Effects (Default Base-outcome) of estimated Model

Name of explanatory Variable	Ordered Logit (ologit)		Ordered Probit (oprobit)		Marginal effects	
	Odds ratio	p-value	Coefficient	p-value	Av. Change	p-value
Lxtics	.7834806	0.045	-.1315271	(0.045**)	.0347897	0.046
Plantigrain	1.955701	0.044	.3479875	(0.047**)	-.0920448	0.047
fertiliser	3.396817	0.023	.6009466	(0.031**)	-.1589541	0.033
Cashcrop	.8332629	0.726	-.0716562	(0.800)	.0189535	0.800
Assets	1.592794	0.028	.2248015	(0.038**)	-.0594614	0.040
Waterdifficulty	2.518244	0.094	.4445402	(0.122)	-.1175836	0.123
Marketbod	.0728062	0.022	-1.311665	(0.022**)	.3469434	0.024
Lownership	6.427079	0.156	1.131103	(0.130)	-.2991837	0.129
Produce	.9795364	0.004	-.0118305	(0.003***)	.0031292	0.003
Goodmktprice	12.3544	0.133	1.436335	(0.168)	-.3799194	0.169
Sourcecookene	.4686374	0.461	-.4192507	(0.477)	.1108944	0.477
Hhconsump	.9991189	0.007	-.0004782	(0.009***)	.0001265	0.010
Goodsmkt	1.500055	0.227	.3003818	(0.102*)	-.0794528	0.101
Outputdecline	1.97879	0.123	.328009	(0.157)	-.0867604	0.158
Climaticeffect	1.650082	0.719	.3460467	(0.672)	-.0915315	0.672
Extensionworker	.11562	0.002	-1.074926	(0.004***)	.2843245	0.004
Hhlsize	.7019842	0.503	-.2050274	(0.465)	.054231	0.465
Hhsize	1.047301	0.005	.0208141	(0.016**)	-.0055055	0.018
Accessestoloan	1.41008	0.600	.1711202	(0.623)	-.0452624	0.623
Reaforlives	1.390325	0.102	.177758	(0.110)	-.0470181	0.112
Villamarket	.9997174	0.117	-.000156	(0.110)	.0000413	0.108
Gendr	.9295217	0.906	.0720962	(0.827)	-.0194433	0.830
Age	1.02927	0.139	.0182243	(0.093*)	-.0048204	0.092
Educ	1.012085	0.664	.0092728	(0.536)	-.0024527	0.535
Mstatus	1.493099	0.034	.2011462	(0.039**)	-.0532044	0.040

Source: Calculated from the field data; using stata 12

	Ordered Logit	**Ordered Probit**
Number of observations	**201**	**201**
LR chi2 (25)	**76.62**	**73.97**
Prob > chi	**0.0000**	**0.0000**
Pseudo R2	**0.2680**	**0.2587**
Log likelihood	**-104.66461**	**-105.98911**

Note: *, ** and * is highly significant, significant and mild in terms of 1%, 5% and 10% respectively.**

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