FOOD SECURITY AND INCOME DIVERSIFICATION NEXUS: USDA APPROACH

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Abstract

This study assesses the linkages between income diversification and household food security status using United State Department of Agriculture (USDA) 18 items questionnaire core module. Multistage sampling procedure was used to select 240 households, data were collected with the use of structured questionnaire and analyzed with descriptive statistics, Rasch model, Simpson Diversification Index (SDI) and ordered logit regression model. The result of the information function revealed that the scale is adaptable for this study. The SDI revealed that the households averagely diversify their income source. The USDA food security results revealed that majority of the households were in very low food security category. The ordered logit regression revealed that age (p<0.05), marital status (p<0.05) and dependency ratio (p<0.05) had negative effects on household food security status while income diversification (p<0.05) and access to health facilities (p<0.1) had positive effects. It was thereby concluded that income diversification increases household food security status while increase in number of dependent individuals reduces it. This study thereby recommended that regional government at all levels should set up skill acquisition and empowerment programs that will enable household's practices farming along with a wide range of income generating activities, this will go a long way in reducing number of dependent individuals and increasing households food security status.

Key words: *food security, income diversification, rasch model, ordered logit*

INTRODUCTION

Since its evolvement in development literature, non-agricultural economy had witnessed an increasing recognition across the rural communities at national and global settings. Farming, in spite of its central importance in rural livelihood, is becoming unable to provide a sufficient means of survival in rural areas, thereby requiring the need for diversification [15]. Livelihood diversification implies a process targeted at broadening of income and livelihood strategies away from purely crop and livestock production towards both off-farm and non-farm activities [28, 15]. Income diversification simply express 'is the presence of two or more income generating activities or sources'. According to [17] "rural livelihood diversification could be described as the process by which rural households construct portfolio of activities and assets in order to survive and improve their living standards". Evidences over the years showed that diversification is the norm [9] rather than the exception [35]. The activities combinations are of different risk profiles which are carefully chosen in other to secure a constant inflow of income. No single individual earn income from a single activity neither do they keep their wealth in form of a single investment. This is because of the uncertainty and risks associated with the outcomes in most business situations, which is more predominant in the agricultural sector given the external factors that interact with the efficiency of its enterprises operation. Farmers in an attempt to enhance their livelihood or mitigate possible farming risk, diversified into both agriculture and non-agriculture activities. Notable income sources are categorized into; agricultural wage income, self-employment in off-farm activities such as agro-processing and marketing, non-farm wage earning, assets

earning and income transfer (remittances). Hence, diversification as implies measure the level of income earning sources associated with a households. Furthermore, the motive of diversification could vary from household to household or individual to individual, falling under a broad views of the pull and push factors. The "pull factors" has to do with the decision of an individual to tap into wealth making opportunities given the resources at his or her disposal, while livelihood and or welfare improvement is the major factor that push household into diversification. However, household's food security status is a key element of a welfare assessment.

Food no doubt is a basic necessity of life, and its importance at the household level as basic means of sustenance is obvious. Adequate food intake in terms of quantity and quality is a key for healthy and productive life [18] and [32]. Food accounts for a substantial part of household's budget, so does it rank topmost in the hierarchy of human needs given its essentiality for a healthy living. Various foods serve as important vehicles for taking nutrients into the body and bringing about a healthy state, hence the need for food to be taken in the right quality and quantity [25]. This therefore makes achieving food security to be of importance in any given country. [14] defined food Security as a situation in which people does not live in hunger or fear of starvation. Food security according to [17] and [29] is when all people at all times have access enough food for an active life, as against food insecurity which is the inability of a household or individuals to meet the required consumption levels in the face of fluctuating production, price and income. Many countries experience food insecurity with food supplies being inadequate to maintain their citizens' per capita consumption. [20] Estimated that almost 1billion people are chronically malnourished and food insecure around the world, majority of these people are found in developing countries mostly in Asia and Africa. [2] Opined that approximately one-third of the people in sub-Saharan Africa are undernourished. However, food security achievement at the national, regional and local levels requires that food must be available, accessible and properly utilized. Food accessibility depends on availability of income to the households as well as distribution of income within the households and food price [14]. The sources of income and their reliability for a steady flow and reliable amounts are important to individuals and households in ensuring food security. The poor households given their inferiority in education, basic technical skills and employment and hence low income, are most vulnerable to food insecurity. The conventional view of the small farm households sustaining themselves solely on their crops is no longer in accords with reality. Peasants are also traders, craftsmen, entrepreneurs, migrant workers, animal raisers and wage laborers [35]. [38] and [10] opined that participation in rural non-farm activities exerts a pronounced impact on rural agriculture, household farm decisions [38] and [16], rural development [19], income and welfare [26] and household food security [37], [8], [19], [14] and [35]. [39] and [15] reported that diversification to non-farm work improves household food security. Diversification research interest in Nigeria revealed that despite the fact that many rural households are engaged in a diverse set of livelihood activities, food security is yet to be achieved. However, it becomes of great necessity to quantitatively link these economic variables (income diversification and food security) with a functionality view of generating more potent and environment specific measures whose adoption can settle the menace of food insecurity in the study area. Although there are considerable literatures linking income diversification and food security [14], [35], [39] and [5] the fact that food insecurity remains a challenge especially among the rural and low income households justify the need to probe further, if diversification of income as a livelihood improvement strategy truly merit any accolade in that regards or otherwise, and therefore propose possible alternative or complementary recommendations upon findings. Although there are growing literatures on linkages between income

diversification and food security, this study differs from other studies as it employs USDA food security approach which measures the extent and intensity of food security. This study will however assess the linkage between income diversification and households food security status, specifically, this study will measures the level of income diversification among the households, assess the food security status of the households and estimate the effect of income diversification on household food security status.

MATERIALS AND METHODS

This study was carried out in Oyo state, Nigeria. The state is an inland state in south-western Nigeria, with its capital at Ibadan. It is bounded in the north by Kwara State, in the east by Osun State, in the south by Ogun State and in the west partly by Ogun State and partly by the Republic of Benin. Multistage sampling procedure was used to select respondents for this study, the first stage involved random selection of four Local Government Areas (LGAs) out of the thirty-three LGAs in the state using table of random numbers from the list of LGAs, the second stage entails random selection of four villages from the selected LGAs, the last stage entails purposive selection of fifteen households from the selected villages making a total sample size of 240 households. Purposive sampling technique was used at the last stage as there was no enough information on the total number of households in the villages. However, only 233 responses from the households were fit for analysis after data clean up. Primary data was collected from the households with the use of structured questionnaire; the data collected were analyzed with simple descriptive statistics, Simpson index of diversification, Rasch model and ordered logit regression model with the use of STATA 14.1 statistical package.

Food Security Analysis
The USDA 18 food security questionnaire core module was used to capture the households food security status, USDA categorizes households using a constructed food security scale that ranges between 0 and 10 for households without children and between 0 and 18 for households with children, the respondent indicated whether the statement was often true, sometimes true, or never true for a given household in the last one year. Appendix I give description of the eighteen questions that were used. Household's response to each of the questions was first coded as either affirmative or negative, sometimes true and often true were considered affirmative response because they indicated that the condition occurred at some time during the period covered by the study. However, households were classified into four food security status base on their number of affirmative responses on the scale. Following the recommended cut-points by USDA, households with non-affirmative response to the 18 questions or 0–2 are classified as High Food Secure (HFS), those with 3–7 as Marginal Food Secure (MFS); 8–12 as Low Food Secure (LFS) and those between 13–18 as Very Low Food Secure (VLFS). For adult-referenced items, households with 0–2 affirmatives are classified as HFS; those between 3 and 5 affirmatives as MFS; 6 and 8 affirmatives as LFS and between 9 and 10 affirmatives responses as VLFS.

Rasch Measurement Model
Rasch model was used to check for reliability and validity of the data collected. Rasch measurement model is a non-linear factor analysis with binary variable such as "yes" or "no" response to a survey item and it falls into the family of Item Response Theory models [24]. The model is a one-parameter model, meaning that it models the "one" parameter difference between person position and item difficulty. Following the specification of [5], [12], and [36]. Rasch model that the log odds of a household (j) responding to an item (q) correctly is a function of ability (θ_j) and the item's difficulty (β_q) was specified as:

$$\text{logit } (P_{q,j}) = \log\left(\frac{Pr(Pq,j)}{1 - Pr(Pq,j)}\right) = \theta_j - \beta_{q'} \dots \ (1)$$

where:
j = number of households/respondents,
q = number of items, and

θ_j is normally distributed random variable with zero mean and variance.

Thus, the Rasch model was specified as:

$$P(X_{jq} = \frac{1}{\theta_j}, \beta_q) = \frac{\exp(\theta_j - \beta_q)}{1 + \exp(\theta_j - \beta_q)}, \ldots\ldots (2)$$

Simpson Diversification Index (SDI)

Due to its wider applicability, computational simplicity and robustness, SDI was used to capture the income diversification of the households, following [1], the SDI was specified as:

$$SDI = 1 - \sum_{i=1}^{n} Z^2 \ldots\ldots\ldots\ldots (3)$$

where:

SDI is a measure of income diversification and Z is income share of each activity, and Z is expressed mathematically as:

$$Z = \left(\frac{k_i}{k_t}\right) \ldots\ldots\ldots\ldots (4)$$

where:

n is the number of income sources;

k_i is the income from each activity, and

k_t is the household's total income.

The value of SDI ranges between 0 and 1. When SDI is less than 0.01 there is no diversification; between 0.01–0.25 low diversification, between 0.26-0.50 average diversification and when greater than 0.51 there is high diversification [1].

Ordered Logit

The effect of income diversification on household food security status was estimated with ordered logit model, this was used because the food security status outcome was ordered or ranked. Following [23] the ordered logit model was specified as:

$$Y_i^* = \sum_{j=1}^{j} \delta_j X_j + \varepsilon_j = Z_j \ldots\ldots\ldots (5)$$

where:

Y^* continuous latent variable,

δ_j the vector of parameters or coefficients to be estimated by the model,

X_j represent vector of the explanatory or independent variables,

$Z_j = \sum_{j=1}^{j} \delta_j X_j$, Z_j is the random disturbance term reflecting that relevant variables may be left out of the equation, or variables may not be perfectly measured.

$Y^* =$ Food security status of the household (0, 1, 2, 3)

Prob $(Y_i = j) = J =$ food security status of households in the order set as:

j = 0, if High Food Secure (HFS),

j = 1, if Marginal Food Secure (MFS),

j = 2, if Low Food Secure (LFS), and

j = 3, if Very Low Food Secure (VLFS).

$X_j =$ vector of explanatory variable conditioning the choice of the jth alternative

$\delta_j =$ parameters to be estimated

$\varepsilon_j =$ error term

$\delta_1 =$ sex of household head (1=male, 0=otherwise)

$\delta_2 =$ age of household head (years)

$\delta_3 =$ marital status of household head (1=married, 0=otherwise)

$\delta_4 =$ household size (Numbers of person)

$\delta_5 =$ dependency ratio (number of non-working adults/number of working adults)

$\delta_6 =$ level of education in (years)

$\delta_7 =$ primary occupation (1=farming, 0=otherwise)

$\delta_8 =$ access to credit (1=had access, 0=otherwise)

$\delta_9 =$ income diversification (Simpson index value)

$\delta_{10} =$ household monthly expenditure (Naira)

$\delta_{11} =$ access to health facilities (1=had access, 0=otherwise)

However, marginal effects were generated to determine the predictive power of variables in the model, the probabilities of respondents being in any of the identified categories are determined using the natural log of the cumulative distribution. Following [13] and [31], the marginal effects of changes in the independent variables are computed as:

$$\frac{\delta \, prop(y = \frac{0}{x})}{\delta \chi} = -f(\mu_0 - x_\delta). \, \delta$$

$$\frac{\delta \, prop(y = \frac{1}{x})}{\delta \chi} = -f[(\mu_1 - x_\delta). \, \delta - f(\mu_0 - x_\delta)]. \delta$$

$$\frac{\delta \, prop(y = \frac{2}{x})}{\delta \chi} = -f[(\mu_2 - x_\delta). \, \delta - f(\mu_1 - x_\delta)]. \delta$$

$$\frac{\delta \, prop(y = \frac{3}{x})}{\delta \chi} = -f(\mu_2 - x_\delta). \delta \ldots\ldots\ldots (6)$$

where: 0, 1, 2, 3 are the various categories (HFS, MFS, LFS and VLFS), χ is the independent variable, μ_0, μ_1, μ_2 are the cut-off values for the ordered logit model and f is the cumulative probability function. The marginal effect for the dummy variable was calculated by taking the probabilities for each category at $v = 0$ and at $v = 1$, and take the difference [31].

RESULTS AND DISCUSSIONS

Validation and Reliability of Rasch Measurement Model

Table 1 revealed the difficulty and easiness parameter of the Rasch model; it was revealed that for the difficulty parameter 14 items were found to be significant while 11 items were found to be significant under the easiness parameter. Although some of the items were not significant, there is no enough evidence to remove them from the analysis.

The Item Characteristics Curves (ICC) in appendix 2 revealed that households could easily provide response to item 2, 3 and 18 while it is very difficult to provide answer to item 9, 14 and 15 in the food security assessment. The information function as displayed in appendix 3 is regular on the interval of the latent trait where the individuals are represented, and it can be concluded that the scale is adaptable for our population.

Table 1. Estimated Theta and Beta coefficient of Rasch Model

Items	Theta (difficulty parameter level)		Beta (easiness parameter level)	
	Estimate	Std Err.	Estimate	Std Err.
q1	0.240	0.310	-2.833*	1.496
q2	-0.215	0.328	-1.652*	0.895
q3	0.579*	0.301	-1.057	0.719
q4	0.579*	0.301	-0.632	0.63
q5	0.735**	0.299	-0.289	0.577
q6	0.579*	0.301	0.008	0.543
q7	1.448***	0.292	0.277	0.52
q8	1.919***	0.292	0.527	0.505
q9	1.718***	0.292	0.767	0.497
q10	1.550***	0.292	1.002**	0.494
q11	1.414***	0.292	1.235**	0.496
q12	1.172***	0.294	1.474***	0.504
q13	1.414***	0.292	1.721***	0.517
q14	1.345***	0.293	1.986***	0.539
q15	1.852***	0.292	2.279***	0.573
q16	1.242***	0.293	2.616***	0.625
q17	0.329	0.308	3.034***	0.713
q18*	-	-	3.623***	0.89

Source: Field Survey Data Analysis, 2020
***, ** and * significant at 1%, 5% and 10% respectively

Income Diversification Strategies

The result revealed that households were involved in diverse income generating sources (farm, off-farm and non-farm). The result showed that more than half (61.80%) were engaged in production of staple crops, lower proportion (1.72%) were engaged in staple and permanent crops, lower portion (6.87%) were engaged in staple, permanent crops and livestock production, smaller proportion (0.86%) were engaged in staple, permanent crops, livestock production and other agricultural production activities, lower proportion (8.58%) were engaged in staple crops and livestock production, lower proportion (11.16%) were engaged in permanent crops production, lower proportion (0.86%) combine permanent crops and livestock production, lower portion (4.72%) were engaged in livestock production while 3.43% were engaged in other agricultural production activities.

The result revealed that most (33.04%) of the households were engaged in processing of

agricultural produce, more than a quarter (29.61%) were traders, lower portion (6.44%) were artisans, lower proportion (7.73%) were civil servants wile almost a quarter (23.18%) did not diversify their livelihood activities. This implies that majority were engaged in agricultural produce processing and this may be because farming was the primary occupation in the area, the result supports the findings of [22] that opined that rural people's livelihoods are derived from diverse sources and are not as overwhelmingly dependent on agriculture.

Table 2. Household's income diversification strategies

Variable	Frequency	Percentage
Farming Activities		
Staple crops	144	61.80
Staple and permanent crops	4	1.72
Staple, permanent crops and livestock	16	6.87
Staple, permanent crops, livestock and others	2	0.86
Staple crops and livestock	20	8.58
Permanent crops	26	11.16
Permanent crops and livestock	2	0.86
Livestock	11	4.72
Others	8	3.43
Total	233	100.00
Non-Farm and Off-farm Activities		
Agricultural produce processing	77	33.04
Trading	69	29.61
Craft/artisanal	15	6.44
Civil service	18	7.73
None	54	23.18
Total	233	100.00

Source: Field Survey Data Analysis, 2020.

Level of Income Diversification

The result revealed that more than half (52.79%) of the rural households typically diversify their income source, less than a quarter (23.18%) did not diversify their income source, none had low income diversification while almost a quarter (24.03%) highly diversify their income source. The mean income diversification among the households was 0.316 which implies that majority of the households averagely diversify their livelihood source.

This result is in tandem with the findings of [4] and [1] that reported average level of livelihood diversification among rural households.

Table 3. Level of household's income diversification

Variable	Frequency	Percentage
Income diversification		
No diversification	54	23.18
Low diversification	0	0.00
Average diversification	123	52.79
High diversification	56	24.03
Total	**233**	**100.00**
Mean	**0.316**	
Minimum	**0.000**	
Maximum	**0.662**	

Source: Field Survey Data Analysis, 2020.

Food Security Categories

The result revealed that more than half (62.66%) of the rural households were in the very low food security category, lower proportion (4.29%) were highly food secure, lower proportion (4.29%) were marginally food secure while more than a quarter (28.76%) were low food secure. The implication of this result is that majority of the rural households were still food insecure despite the fact that the bulk of food produced comes from rural areas, this result is consistent with the findings of [31] and [7] that reported that the food insecurity among farming households in North-Central Nigeria and South-Western Nigeria were 84% and 65% respectively.

Table 4. distribution of households according to their food security status

Food Security Status	Frequency	Percentage
High Food Security	10	4.29
Marginal Food Security	10	4.29
Low Food Security	67	28.76
Very Low Food Security	146	62.66
Total	**233**	**100.00**

Source: Field Survey Data Analysis, 2020.

Result of Ordered Logit Estimates

The pseudo R-square associated with ordered logit model were observed as inappropriate measure of the predictive power of ordered response models. Therefore, the chi-square value and the log-likelihood ratio criteria were used to evaluate the effectiveness of the

model in line with [30]. The result revealed that the chi-square value of 46.2 shows that variables in the model are fit to explain the factors influencing the food security status of the rural households, also the value of probability of chi-square of 0.0000 shows the overall significance of the model at 1% probability level ($p<0.01$) with a lower log likelihood of -201.837. The estimated cut-off points (μ) satisfy the conditions that $\mu 1< \mu 2< \mu 3$ implies that these categories are ranked in an ordered way [27]. The result revealed that age ($p<0.01$), marital status ($p<0.05$) and dependency ratio ($p<0.05$) had negative effects on the food security status while income diversification ($p<0.05$) and access to health facilities ($p<0.1$) had positive effects. The coefficient of age of household heads showed that increase in age of the household heads decreases the probability of being food secure, the implication of this result is that increase in age of household heads reduces the food security status of the households; this result is in line with the findings of [33] who reported a negative relationship between age and household food security status in south-

western Nigeria. The coefficient of marital status revealed that the food security status of married households is likely to reduce compared to their unmarried counterparts. This result is consistent with the finding of [31] who reported an inverse relationship between marital status and household food security status in North-central Nigeria but contrary to the findings of [40] that reported a direct relationship. The coefficient of dependency ratio revealed that increase in number of dependent individuals reduces the food security status of the households, this implies that the higher the number of dependent individuals the lower the household food security status. This result supports the findings of [11] and [40] that reported similar results. The coefficient of income diversification revealed that the higher the level of income diversification the higher the food security status of the households, this implies that highly diversified households are more likely to be food secure, this result conform with the findings of [15] who reported that income diversification improves household food security status.

Table 5. Effect of income diversification on household food security status

Variable	Coefficient	Robust Standard Error	z-value	P-value
Sex	-0.230	0.338	-0.68	0.497
Age	-0.029**	0.013	-2.23	0.026
Marital status	-0.961**	0.459	-2.09	0.036
Household size	0.015	0.049	0.30	0.763
Dependency ratio	-0.603**	0.280	-2.15	0.031
Level of education	-0.021	0.034	-0.61	0.539
Primary occupation	-0.144	0.344	-0.42	0.676
Access to credit	-0.175	0.297	-0.59	0.556
Income diversification	1.507**	0.696	2.17	0.030
Household monthly expenditure	-1.71e-07	1.89e-06	-0.09	0.928
Access to health facilities	0.585*	0.328	-1.79	0.074
/cut1	-5.809	1.035		
/cut2	-5.002	0.998		
/cut3	-2.948	1.013		
Diagnostic test				
Wald chi^2(12)	46.20***			
Prob > chi^2	0.000***			
Pseudo R^2	0.060			
Log pseudolikelihood	-201.837			

Source: Field Survey Data Analysis, 2020
***, ** and * significant at 1%, 5% and 10% respectively

The coefficient of access to health facilities revealed that households that have access to

health care facilities are more likely to be food secure compared to their counterparts that did

not have access to health facilities. This result supports the finding of [31] that reported positive relationship between household food security status and access to health care facilities.

Marginal effects of food security categories
The marginal effects of age revealed that the food security status of VLFS decreases by 0.007 if age of household heads increases by 1 year, this is so because as age increases productivity reduces thereby impacting negatively on the food security status. This result conforms with the findings of [34], [33], however, food security status of LFS, MFS and HFS increases by 0.005, 0.001 and 0.001 respectively if age of household heads increases by 1 year, this result agrees with the findings of [3] that reported a direct relationship between age and household food security status. The marginal effect of marital status revealed that the food security status of married household heads among VLFS category is likely to reduce by 0.197 compared to their unmarried counterparts, this is so because married households are more likely to have high number of dependent

individuals thereby reducing per capita food consumption. This result supports the findings of [31], however, the food security status of married household heads among the LFS, MFS and HFS is likely to increase by 0.150, 0.025 and 0.0022 respectively, and this might be because married household members are more likely to pool their resources together thereby resulting to higher food security status. This result is consistent with the findings of [11] and [40]. The marginal effects of dependency ratio revealed that if the number of dependent individual increases by a unit the food security status of VLFS, LFS, MFS and HFS households will decrease by 0.140, 0.101, 0.020 and 0.019 respectively. This implies that household with more dependent individuals are more likely to be food insecure. This result is in tandem with the findings of [11], [33] and [40]. The marginal effects of income diversification revealed that if the income diversification increases by a unit the food security status of VLFS, LFS and MFS households will increase by 0.351, 0.253 and 0.047 respectively.

Table 6. Estimates of marginal effects

Variable	Very low food security		Low food security		Marginal food security		High food security	
	dy/dx	P>z	dy/dx	P>z	dy/dx	P>z	dy/dx	P>z
Sex+	-0.0530	0.493	0.0385	0.497	0.0075	0.494	0.0070	0.4900
Age	-0.0068**	0.025	0.0049**	0.029	0.0010*	0.055	0.0009*	0.071
Marital status+	-0.1969**	0.014	0.1498**	0.016	0.0247*	0.042	0.0224**	0.049
Household size	0.0035	0.763	-0.0025	0.764	-0.0005	0.765	-0.0005	0.758
Dependency ratio	-0.1403**	0.032	-0.101**	0.039	-0.0202*	0.059	-0.0188*	0.065
Level of education	-0.0049	0.541	0.0036	0.531	0.0007	0.559	0.0007	0.581
Primary occupation+	-0.0337	0.678	0.0241	0.676	0.0049	0.688	0.0046	0.682
Access to credit +	-0.0155	0.695	0.0112	0.695	0.0022	0.703	0.0021	0.694
Income diversification	0.3505**	0.031	0.2531**	0.027	0.0504	0.105	0.0470*	0.089
Household monthly expenditure	-3.97e-08	0.928	2.87e-08	0.928	5.71e-09	0.928	5.33e-09	0.928
Access to health facilities+	0.1391*	0.077	0.09691*	0.072	0.02158	0.141	0.02065	0.146

Source: Field Survey Data Analysis, 2020
***, ** and * significant at 1%, 5% and 10% respectively
(+) dy/dx is for discrete change of dummy variable from 0 to 1

This implies that households that diversify into non-farm and off-farm livelihood sources

are more likely to be food secure, this is so because diversification provides an alternative

income source thereby enhancing food security. This result supports the findings of [15], [6] and [21].

The marginal effect of access to health facilities revealed that the food security status of households that have access to health facilities among VLFS and LFS category is likely to increase by 0.139 and 0.097 compared to their counterparts that did not have access to health facilities, this is so because access to and use of health facilities will increase the healthy time of the households thereby enhancing productivity and this will invariably improve their food security status.

CONCLUSIONS

This study was carried out to assess the effect of income diversification on household food security status using USDA 18 items questionnaire core module. Rasch model was used to check for reliability and validity of the scale, the result of the information function revealed that the scale is adaptable for the study. It was revealed that production of staple crops was the major farming strategy adopted by the households while processing of agricultural produce was the major off-farm strategy adopted. The result of Simpson Diversification Index revealed that more than half of the household's typically diversify their income sources, larger proportion of the households were food insecure as they measure very high on the food insecurity scale. The result of the determinants of food security revealed that households with older and married heads were less likely to be food secured. Similarly, increasing the number of dependent individuals reduces household food security status, however, increase in number of income sources as well as having access to health facilities increases household's food security status. It was thereby concluded that income diversification increases household food security status whereby increase in number of dependent individuals reduces household food security status. This study thereby recommended that regional government at all levels should set up skill acquisition and empowerment programs that

will enable household's practices farming along with a wide range of income generating activities, this will go a long way in reducing number of dependent individuals and increasing households food security status.

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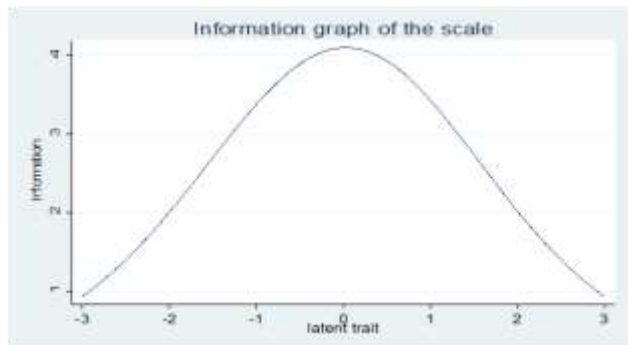Appendix 1. Eighteen (18) Households' Food Security Items

S/No	Questions/Statements
1	We were worried our food would run out before we got money to buy more
2	The food we bought just didn't last and we didn't have money to get more
3	We couldn't afford to eat balanced diet
4+	We relied on only a few kinds of low cost food to feed the children
5+	We couldn't feed the children a balanced meal
6+	The children were not eating enough because we just couldn't afford enough food
7	Did some adults ever have to eat less than you felt you should eat because there wasn't enough money to buy food?
8	How often did this happen in the last 12 months?
9	Did some adults ever have to eat less than you felt you should eat because there wasn't enough money for food?
10	Were some members ever hungry but didn't eat because you couldn't afford enough food?
11	Did some members ever lost weight within the last 12 months because there wasn't enough food?
12	Were there ever a time within the last 12 months that some adults could not eat for a whole day because there wasn't enough money to buy food?
13	How often did this happen in the last 12 months?
14+	Did you ever have to cut the size of some of the children's meal within the last 12 months because there wasn't enough money to buy food?
15+	Did any of the children ever had to cut the size of some of the children's meals within the last 12 months because there wasn't enough money to buy food
16+	How often did this happen in the last 12 months?
17+	In the last 12 months, were the children ever hungry but you just couldn't afford more money?
18+	In the last 12 months, did any of the children ever not eat for a whole day because there wasn't enough money for food?

+Not applicable to households without children.
Source: [41]
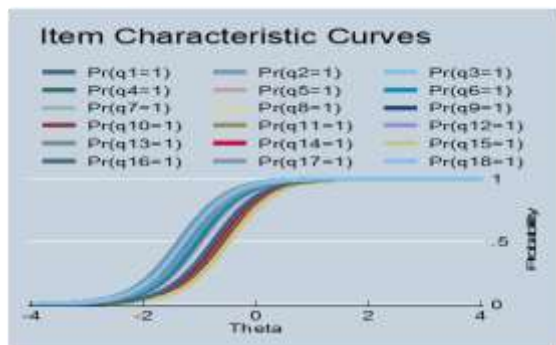
Source: Field Survey Data Analysis, 2020.

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