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Higher Food Price, Social Safety Nets and Food Consumption Diversity in Nigeria

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Abstract

Consumption of diverse diets is an important factor in promoting good health and nutrition. Most of the studies on food demand in developing countries focused largely on the quantity consumed of specific foods or food-groups with little attention on diversity in food consumption. This study examined the extent of diversity in household diets and influence of food prices, household income and social interventions on food consumption variety in Nigeria using the Living Standard Measurement Survey (LSMS) panel data of 2012/2013 and 2015/2016. Food counts and Berry measures of food consumption diversity were constructed and used as regressands respectively in the Panel Poisson and fixed effects regressions employed for analysis. We found that nominal income growth, or cash assistance is unlikely to substantially advance dietary diversity unless price inflations are adjusted for. However, participation in food distribution may exert significant and positive (albeit weak) influence on food consumption diversity. The effects of food prices on the various dimensions of food consumption diversity mixed, with increases in prices of cereals, beef and eggs much more likely to reduce the number foods group consumed, and that of fish and tuber depressing the spreads of food expenditure in household diets. Agricultural households and households headed by females consumed more highly diverse diets. Combined efforts to promote agriculture, enhance household income, and sensitively-guided efforts to curtail food price inflation and gender-based interventions are advocated, among others.

Key words: Food diversity; Food prices; Income growth;

JEL Classification: I3 – Welfare, Well-being, and Poverty

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Introduction

Much of the empirical literature on food consumption behaviour among households in developing countries, especially in Africa have focused more on the quantity consumed of a individual foods or food groups and their determinants. Diversity in food consumption and its causal factors are less studied. Paucity of empirical studies on what influences consumption of diverse foods among households could be partly responsible for why most African countries still domiciliate large number of malnourished population (Pinstrup-Andersen, 2009) despite the various policy actions and programmes to enhance food security and nutrition. In his view of the reasons for the limited success (slow progress) of programmes directed at addressing food insecurity and related concerns in many developing countries (Nigeria inclusive), Clover (2003) linked poor performance of interventions to faulty actions and incorrect analysis; which apparently, from demand side appraisal, include limited focus on (or complete overlook of) other dimensions of food security (Pinstrup-Andersen, 2009; Barrett, 2010) such as food consumption diversity. An understanding of the factors influencing diversity in food consumption could offer useful information on how policy levers can be controlled to promote household food security and nutrition in the country.

The diets of many households in Africa are predominantly plant-based, consisting largely of starchy staples (which contain low number of micro-nutrients that are often not easily absorbed) with little or no proteins of animal origin and few fresh fruits and vegetables (Arimond and Ruel, 2004). Understanding diversity in food consumption is crucial in various areas. Welfare economists would parallel diet diverseness with improvement in consumer's welfare in that it weakens diminishing returns to food quantity and increases the chance of matching consumer's preferences with attributes of food products (Li, 2013). A varied diet is generally conceived by nutritionists as an essential component of high-quality diet; having high correlation with adequate of intake of protein and micro-nutrients as well as prevention of excessive intake of other nutrients such as fat and chronic diseases (Ruel, 2002; Johns and Sthapit, 2004). Inadequate intake of micro-nutrients is well pronounced in many developing countries leading, among others, to impaired cognitive development, blindness especially among children, heightened morbidity, and in severe cases, mortality. Poor immune functioning and high susceptibility to infectious diseases are also among the well-known debilities associated with protein intake deficiency.

However, efforts have been made to towards improving income or consumption of the poor, protection of vulnerable groups in developing countries (particularly in Africa) against livelihood risks and enhancement of the social status as well as the rights of the marginalised (Holmes *et al.*, 2012). Such intervention is known as considered as “Social Protection or social safety nets”. It involves a blend of policies, programs and interventions aimed at protecting poor and food insecure people or those who may be vulnerable to poverty and food insecurity (FAO, 2015). In Africa social safety nets have been implemented in various forms including strategic grain reserve, food pricing policies, and input subsidy, among others. In addition, social protection instrument has also been used to influence food accessibility through two main mechanisms; “direct transfer of food”, also known as food aid, and “smoothing or raising household income”; this could be done through conditional or unconditional cash transfer

which immediately increases household income to spend on food. Performance of interventions aimed at addressing food insecurity and some of these nutrition related health problems can be enhanced with better knowledge of the extent of diversity in food consumption and the factors responsible for the diversity. Given that consumption of diverse diets is related to nutritional quality and reduction of a plethora of health challenges, studies on demand for food variety would have far-reaching implications for the stock of human resources of a nation in terms of people's health (Schultz, 2001), labour productivity or wage-earning capability and ability to contribute to the socioeconomic development of the nation. Following the macroeconomic view that consumption expands along consumer's hierarchy of wants in the process of economic growth, Thiele and Weiss (2003) notes that consumption of more diverse products (food products inclusive) plays a crucial role in the process of long-run economic growth and development. Knowledge of food consumption diversity could enhance better understanding of the evolutionary development and structure of food marketing systems and furnish food-processing industries with information on the variety of convenience foods to produce, as well as the marketing strategies understanding to employ in order to meet consumers' needs (Thiele and Weiss, 2003; Pingali, 2007) in different segments of the population.

Besides, such knowledge could provide opportunities for farmers to increase earnings from agriculture. Some farmers who have predominantly engaged in the production of a particular crop may, in a bid to respond to consumers' needs for food varieties, diversify into production of other crops or livestock especially if such shifts in farm structure would stimulate higher farm profits. Improvement in farm earnings may also induce higher demand for non-agricultural goods and services in the rural areas. In response to the demands for these non-agricultural goods and services, some rural households may establish small businesses; thereby creating more employment opportunities and increased income for rural folks.

Dietary diversity is broadly defined as the number of different foods or food groups consumed over a reference period (Ruel, 2002). Based on this definition, a number of studies have constructed a one-dimensional (food count) index to measure the degree of food consumption diversity by summing-up the number of individual/specific foods or food-groups consumed by households/individuals in a given locality over a specified period. The food count index is relatively simpler to compute and understand, and clearly specifies the distribution of consumption pattern in terms of the number of different food items in household's food basket. Hence, the study chose to rely on food-group count as a measure of dietary diversity following its associated strength to clearly specify the distribution of consumption pattern in terms of the number of different food items in household's food basket. Furthermore, a number of findings have suggested that dietary diversity index constructed based on food-group counts could predict nutrient intake adequacy in the same way as, or better than the one that is constructed on individual foods (Hatløy et al., 1998; Ruel, 2002; Hoddinott and Yohannes, 2002; Torheim et al., 2004). Although food count index is identified with a limitation of not being able to apportion weights to individual food commodities and as such leaves a vague idea of the health/nutrient contents of household's food basket (Das, 2014) as different food items contains different nutritional information. However, its estimation still offers a clear direction of food consumption diversity among households. The second (two-dimensional index) approach for assessing dietary diversity takes into consideration the number of food-groups consumed and

their concentration (distribution of food expenditure shares) in the food budgets of the households. However, the index is a complex (composite measure) which does not give details of the specific number of foods in the household's food basket. Nevertheless, economic literature have also measured food variety using the two-dimensional index (Lee and Brown, 1989; Liu et al., 2014; Das, 2014). The main objective of the study is therefore to examine the extent of households' dietary diversity with respect to its associated socioeconomic predictor and social protection instruments aimed at improving food security status among households in Nigeria. The study also constructs food diversity measures based on one-dimensional (simple food count) index as well as using other dimensional measure to check whether econometrics analysis would establish similar results in terms of the predictors in the two measures adopted for the food consumption diversity. The remainder of the paper is organized as follows. The next section presents the theoretical/conceptual framework and diversity measures. Thereafter, specification of econometrics models are presented. This is followed by the section that describes data for the study. Results and discussion are presented in the following section while the conclusion and policy recommendations are covered in the last section.

Theory/Concepts and Measures of Food Diversity

This empirical study derives from the traditional demand theory as extended by Jackson (1984) in his work on the hierarchy demand and Engel's curve for commodity variety. He argued that the homothetic preferences implicit in the traditional consumer choice model, as reflected by smooth indifference curves that are convex to the origin (Lancaster, 1990), presumes that diverseness in consumption is only influenced by prices and that income increase has no impact on demand for variety. This traditional theoretical approach is unsuitable for modelling consumer demand for diversity as diverseness in consumption cannot alone be ascribed to price changes. Consequently, Jackson, drawing on Maslow hierarchy of needs, proposed a hierarchical model of consumer demand (model of hierarchy of purchase) by which income effect could be expected on diversity. In Jackson conception, consumer behaviour is characterised by the following: at low level of income, only a limited number of foods is bought; and as income grows, the range of purchased foods expands. It is also presumed that variety increases independently of consumer's level of income such that no food leaves the consumption bundle set at any given time. These attributes lay the groundwork for the utility maximisation problem. Assuming separability between food and non-food items, Jackson conceptual approach to food consumption diversity began by specifying utility maximization problem for food items c_i as follows:

$$V(c)_i = v\left(c_1, c_{2,}\, c_{3,}\, \ldots\ldots\ldots\ldots\, c_N\right); s.t. \sum_{i=1}^{N} p_i\, c_i = Y \; and \; c_i \geq 0 \qquad (1)$$

where c_i is the quantity of food item i and p_i represents the price of i^{th} food commodity, Y is the total food expenditure and N is the total number of food items. The Lagrangian function (L) can be stated as:

$$L = v\left(c_1, c_{2,}\, c_{3,}\, \ldots\ldots\ldots\ldots\, c_N\right) + \boldsymbol{\lambda}(\boldsymbol{Y} - \sum_{i=1}^{N} p_i\, c_i) \qquad (2)$$

where λ is the Lagrangian multiplier. Using the Karush-Kuhn-Tucker (KKT) conditions, L is first maximized with respect to all the choice variables c_i, and the related KKT conditions are:

$$\frac{\partial L}{\partial c_i} = \frac{\partial v}{\partial c_i} - \lambda p_i \leq 0 \quad (3)$$

$$c_i\left(\frac{\partial v}{\partial c_i} - \lambda p_i\right) = 0 \quad (4)$$

and $c_i \geq 0$ (5)

Then L is minimized with respect to λ with the related KKT conditions stated as

$$\frac{\partial L}{\partial \lambda} = Y - \sum_{i=1}^{N} p_i c_i \geq 0 \quad (6)$$

$$\lambda\left(Y - \sum_{i=1}^{N} p_i c_i\right) = 0, \quad (7)$$

and

$$\lambda \geq 0 \quad (8)$$

Solving the above equations leads to Marshallian demand functions[1] represented mathematically as:

$$c_i = c_i\,(Y, \mathbf{p}) \quad (9)$$

If condition (4) is satisfied, then $c_i = c_i\,(Y,\mathbf{p}) = 0$ implies that there should exist commodity i with zero-consumption at the optimum, given the budget constraint. From equation 9, and with concept of cardinality, the number of different items actually purchased by the consumer at given prices can be stated as:

$$M(c) = \{i | c_j(p, Y) > 0\} \quad (10)$$

Assuming the Stone-Geary type additive preferences function $\{U(\mathbf{c}) = \Sigma_i u(c_i)\}$, M denotes the commodity diversity that consumer demands. If $M(c) = \{i|c_j(p, Y) > 0)$ is defined as set of foods in a purchased set at given prices, then by the cardinality of M, the number of discrete (distinct) food items demanded (purchased) is allowed to be a function of price vector and income (total expenditure) (Jackson, 1984). This leads to the count measure of food consumption variety expressed as the total number of distinct food items in the purchase set of the consumer (household). The set of M (the number of purchased goods) is a monotonically

[1]If all ci is greater than zero, the KKT condition suggests (from equation 3) that $\lambda = \frac{\partial v}{\partial c_i}$. With $p_i > 0$ and presuming consumer's non-satiation such that $\frac{\partial v}{\partial c_i} > 0$, then $\lambda > 0$. If $\lambda > 0$, then KKT condition suggests (from equation 7) that budget constraint holds as equality with $c_i > 0$ corresponding to the interior solution under the classical constrained utility maximization problem. Likewise, for the case in which $c_i = 0$, the KKT condition suggests that $\frac{\partial v}{\partial c_i}$ pi $\leq \lambda$ with positive p_i and non-satiation.

increasing function of income (total expenditure); and increases asymptotically at a decreasing rate, resulting in non-linear Engel curves.

Based on Jackson's hierarchical model of consumer demand, another measure of food consumption variety which tends to assess diversity not only by the number of foods but also by the rates of food consumption can be constructed. In this context, the rates/frequency of consumption of a particular food item is assumed reflect in the concentration, distribution or share of consumers' food expenditure dedicated to the particular food item among the different food categories. Consequently, another measure of food diversity that accounts for the concentration (Thiele and Weiss, 2003; Liu et al., 2014; Rizov *et al*., 2014) were constructed. One of mostly employed of such food diversity measures is Berry index . The higher the values, the greater the degree of diversity in food consumption. If a household consumes a single food item or a classified food-group, the Berry diversity index is zero and comes close to unity if the household spread food spending equally among a number of foods (Liu *et al.*, 2014). The Berry Index (*BI*) (Berry, 1971) for a given household is specified as:

$$BI = 1 - \sum_{i=1}^{N} w_i^2 \qquad (11)$$

where w_i is the expenditure share of food commodity i. $w_i = \frac{p_i c_i}{\sum_{i=1}^{N} p_i c_i}$ and $p_i c_i$ is the expenditure on food commodity i over the reference period. N is the total number of food items. Berry index is equal to one less the Harfindahl index ($\sum_{i=1}^{N} w_i^2$).

Econometrics Estimation Procedure

Food count Index

For the simple food counts index of food consumption diversity, specification of empirical (econometrics) model beings with a supposition that a count (outcome) variable y_j is random in a given time interval, having a Poisson distribution with probability density specified as:

$$P(y_j = m_j) = \frac{exp^{\lambda_j} \lambda_j^{m_j}}{m_j} \qquad m = 1, 2, 3.....N \qquad (14)$$

where m_j is the realized value (outcome) of the random variable. In its empirical realization, y_j represents the number of food groups consumed/purchased by household j out of N=12 food groups. Poisson model is a one-parameter distribution with mean and variance of y_j equalling λ_j. To include a set of regressors (X_j) into the analysis, and to fend-off negativity of mean y_j, the parameter y_j of the Poisson model is stated as:

$$E(y_j|X_j) = \lambda_j = exp(\alpha + \beta_1 X_{1j} + \beta_2 X_{2j} + ... + \beta_k X_{kj}) \qquad (15)$$

The standard error robust option was selected during model estimation to correct for possible over-dispersion in the data (Cameron and Trivedi, 2010).

Berry Index Measures

The *BI was* used as response variables in the econometrics (regression) models employed for analysis. The dietary diversity model is specified for the Berry Index as:

$$BI_j = \alpha + \beta_1 X_{1j} + \beta_2 X_{2j} \ldots\ldots + \beta_k X_{kj} + \varepsilon_j \quad (16)$$

where α and β_1 to β_k are parameters to be estimated, X_1 to K_k are the explanatory variables while ε_i is the error term assumed to be normally distributed with zero mean and constant variance. The regression models were estimated using the fixed effects model while correcting for potential heteroskedasticity using the robust standard error option in the STATA (15) software that was used for the analysis. Description of dependent variables and explanatory variables in the (fixed effects and panel Poisson) regression models are indicated in Table 1.

Data and Sources of Data

The data used for this study were extracted from two main sources. The first data set was the household level panel data for 2012/2013 and 2015/2016 post-planting and post-harvest agricultural seasons. The data were collected by the World Bank in collaboration with the National Bureau of Statistics (NBS), Nigeria. The panel survey was targeted to cover a total of 5,000 households selected from rural and urban areas of the 36 states of the country. The data covered different aspects of household livelihoods[2]. Included data are the socioeconomic characteristics of the household and household head such as household size, age, sex, marital status, education of household head, location (rural-urban), season (post-planting or post-harvest seasons), whether or not a household engages in agriculture as main source of income, quantity of different foods consumed by the households, quantity of food purchased, value of each food purchased, and expenditure on specific non-food items, and safety nets (this include cash transfers and free food distribution). Also, data on food consumption and purchases (expenditures) were collected over a recall of period of 7 days, expenditure data on some non-food items either were reported on weekly and monthly basis (frequent non-food purchases), or over a period of 6 months or 1 year (non-frequent non-food purchases). The value of each of the food consumed by a household was extrapolated from the corresponding value of the food purchased[3].

The second aspect of the data used include the retail price of some specific foods collected by the NBS across the 36 states of the country, and in months and years corresponding to the household panel survey. The food items included in the data are imported rice, local rice, maize, sorghum, millet, beef (meat), fish, egg, yam, *garri*, beans, and palm oil. These specific food items are very critical to household food security in the country as they constitute important components of household diets. However, the study chose to consider the direct influence of average price of some of the food groups (7 of them) considered the most commonly consumed food groups among households, other than the food price index. In order to construct a measure of dietary diversity, food items were grouped into twelve (12): cereals, root and tubers, milk and dairy, egg, fish/sea foods, meat, pulses, fruits, vegetables, sweeteners, fat and oil and

[2]More details about the dataset and information therein can be accessed via http://econ.worldbank.org/WBSITE/EXTERNAL/EXTDEC/EXTRESEARCH/EXTLSMS/0,,contentMDK:23512353~pagePK:64168445~piPK:64168309~theSitePK:3358997,00.html

[3] Extrapolation for the value of each food item consumed involved multiplying the value of food purchased by the quantity of food consumed and then dividing the product (outcome) by the quantity of food purchased.

miscellaneous group (Swindale and Bilinsky, 2005). The percentage contribution of other food groups (e.g. vegetables, fruits, beverages etc) whose average prices were not included in the estimation is very low. Descriptive and measurement details of the variables used in the study analysis is presented in Table 1.

Results and Discussion

Table 2 shows the descriptive statistics of food consumption diversity among households both in the lean season (2012 and 2015) and surplus season (2013 and 2016) key variables that were used in the regression estimation. Using the food count index, majority are had high level of food diversity in 2015 (35.1%) while an average household is considered to have experience medium level of food consumption diversity in each year. Also, using the berry index, majority of the households are highly diverse in food consumption in year 2013 (48.6%) while the percentage of the households that are moderately and highly food diverse are fairly distributed across the year. The overall distribution shows that few households are less food diverse across the year irrespective the basis of classification (food count or berry index).

The poisson regression estimation revealed that harvest/surplus season has a positive and significant influence on food consumption diversity. This implies that an average household stands the change to consume a more diverse food during harvest/surplus season. This is mostly attributed to fall in prices of food items during harvest/surplus season. The situation is pertinent to most developing countries as stated by the UN/WFP (2007) "when foods are surplus or during harvest period prices of food are more likely to fall and thus consequently affects food consumption diversity". The result also suggest that participation in food distribution programme may increase the number of food groups consumed by the households. Thus, safety nets policy in terms of food transfer in Nigeria would go a long way in bring about consumption of a more diverse food particularly among the vulnerable households.

In all the econometrics (Poisson and fixed effects regression) models estimated, results consistently indicate a positive and insignificant influence of income level on food consumption. This implies that an average household is unlikely to consume a more diverse food with an increase in nominal income level. Poisson regression results showed that the prices of food like cereal, egg and meat have negative and significant influence on food consumption diversity. Cereals for instance constitute the most commonly consumed food group among the prevalent ones included in the estimation. Moreover, the negative influence of food price on consumption of diverse foods as established by previous studies (Rashid *et al*., 2011; Das, 2014). The study also established, similar to some past studies (Clauson et al., 2005; Jones et al., 2014; Liu et al., 2014).. The results of Poisson models indicate that female headed households are unlikely to consume higher number of foods than male headed households, while regression results show that female headed households are much more likely to allocate food budget more evenly on the range of important foods consumed than their male headed household counterparts. Such food spending habits could promote higher intakes of some essential nutrients among members of households headed by females. Educational attainment

from primary up to tertiary education would lead to significant decrease in household food consumption diversity, whereas attainment above first degree is likely to significantly induce food consumption diversity. This suggests that the plan to bring about diversification in household food consumption profile is not necessarily a function of level of education attained/sensitization. The result contradicts the report of Thiele and Weiss (2003).

Conclusions

The study sought to examine the influence of some economic variables (income and price), household demographic characteristics and social assistance on consumption of varied foods in Nigeria using household survey data obtained from the World Bank – Living Standard Measurement Survey (LSMS). A one-dimensional index (simple food counts) as well as other dimensional (Berry) measure of dietary diversity were constructed and used as dependent variables in the econometrics models estimated. Results of econometrics analysis consistently reveal income and food prices as the economic factors influencing consumption of diverse foods, exerting positive and negative influence respectively. Educational attainment up to university degree does not positively induce consumption of a more diverse food among households in Nigeria. Although female headed households are unlikely to consume higher number of food groups than male headed households, they are likely to allocate spending much more evenly on the range of foods they consume. Hence, income improvement strategy, efforts to curtail food price inflation and sensitively-guided gender-based and social assistance interventions are advocated, among others..

Table 1: Definition and Descriptive Statistics of the Variable Used for Analysis

Variables and their Definition	Year 2012 N = 3,885		Year 2013 N = 4,133		Year 2015 N = 4,072		Year 2016 N = 4,176	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
**Food group count	7.13	1.96	7.64	1.86	7.72	1.79	7.66	1.78
**Transformed Berry Index of the food group	0.63	0.16	0.65	0.16	0.62	0.17	0.62	0.17
*Harvest season/surplus season, Dummy (1 if yes, 0 otherwise)	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
*Nominal income	14,980	41,636	14,980	41,636	14,980	41,636	14,980	41,636
*Income square	1.7e11	1.9e13	1.7e11	1.9e13	1.7e11	1.9e13	1.7e11	1.9e13
*Non-food price index	4.94	0.00	4.97	2e-3	5.15	0.03	5.22	8e-3
*Agricultural households, Dummy (1 if yes, 0 otherwise)	0.66	0.47	0.69	0.46	0.65	0.47	0.63	0.48
*Natural log of average price of available cereal	4.85	0.12	4.92	0.21	4.90	0.21	5.04	0.18
*Natural log of average price of root and tuber	4.82	0.09	4.91	0.91	4.96	0.14	4.95	0.14
*Natural log of average price of beans	5.49	0.08	5.46	0.18	5.43	0.23	6.42	0.17
*Natural log of average price of palm oil price	5.62	0.07	5.66	0.10	5.64	0.08	5.81	0.14
*Natural log of average price of egg	5.84	0.12	5.85	0.85	5.82	0.07	5.85	0.06
*Natural log of average price meat	6.82	0.08	5.12	0.48	5.32	0.26	5.42	0.16
*Natural log of average price of fish	7.25	0.19	7.21	0.15	7.33	0.19	7.44	0.27
*Urban household, Dummy (1 if from urban, 0 otherwise)	0.29	0.45	0.31	0.46	0.32	0.46	0.32	0.47
*Male headed household, Dummy (1 if yes, 0 otherwise)	0.85	0.35	0.85	0.35	0.81	0.39	0.80	0.30
*Household head is married, Dummy (1 if yes, 0 otherwise)	0.66	0.47	0.62	0.48	0.58	0.49	0.56	0.49
*Age of household head (years)	51.7	14.3	51.8	14.8	52.9	14.4	52.8	14.36
*Household head attained MSc/PhD, Dummy (1 if yes, 0 otherwise)	0.01	0.12	0.00	0.00	0.00	0.00	0.01	0.13
*Household head attained Degree/HND, Dummy (1 if yes, 0 otherwise)	0.03	0.18	0.00	0.00	0.00	0.00	0.04	0.19
*household head attained OND/NCE Dummy (1 if yes, 0 otherwise)	0.03	0.19	0.00	0.00	0.00	0.00	0.04	0.20
*Household head attained Secondary school education Dummy (1 if yes, 0 otherwise)	0.19	0.39	4e-3	0.22	0.00	0.00	0.21	0.41
*Household head attained Primary school education, Dummy (1 if yes, 0 otherwise)	0.24	0.43	2e-3	0.01	0.00	0.00	0.24	0.43
*Household receiving cash transfers, Dummy (1 if received yes, 0 otherwise)	0.00	0.00	1e3	0.03	0.00	0.00	2e-4	0.01
*Household receiving food transfers Dummy, (1 if received, 0 otherwise)	0.00	0.00	0.01	0.12	0.00	0.00	4e-4	0.06

Note: **Dependent variable; *Independent variable; S.D. = Standard Deviation,

Table 2: Descriptive Statistics of Dietary Diversity among Households on Yearly Basis

Year	Dietary Diversity Using Food Count						Dietary Diversity Using Berry Index					
	Low diversity		Medium diversity		High diversity		Low diversity		Medium diversity		High diversity	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%	Freq.	%
2012 (N = 3,885)	396	10.2	2,463	63.4	1,026	26.4	380	9.8	1,829	47.1	1,676	43.1
2013 (N = 4,113)	176	4.3	2,571	62.2	1,386	33.5	356	8.6	1,769	42.8	2,008	48.6
2015 (N = 4,072)	165	4.1	2,479	60.9	1,428	35.1	540	13.3	1,838	45.1	1,694	41.6
2016 (N = 4,176)	184	4.4	2,627	62.9	1,365	32.7	547	13.1	1,912	45.8	1,717	41.1

Note: Freq. = Frequency. % = respective percentage value. Year 2012 and 2015 are lean/planting season; 2013 and 2016 are surplus season.

Table 3: Regression Results of Factors Influencing Food Consumption Diversity among Households in Nigeria

Variable	Food-group Count			Transformed Berry Index (TBI)		
	Coefficient	Robust S.E.	z-value	Coefficient	Robust S.E.	t-value
Harvest season/surplus season, Dummy	0.02512***	0.00468	5.36	0.00117	0.00342	0.34
Nominal income	-0.07061***	0.00494	-14.29	0.02501***	0.00357	7.01
Income squared	0.10481***	0.00545	19.22	0.02085***	0.00408	5.10
Non-food price index	0.17071***	0.02454	6.96	-0.10551***	0.01755	-6.01
Agricultural households, Dummy	0.00587*	0.00342	1.72	0.00605**	0.00260	2.32
Natural log of average price of available cereal	-0.10385***	0.02010	-5.17	0.07603***	0.01479	5.14
Natural log of average price of root and tuber	0.05228***	0.01249	4.18	-0.00939	0.00952	-0.99
Natural log of average price of beans	0.03981***	0.01275	3.12	0.00635	0.01095	0.58
Natural log of average price of palm oil price	0.01619	0.01968	0.82	0.00049	0.01346	0.04
Natural log of average price of egg	-0.10044***	0.02161	-4.65	0.00265	0.01504	0.18
Natural log of average price meat	-0.01296***	0.00353	-3.68	-0.00475*	0.00262	-1.81
Natural log of average price of fish	0.00392	0.00392	0.45	-0.03344***	0.00684	-4.89
Urban household, Dummy	0.03868	0.03325	1.16	0.02342	0.01948	1.20
Male headed household, Dummy	-0.02309***	0.00537	-4.30	-0.00706*	0.00403	-1.75
Household head is married, Dummy	-0.00792*	0.00421	-1.88	0.00248	0.00304	0.81
Age of household head (years)	-0.00009	0.00012	-0.78	-0.00002	0.00009	-0.24
Household head attained MSc/PhD, Dummy	0.03109*	0.01681	1.85	0.00183	0.01327	0.14
Household head attained Degree/HND, Dummy	-0.01891	0.01315	-1.44	0.00074	0.00848	0.09
household head attained OND/NCE, Dummy	-0.03657***	0.01297	-2.82	-0.00830	0.00883	-0.94
Household head attained Secondary school education, Dummy	-0.02612***	0.00633	-4.13	-0.00811*	0.00463	-1.75
Household head attained Primary school education, Dummy	-0.01567***	0.00561	-2.79	-0.00451	0.00432	-1.04
Household receiving cash transfers, Dummy	-0.28643**	0.13463	-2.13	-0.19474***	0.04417	-4.41
Household receiving food transfers, Dummy	0.04631**	0.02085	2.22	0.00648	0.01553	0.42
Log pseudolikelihood	-20713.221			-		
Wald chi^2 (23)	782.39			-		
F-value				9.47		
R-square				0.467		

Source: Computed from LSMS Panel Data of 2012/13 to 2015/16. ***, **, * represent coefficients significance level at 1%, 5% and 10% respectively.

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