

# Factors Influencing Household Expenditure Patterns on Cereal Grains in Nasarawa State, Nigeria

E. A. Ojoko, G. B. Ubugadu

**Abstract**—This study aims at describing the expenditure pattern of households on millet, maize and sorghum across income groups in Nasarawa State. A multi-stage sampling technique was used to select a sample size of 316 respondents for the study. The Almost Ideal Demand System (AIDS) model was adopted in this study. Results from the study shows that the average household size was five persons with dependency ratio of 52 %, which plays an important role on the household's expenditure pattern by increasing the household budget share. On the average 82 % were male headed households with an average age of 49 years and 13 years of formal education. Results on expenditure share show that maize has the highest expenditure share of 38 % across the three income groups and that most of the price effects are significantly different from zero at 5 % significant level. This shows that the low price of maize increased its demand as compared to other cereals. Household size and age of household members are major factors affecting the demand for cereals in the study. This agrees with the fact that increased household population (size) will bring about increase consumption. The results on factors influencing preferences for cereal grains reveals that cooking quality and appearance (65.7 %) were the most important factors affecting the demand for maize in the study area. This study recommends that cereal crop production should be prioritized in government policies and farming activities that help to boost food security and alleviate poverty should be subsidized.

**Keywords**—Expenditure pattern, AIDS model, budget share, price cereal grains and consumption.

## I. INTRODUCTION

URBANIZATION has played a significant role in changing global food consumption patterns. With increased urbanization and higher disposable income, urban residents' demand for food is expected to increase among developing countries. According to [1] urbanization refers to phenomenon of increasing concentration of the population in urban settings. Based on the United Nation's postulates, the population of the world today is about seven billion people and this figure is expected to grow by more than a billion people between 2010 and 2015, while the rural populations will hardly grow at all [2]. This is as the result of people moving in response to better economic opportunities in urban areas or a lack of prospects in rural areas. Also, the level of urbanization varies from region to region with about 70 % of the Nigeria population being urban [3]. Urbanization also brings about major changes in consumer's demand for

agricultural products such as cereal crops. These changes as opined by [4] result in changes in the dietary habits of urban dwellers, and also create changes in both rural and urban food security.

The theory of demand predicts that food demand is a function of commodity prices, per capital income and population growth [5]. The implication of this is that increased urbanization brings about growing and changing demands for food and other agricultural products. The expectation therefore is that households adjust their consumption for food commodities such as millet, maize and sorghum in response to various shocks such as markets prices, commodity supplies and population growth. Furthermore, the pattern of food consumption in Nigeria has been undergoing dramatic changes. Many economists have attributed these changes to such factors as higher income of households, an ageing population and a more Westernized lifestyle [6]. It is therefore clear that many factors could have influenced Nigerian food consumption patterns and an understanding of these factors is important for the assessment of the agricultural products market. According to [6], though food production and consumption patterns interact with each other, an appreciation of consumption implication for agricultural production policies is only beginning to evolve.

The consumption pattern of a household is the combination of qualities, quantities, acts and tendencies characterizing a community or a human group's use of resources for survival, comfort and enjoyment [3]. Of course the type of food and non-food items consumed, vary from region to region. Consumption patterns normally contribute greatly to the social and economic policy of the country. In a developing country like Nigeria, the consumption pattern is skewed towards food, that is, food accounts for a higher proportion of total expenditure, while in developed countries the opposite is the case.

Reference [3] reports on the consumption pattern in Nigeria for 2009/2010 revealed that at the national level, the total expenditure on food and non-food for 2009/2010 is N24, 253, 670, 127, 758:80. The report also revealed that 64.68 % of the total household expenditure in 2009/2010 was spent on food, with the balance of about 35.32 % spent on non-food items. Tubers and plantain were responsible for the largest proportion of household expenditure representing 14.6 percent of total household expenditure. This group was followed by rent, vegetables, other cereals and beans and peas each taking up 12.1 %, 9.9 %, 6.7 % and 6.2 %, respectively, of the total household consumption. Further analysis of food expenditure by households in 2009/2010 reveals that total cereals (adding

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maize, rice and other cereals categories) and tubers and plantain accounted to a combined 46.7 % of total household expenditure on food and 30.2 % of total household expenditure. Household expenditure on non-food items were directed, as previously mentioned, mostly at rent, clothing and footwear and other services (which includes information technology and communication equipment, as well as things like insurance, domestic help, and so on), and fuel and light, each representing 34.3 %, 13.5 %, 12.7 % and 12.5 %, respectively, of total non -food expenditure and 12. 1 %, 4.79 %, 4. % and 4.43 % of total household expenditure, respectively.

In the research of [7] on food expenditure patterns among urban Households in Ibadan, Nigeria, results showed that the age of respondents, level of education and occupation of the household head as well as the household income significantly influenced household's monthly food expenditure in the study area [8], in their study opined that the significant determinants of consumption among rural household heads include income, savings and education. Their study revealed that the consumption of the household will increase by 38 kobo if their income increases by ₦1 while the consumption of household will decrease by 18 kobo if their savings increase by ₦1, *ceteris paribus*.

An understanding of the food demand/expenditure patterns of households on food crops like cereal grains is important to policy makers in addressing a number of issues, which include improving and formulating crop-diversification policies and programs that will boost food production. This study was therefore carried out to achieve the following objectives:

- (i) describe the expenditure pattern of households on millet, maize and sorghum across income groups in the study area,
- (ii) estimate the factors that affects demand of selected cereal grains in the study area, and
- (iii) assess the factors that influence preferences of households for millet, maize and sorghum in the study area.

#### A. Theoretical Framework

In micro-economic theories, the consumption behaviour was derived on the postulate of utility maximization subject to a linear budget constraint. Since urban households are net food buyers, it is assumed that they do not produce their own food but rather buy their food. As such their cereal consumption depends on their income level,  $M$ , the price of cereal,  $P_c$ , as well as the prices of other food substances (substitutes),  $P_f$ . Households maximize their utility  $u$ , from the consumption cereals, and other foods, given a household income  $M$  and other household characteristics,  $Z$ .

Mathematically,

$$\text{Max } u(C_c, S_f, Z) \text{ subject to } P_c C_c + P_f S_f \leq M \quad (1)$$

Applying the Lagrangian method of maximization,

$$\text{Max } L = f(C_c, S_f, Z) + \lambda (M - P_c C_c + P_f S_f) \quad (2)$$

where;  $P_c$ =Price of Cereals,  $P_f$ = Price of other foods.

Differentiating and deriving first order conditions,

$$\frac{\partial L}{\partial C_c} = \frac{\partial F}{\partial C_c} - \lambda P_c = 0 \quad (3)$$

$$\frac{\partial}{\partial S_f} = \frac{\partial F}{\partial S_f} - \lambda P_f = 0 \quad (4)$$

$$\frac{\partial L}{\partial \lambda} = M - P_c C_c - P_f S_f = 0 \quad (5)$$

Substituting (3) and (4) into (5);

$$M = 2 \lambda P_c P_f \Rightarrow \lambda = \frac{M}{2 P_c P_f} \quad (6)$$

$$Q_c = \lambda P_c = \frac{M}{2 P_c P_f} * P_c \quad (7)$$

$$Q_c = f(M, P, P_f) \quad (8)$$

Therefore, the demand for cereals depends on household income,  $M$ , own price of cereals as well as price of other foods (substitutes). Household characteristics;  $Z$  and taste,  $t$  of consumers also affect the demand for cereal crops. Thus

$$Q_c = b_0 + b_1 P_c + b_2 P_{sf} + b_3 M + b_4 t + b_5 Z + \mu \quad (9)$$

#### B. The Study Area

The study will be carried out in Nasarawa state of Nigeria. The state is located at longitude 8°32'N and latitude 8°18'E. It is bounded in the north by Kaduna state, in the west by Abuja Federal Capital territory, in the south by Kogi and Benue states and in the east, by Taraba and Plateau state. The state covers an area of about 28,735 square kilometres and it has a population of about 1,863,275 people with a population density of 75 people per square kilometre [9]. The state is made up of thirteen local government areas and about 15 major ethnic groups. The area is almost entirely woodland with tall grasses. The major occupations of the people are farming, fishing, dyeing, weaving, carving and black smith [10] and the major crops grown in the area includes: cassava, yam, rice, millet, maize, sorghum (guinea corn), beans, soybeans, beneseed and Melon.

## II. MATERIALS AND METHODS

A multi-stage sampling technique was used. In the first stage, one local government area was purposively selected from each of the three senatorial zones. The choice of these local government areas was based on the fact that they are the most urbanized in their respective zones. In the second stage of the selection process, the local government Headquarters was purposively selected because it has more urban dwellers than the surrounding villages. Furthermore, the third stage of

the sampling process involved random selection of two wards from each of the local government headquarters and then a proportional 5 % of the sampling population of households in each of the selected ward was chosen given a sample size of three hundred and sixteen (316) for this study.

The data was collected through administration of well-structured questionnaire which was administered with the aid of enumerators.

### C. Model Specification

The Almost Ideal Demand System (AIDS) model of [11] was adopted in this study. A cost function as suggested by Deaton and Muellbauer was applied and by Shepard's lemma, a modified version of an AIDS model was derived, in which expenditure share of a food category is a function of prices and the related food expenditures as:

$$w_i = \alpha_i + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_i \ln(X / P) + \lambda_i \text{months} \quad (10)$$

where  $w_i$  is the expenditure share associated with millet, maize and sorghum;  $p_j$  is the retail prices of millet, maize and sorghum;  $\alpha_i$  is the constant coefficient of the share equation for millet, maize and sorghum;  $\gamma_{ij}$  is the slope coefficient associated with millet, maize and sorghum in each share equation;  $\lambda_i$  is the slope coefficient of the year for each observation; while  $X$  is the total nominal expenditure per capita on the system of the three grains (millet, maize and sorghum) and this is specified as:

$$X = \sum_{i=1}^n p_i q_i \quad (11)$$

In which  $q_i$  is the quantity demanded for millet, maize and sorghum respectively and  $p_i$  is the retail price for each of the three grains respectively; and  $P$  is the price index defined in two different ways which come into nonlinear AIDs and LA-AIDs models. First, the nonlinear AIDS model is defined as (10) aforementioned with  $P$  expressed as:

$$\ln P = \alpha_0 + \sum_{i=1}^n \ln p_i + 1/2 \sum_{i=1}^n \sum_{j=1}^n \gamma_{ij} \ln p_i p_j \quad (12)$$

The first order conditions can be derived for the cost function or the expenditure share function for millet, maize and sorghum respectively and the nonlinear price index function. Second, a linear approximation of the nonlinear AIDS model also suggested by [11] is specified as (11) aforementioned with  $P$  expressed as:

$$\ln P = \sum_{i=1}^n w_i \ln p_i \quad (13)$$

A linear price index and the expenditure share functions give rise to the linear approximate AIDS (LA-AIDS) model. The theoretical properties of the AIDS model are subject to the following constraints: adding up, homogeneity in prices and income and symmetry of cross effects of demand functions:

$$\begin{aligned} \sum \alpha_i &= 1 \\ \text{Adding up; } \sum \gamma_{ij} &= 0 \\ \sum \beta_i &= 0 \end{aligned} \quad (14)$$

Homogeneity is satisfied if and only if, for all  $i$ ;

$$\sum \gamma_{ij} = 0 \quad (15)$$

Symmetry is satisfied if;

$$\gamma_{ij} = \gamma_{ji} \quad (16)$$

This study focuses on estimating demand system for selected cereals (millet, maize and sorghum). Therefore, the effect of economic and demographic variables on demand for food was examined. A stone price index suggested by [11] is considered in the function to effectively include demographic variables through either translation or scaling methods [12].

$$\ln P = \sum w_i \ln p_i \quad (17)$$

The translation approach is more appropriate to model demographic effect for consumables. Also, the stone price index improves the linear approximation of the model where prices are engaged. We therefore re-specify the equation as:

$$\alpha_i = \alpha_0 + \sum \alpha_i H_i \quad (18)$$

where  $H_i$  is the  $i^{\text{th}}$  demographic variable. The extended model including demographic variables and error term ( $\varepsilon_i$ ) is defined as:

$$w_i = \alpha_0 + \sum \alpha_i H_i + \sum_{j=1}^n \gamma_{ij} \ln p_j + \beta_i (X / P) + \varepsilon_i \quad (19)$$

where  $H_i$  are demographic variables which includes; SEX = male or female (gender of the household head), EDU= number of years of education, SIZE = log of household size, CHILDREN= number of persons aged 0-17, ADULT=

number of persons aged 18-64,  $\varepsilon_i$  is random disturbances assumed with zero mean and constant variance.

We simultaneously estimate the budget share equations as a system of equations using STATA 11 software package.

### III. RESULTS AND DISCUSSION

TABLE I  
SUMMARY STATISTICS OF SOCIO-ECONOMIC CHARACTERISTICS OF URBAN HOUSEHOLDS

Variables (unit)	Mean value of dominant indicator	Standard deviation
Household size (number)	5.1405	0.2923
Dependency ratio (%)	0.5298	0.023
Gender of household head (Male = 1, Female = 0)	0.8281	0.0541
Age of household head (years)	49.8171	1.6254
Education of household head (years of schooling)	13.1578	0.5104
Household expenditure on food away from home (₦)	2000.3584	24.5266
Household expenditure infrequently on non-food items (₦)	10,800.341	73.1451
Household expenditure on frequently non-food item (₦)	7,350.156	54.2681
Major occupation of household head (%)	70	
Household head expenditure on food at home (₦)	40,000.321	103.215

Source: Computed from Survey Data (2014).

Table I presents and discusses the summary statistics of the socio-economic characteristics of the respondents. On an average, the household size of the sample was 5.14 with dependency ratio of 52 % which shows that about half of the households were not working. [13] found out that larger households spent more on non- food items than they did on food items. Hence their budget shares were greater for education and housing as compared to at-home food expenditure. Works by [14] and [6], also show positive relationships between food expenditure and household size. Also, the dependency ratio plays an important role in the expenditure pattern of a household. An increase in the dependency ratio increased the budget share of the crops consumed.

About 82 % of the households were headed by males. Various studies have also opined that indeed gender has an effect on household expenditure patterns. According to [15], changes in income that accrued to women in Niger, had a positive impact on household food expenditures. In Ivory Coast, [16] also found a marginal positive effect of women's income share on household food budget share. The average age of the consumers is 49 years. The age of a consumer will certainly affect his or her decisions including demand patterns. According to [17], the aged spend more on durable consumer goods, the young spend more on basic necessities. Age has been shown to influence consumption demand in a nonlinear fashion according to [18]. The consumer's biogenic and psychogenic needs over the life cycle were identified as the reasons why the inclusion of the age variable is justified. Using survey data to follow eight cohort groups from 1982 through 1995, [18] found that younger people spent less than

older people on food at home, meat, poultry, fish, eggs, and dairy products, but more on cereal and bakery goods because of higher energy demand resulting from higher level of activity.

The average number of years of formal education was estimated at 13 years. This implies that an average urban household head could read and write. [19] investigated the effect of the level of education on consumption in South Africa. His results indicated that an increase in the level of education yielded an increase in per capita expenditure for all categories of expenditure. The results suggested that increased education has a greater effect on the expenditure for non-essential goods than it does on essential goods. The average monthly per capital expenditure on food away from home was as low as less than 3 % of the monthly expenditure on food at home expenditure. This shows that food commodities are actually demanded from home consumption. About 70 % of the sampled household heads are civil servants.

TABLE II  
SELECTED CEREAL CROPS COMPOSITION AND THEIR EXPENDITURE SHARES

Expenditure Share	Income quartiles		
	1	2	3
W <sub>1</sub> (Millet)	0.2021 (0.0478)	0.2001 (0.0378)	0.2131 (0.0252)
W <sub>2</sub> (Maize)	0.3946 (0.0713)	0.4281 (0.1002)	0.3850 (0.0938)
W <sub>3</sub> (Sorghum)	0.2430 (0.0868)	0.2378 (0.0852)	0.2359 (0.0773)

Source: Computed from Survey Data (2014).

Note: (1) Number of observation N=316. (2) In the income quartile, 1 represent the lowest and 3 the highest income group.

Table II show a system of expenditure shares for three food commodities used to determine the expenditure pattern of households for cereal crops budget. The resulting shares from Table II reveals that maize has the highest expenditure share among the three selected cereal crops with expenditure share of over 38 % across the three income groups. This can be attributed to the low unit price of the crop with the low income group having the highest share of 39.5 % across all income groups, while millet have the lowest share of about 20 % across the three income groups among the three selected cereal crops. This can be attributed to the high unit price of the crop when compared to the prices of maize and sorghum. These findings are in conformity with the law of demand which states that the higher the price, the lower the quantity demanded and lower the price, the higher the quantity demanded of a commodity.

Table III presents the estimated price and demographic effects on the demand of cereal grain in the study area and test of homogeneity. The result revealed that most of the price effects are significantly different from zero at 5 % significant level suggesting that a total change in price level leads to some change in expenditure share of households for each of the crop. This means that there is higher quantity response to movement in relative prices. This result is in line with the findings of [20], which states that, a commodity own price and prices of substitutes will affect the demand for that particular

commodity. He further averred that, since the commodities are competitors, a rise in the price of one would eventually lead to an increase in the demand for the other and vice versa. Table III also shows that most of the demographic variables are statistically significant. Household size is significant at 5 % significant level indicating a positive relationship between household size and demand for cereal in the study area. This result is so because household is considered as the basic unit of consumption. The result of this study agrees with the study of [13] on rural Chinese household. He found out that large households spend more on food items than on non-food items.

TABLE III  
ESTIMATED PRICE AND DEMOGRAPHIC EFFECTS ON CEREAL DEMAND

Variables/Crop	Millet	Maize	Sorghum
Constant	0.2664*** (0.2982)	0.4757*** (0.0298)	0.2579*** (0.0219)
LN P <sub>1</sub>	0.1315** (0.0947)	-0.0906** (0.0856)	0.0409 (0.0688)
LN P <sub>2</sub>	-0.0906 (0.0855)	0.1809** (0.1209)	-0.0903 (0.0891)
LN P <sub>3</sub>	0.0409** (0.6885)	-0.0903** (0.0891)	0.1312** (0.0960)
ΣLN P	-0.5153* (-0.2831)	1.6291*** (0.2978)	0.1058 (0.3129)
LN EXP	-0.3664** (0.1501)	0.3252** (0.1494)	0.0412 (0.1200)
Gender H/H	0.0099 (0.0442)	-0.0290 (0.0436)	0.0191 (0.0362)
Age H/H	0.0073** (0.0029)	-0.0068** (0.0029)	0.0004 (0.0023)
Household size	-0.0524** (0.0232)	0.0676** (0.242)	0.0152 (0.0184)
Education	0.0152** (0.0074)	-0.0143** (0.0074)	-0.0008 (0.0059)
Age group 1-17	0.0796*** (0.0275)	-0.0786*** (0.0279)	-0.0011 (0.0215)
Age group 18-64	-0.0065 (0.0226)	0.0082 (0.0228)	-0.0017 (0.0186)

Source: Computed from Survey Data (2014).

Note: (1) The number of observation in all model is N = 316, (2) values in parenthesis are standard error, (3) \*\*, \*\*\* coefficients are significant at 5% and 1% level respectively, (4) Subscript 1, 2, 3, stands for millet, maize and sorghum respectively, (5) LN P = Coefficient of price, (6) LN EXP = Coefficient of expenditure (7) (8) H/H = Household head.

Age of household, as revealed in Table III, shows a level of significance at 1 %, indicating a strong positive relationship between age of household head and expenditure. Furthermore, in Table III, it was also revealed that the young household members show some level of significance at 1 % significant level on expenditure while the adult shows no significant level. This implies that the young will prefer to spend larger share of their income on food, while the aged spent more on investment. This agrees with the findings of [18] which revealed that age has been shown to influence consumption in a non-linear fashion and [17] opined that the aged spend more on durable consumer goods while the young spend more on basic necessities.

Education was revealed by the result of this study in Table III to be significant on expenditure at 5 % level of significance. This is because the level of education of a consumer is expected to influence his reluctance on certain traditional belief. [19] opined that an increase in the level of

education will yield an increase in per capita expenditure for all categories of expenditure.

Gender of household head from Table III shows no level of significance for the demand of cereals in the study area. This could be attributed to the result in Table I which revealed that about 82.8% of the households in the study area was male headed. Men and women do not exhibit the same expenditure patterns due to their different needs and wants. Thus, gender of a consumer is expected to influence his or her purchasing decisions. [21] asserted that men are mostly concerned about capital expenditure and away-from-home food expenditure whereas women mostly purchase clothing, cosmetics, food for the home, among other things.

The row headed ΣLN P, (Table III) shows the absolute effect on each value share of a 1 % increase in all prices and total expenditure. Under homogeneity, this should be zero and the t-test gives the significance of deviation from zero. Hence, a proportional increase in prices will decrease expenditure on millet and increase expenditure on maize. Therefore, the homogeneity condition is rejected for millet and maize. The test result shows that the homogeneity condition in the estimated demand system holds only for sorghum. These results indicate that available data for the other commodities may be inconsistent with demand theory and money illusion may be present among consumers. The results do not, however, imply that consumer theory is rejected on the basis of these findings. This result is in line with the findings of [11] and [6] which revealed that homogeneity conditions does not hold for many commodities.

TABLE IV  
FACTORS THAT INFLUENCE PREFERENCES OF RESPONDENTS

Factors	Frequency	Percentage (%)
Taste	61	20.20
Nutrient contents	10	3.45
Price	19	6.20
Cooking quality and appearance	200	65.70
Colour	2	0.56
Ease of preparation	6	2.00
Multiple usage	6	1.89

Source: Computed from Survey Data (2014).

Table IV shows the factors that influenced preferences of respondents on the selected cereal crops. The table revealed that cooking quality and appearance in all varieties and forms of maize were perceived by the households as the most important factors influencing their demand for maize. This factor accounts for 65.7 % of the reasons for the preference of maize by the respondents. Taste is another important factor considered by the respondents for the preference of maize. This factor accounts for about 20.2 % of the reasons for the preference of maize by some of the urban households.

#### IV. CONCLUSION

The findings from this research shows that maize has the highest expenditure share among the three selected cereal crops with expenditure share of over 38 % across the three income groups. This can be attributed to the low unit price of

maize in the study area. The low income group had the highest share (39.5 %) of expenditure on maize across all income groups, while millet have the lowest share of about 20 % across the three income groups among the three selected cereal crops. Also, household size and age were positively related with the demand for cereal grains in the study area. This result agrees with the study of [13], on rural Chinese household, who found out that large household, spend more on food items than on non-food items. In terms of preference by households for millet, maize and sorghum, cooking quality and appearance were perceived by the households as the most important factors influencing their demand for cereal grains. This study therefore recommends that policy that prioritizes cereal crop production and subsidies for farmers should be encouraged as this will help to boost food security and alleviate poverty.

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