SOCIOECONOMIC DETERMINANTS OF HOUSEHOLD DEMAND FOR FOOD IN OSUN STATE NIGERIA

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ABSTRACT
This study described the food demand of households in Osun State, Nigeria with a view to identifying the determinants of household food expenditure. Multistage sampling procedure was used to select 669 households in the study area and structured questionnaire was used to obtain primary data from respondents. Data on socio-economic characteristics and expenditure pattern were analysed using descriptive statistics while demand for food groups in this study was estimated using Quadratic Almost Ideal Demand System (QUAIDS) model. Findings revealed that 57.4% of the household heads were male, 56% were married, with a mean age and household size of 55 years and 7 persons respectively. Grains had the largest share of household total food expenditure, ranging from about 45% and 40 % among the high income quartiles and urban households to 63% and 52% among the low income quartiles and rural households. The poorest households had the least (₦ 7,817.35) mean food expenditure, with about 0.57% as food expenditure as percentage of income and the richest households had the highest (₦ 10,315.55) expenditure share. Result from the QUAIDS model revealed that budget share of households on grains/starch increases with increase in price of grains/starch ($p<0.01$), while it decreases with increase in prices of animal protein ($p<0.01$) and fat/oil ($p<0.05$). The study conclude that policy-makers should consider consumer behavior at different income levels, as this will affect the rate at which people

have access to food as such enhancement programs needs to be region-specific especially in low income earning states and take into account these behavioral differences in food expenditures.

Keywords: Food Expenditure, Quadratic Almost Ideal Demand System, Rural and Urban Households.
JEL Classification: DI3, I31, R20.

1. Introduction

Food is a basic necessity of life. Its importance, at the household level, is obvious since it is a basic means of sustenance (Haddabi et. al. 2019). In view of the importance of food in man's life, food is rated as the most basic of all human needs. Man needs food for life's sustenance, prevention of sickness and in providing energy for the normal psychological activities of the body including the normal state of mind. Hence, the need for food security becomes pertinent as it eventually affects a nation's productivity and growth. Food and Agriculture Organisation (2002) reported that food security exists when all people at all times have access to safe nutritious food to maintain a healthy and active life. The main goal of food security is for individuals to be able to obtain adequate food needed at all times, and to be able to utilize the food to meet the body's needs. Intake of food is essential process for human beings to survive. Various foods serve as important "vehicles" for taking nutrients into the body and bringing about human pleasure, hence, the need for food not only to be taken in the right quantity but also the quality. There are different classes of essential nutrients which must be taken in good quality food to have a balanced diet. These include carbohydrates, protein, fats and oil, vitamins and minerals (Adeyeye, 1992) and is ingested and assimilated by an organism to produce energy, stimulate growth, and maintain life.

The number of people consuming less than the nutritional requirement of 2,100 calories per day in sub-Saharan Africa was estimated at 337 million in 2001, this amount to 57 percent of the population of the region (Rosen and Shala, 2002). Studies showed that the world population could reach eight billion by 2025. Nearly all of the increase of two billion people in the next 25 years will be in the developing countries (McCalla, 2001). Food and nutrition are basic human rights because they are necessary inputs for human development.

In Nigeria, different food types are associated with different ecological regions and ethnic groups. For instance, the Fulanis are highly noted for dairy and meat consumption, while the Ibibios are noted for high consumption of starchy and sea foods (Ezzati, *et al.*, 2002). While global food demand, especially in developing countries, is expected to increase with income, the food share of total budget is expected to decline as income increases. As population grows, food demand also grows. With increasing income and urbanization, demand for food not only increases, but changes with shifts in consumption patterns (Helene, 1990).

According to the Food and Agriculture Organization of the United Nations (FAO) "State of the Food Insecurity in the World" report (2012), there were 868 million people who suffered from undernourishment in the 2010 - 2012 period. Approximately two billion people had negative health consequences caused by micronutrient deficiencies. The global food crisis ("silent Tsunami" or the "perfect storm") affects 2 billion people in the world, of which

currently 850 million people face extreme hunger and 25,000 people die each day from starvation. Of the 37 most affected countries, 21 are in Africa. According to Olarinde and Kuponiyi (2005), households 'consumption of carbohydrate/starchy food is significantly higher (₦ 3,465.13) than of protein and vitamins (₦ 750.54 and N191.43) respectively. In Nigeria, majority of people within the country are food insecure because of high prevailing poverty level and poor performance of the Nigerian agricultural system (Oyefara, 2005). Thus, majority of Nigerians are poor, lack physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs.

Previous efforts to enhance food security achieved limited successes as most of the interventions concentrated more on the supply side of the problem with little detailed evaluation of the demand side. Soaring prices of food commodities, inadequate purchasing powers, and income inequalities have been identified, among others, as critical demand side factors stimulating food insecurity and malnutrition among the majority of households in Nigeria and other developing countries (Obayelu, 2010; FAO, 2012). The greater problems of food insecurity and malnutrition are often endured by poor households. Above 70 percent of Nigerian households are poor and spend at least 60 to 80 percent or more of their incomes on food (Obayelu, 2010). Available statistics (national average) indicate that staples account for about 55 percent of the food budget in Nigeria (NBS, 2012) with most poor households devoting more than 60 percent of their food spending to staples (Ashagidigbi *et al.,* 2012).

Food demand analyses play a vital role in addressing the hunger issue. In Nigeria, food prices continue to soar up day by day, and, ultimately going out of the reach of the common man while household incomes in the country are significantly debased by the staggering inflation rate. The majority of the currently influential papers have appeared following the adoption of flexible functional forms, which rely heavily on duality theory. The Generalized Leontief (Diewert, 1971), the Translog (Christensen et al., 1975), the Rotterdam (Theil, 1965, Barten, 1977), and the Almost Ideal Demand System or AIDS (Deaton and Muellbauer, 1980) are examples of popular demand models. Their functional forms are locally flexible, in the sense that they do not put a priori restrictions on the possible elasticities at a point. As a result, a number of alternative flexible functional forms with larger regular regions have been developed. Examples include the Quadratic AIDS model (QUAIDS) (Banks *et al.,* 1997), the Laurent model (Barnett, 1983, 1985; Barnett and Lee 1985; Barnett *et al.* 1985, 1987), and the Generalized Exponential Form (G.E.F) (Cooper and McLaren, 1996).

Different previous food demand studies in Nigeria used the Almost Ideal Demand System (AIDS) model, but its shortcoming is that it assumes linear Engel curves and constant expenditure elasticity, and such assumptions have been shown to be restrictive (Meekashi and Ray (1999) and Abdulai (2004), therefore this study will attempt the use of the Quadratic Almost Ideal Demand System (QUAIDS) model to address the household food demand structure in Osun State, South-West Nigeria to ascertain the relationship and degree of responsiveness of the household food expenditure and budget. This study aims at providing empirical evidence to theoretical assumptions that increase in income does not translate to increase in food expenditure among households.

This study therefore seeks to examine the determinants of food demand for households in Osun state, specifically to describe the socio-economic characteristics of the households, examine the food expenditure pattern across income groups and to estimate the structure of household demand for food in the study area.

2. Literature Review and Framework for QUAIDS Model

The general economic welfare challenges facing most Nigerian urban households affect the demand and subsequent consumption of these food items, and as a result poor households tend to demand more of starchy foods and less of protein food (Akintola and Udoh, 2002). The demand for food as it is the case for any other commodity depends on a number of factors which include income, own-price, consumer preferences, and prices of other substitutes. Demographic factors, such as changes in household size and in the age distribution of the population, can bring about changes in consumption demand for food drives production, and therefore stands out that, the more food item that is demanded; the more its production is encouraged.

An evaluation of the demand function for food items is very important, and needs immediate attention. Empirical studies on food demand among consumers in major Nigerian cities had received low priority among researchers even in the face of rising food demand and deficit domestic supply. This issue is further compounded by the increasing food insecurity and the geometric rise in the population of the country. The food demand function can be estimated from maximizing the utility function subject to budgetary behaviour of the consumer, in that the consumer maximizes utility from consumption, given income and the market prices of the commodity. There are various algebraic specifications of the demand system, and these include: the Linear and Quadratic Expenditure Systems, the Rotterdam model, Translog model, the Working model, and the Linearized Approximated Almost Ideal Demand System (LA/AIDS) (Taljaard et al., 2004).

Estimation of demand functions consistent with economic theory has been highly researched in the last four decades. Estimation of demand for goods and services has also attracted the attention of both theoreticians and empiricists, and a very dense literature is now available. Some of these studies such as Blundell (1998) have ignored required connections between theory and empirical analysis, while concentrating on the estimation of single linear demand equations. Poi (2002) has been directed towards the estimation of complete demand systems. Estimation of demand functions is very useful as it provides information on income and price elasticities. The measurement of income and price elasticities is required for the design of many different policies. The goal of demand analysis is to model households' expenditure patterns on a group of related items in order to obtain estimates of price and income elasticities and to estimate consumer welfare. As emphasized by Blundell (1988), there are few aspects of political economy that do not require some knowledge about consumers' household behavior. Empirical evidence on consumer's behavior is increasingly important in the formulation and analysis of economic policies. Consumption affects economic activity in several dimensions. For instance, one of the most often used practices to measure the effect of price changes on consumption is to estimate demand functions.

The analysis of consumer behavior is indispensable since there are few aspects of economic policy that do not require some knowledge of household behavior. To be able to estimate demand function, many functional forms are available, economic theory does not answer the question of which specification is the best to choose in estimating it.

Quadratic Almost Ideal Demand System

$$\varphi(x,p) - \left[\left(\frac{log\ x - log\ a(p)^{-1}}{b(p)}\right) + \lambda(p)^{-1}\right] \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 1$$

Where, $\frac{logx - loga(p)}{b(p)}$ is the indirect utility function of a PIGLOG demand system and λ (p) is a differentiable, homogeneous of degree zero function of p. One particular member of this class of demand systems is QUAIDS and is specified as follows:

$$\log a(p) = \alpha_0 + \sum_k \alpha_k\ logP_k + \frac{1}{2}\sum_k \sum_j \gamma^*_{kj}\ logP_k\ logP_j \ldots\ldots\ldots\ldots\ldots 2$$

$$b(p) = \prod_i {P_i}^{\beta i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots 3$$

$$\lambda(p) = \sum_i \lambda_i \log P_i \ldots\ldots\ldots\ldots\ldots\ldots 4$$

Where; **x** is total expenditure, **p** is a vector of prices, **a(p)** is a function that is homogenous of degree one in prices, and **b(p)** and **λ(p**) are functions that are homogeneous of degree zero in prices. As in the original AIDS model, ln a(p) and ln b(p) are specified as the translog and Cobb-Douglas equations. The application of Roy's identity to equation (1) gives the QUAIDS budget share equations. This leads to the following empirical specification of the QUAIDS budget share equations:

$$\omega_i = \alpha_i + \beta_i\ log\left(\frac{x}{a(p)}\right) + \frac{\lambda_i}{\prod_k {P_k}^{\beta_k}}\left(log\left(\frac{x}{a(p)}\right)\right)^2 + \sum_i \lambda_{ij} \log P_j \ldots\ldots\ldots\ldots\ldots\ldots 5$$

for i = 1,…,n and where log a(p) can be approximated by the Stone price index: $\sum_k w_k \log p_k$ (Deaton and Muellbauer, 1980). The QUAIDS budget shares reduce to those of AIDS if λ i= 0 for all i. In that case the rank three Engel curves of QUAIDS reduce to rank two Working-Leser Engel curves. As shown in equation (5), Banks *et. al.,* (1997) show that the coefficients of the quadratic term in these demand functions must depend on price. This however goes contrary to the quadratic extension of the AIDS model in Blundell, *et. al.,* (1993) where the quadratic term is price independent.

In order to ensure theoretical consistency and to reduce the number of parameters to be estimated, additivity, homogeneity and symmetry restrictions are normally imposed on the parameters to ensure integrability of the demand system (Moro and Sckokai, 2000).

Addding-up simply requires that the household does not spend more than its total budget (i.e $\sum_i W_i = 1$), Adding-up requires the following restrictions to be satisfied and can be expressed in terms of model parameters as follows:

$$\sum_{i=1}^{k} \alpha_i = 1, \sum_{i=1}^{k} \beta_i = 0, \sum_{i=1}^{k} \lambda_i = 0, \sum_{i=1}^{k} \gamma_{ij} = 0, \quad \forall j \ldots\ldots\ldots\ldots\ldots\ldots 6$$

Homogeneity is satisfied if $\sum_{i=1}^{k} \gamma_{ij} = 0$ for all i

3. Methodology

Osun State was carved out of Oyo State on August 27, 1991. Its capital is Osogbo located in South-West Nigeria. Osun State is landlocked and occupies 9,251 square kilometres. Osun State shares borders Kwara State to the North, Oyo State to the West, Ogun State to the South and Ondo and Ekiti States to the East. The coordinates of the State is located within latitudes $7^0$30'N $4^0$30'E and longitudes 7.500^0N 4.500^0E. It has a land area of 8,882 square kilometer, with a total population of 4,137,627, consisting of 1,740,619 males and 1,682,916 females (NPC, 2006), having a projected population growth of 4,009,837 by 2012.The climate is entirely tropical with two district seasons; the rainy and dry season. The State ecological features provide opportunity for various crops and cropping patterns. Tree crops such as cocoa, kola, citrus and oil palm are cultivated while arable crops such as maize, yam, rice, cassava, tomato and pepper are also cultivated. The Osun State Agricultural Development Programme (OSADEP) has divided the State into three zones (Iwo, Osogbo and Ife-Ijesha) based on geographical spread.

Method of data collection and data Analysis

Multistage sampling procedure was adopted in this study. The first stage involved a selection of the three ADP zones (namely, Iwo, Osogbo and Ife-Ijesha) in Osun State. At stage 2, three blocks were randomly selected to capture 50 percent of each zone this gave a total of nine blocks. The third stage also involved a simple random selection of four cells each in from the randomly selected blocks. The final stage involved a simple random sampling of twenty households from each of the selected cells. In all, a total of seven hundred and twenty (720) households were sampled but responses from only six hundred and sixty nine (669) respondents were valid for the data analysis for this study (giving 93percent response rate). The information collected included value of own-food produced and expenditure on the type of food purchased by the households. For each household, expenditure profile on the following five food groups were used: (1) staples {including grains and starch foods}, (2) animal and plant protein food, (3) fruits and vegetables, (4) fats & oils, and (5) others. Included also are household's socio-economic variables such as: gender, years of education, and major occupation of household head, household with different age composition, and household size.

Model Specification

Descriptive statistics of mean, standard deviation, frequency and percentage were employed to describe socioeconomic and other relevant variables considered in this study.

The food demand estimation was carried out using Quadratic Almost Ideal System (QUAIDS) model. The QUAIDS model was estimated using nlsur (Non Linear Seemingly Unrelated Regression) command in STATA with theoretical restrictions of adding-up,

homogeneity, and symmetry imposed during estimation. The empirical specification of the QUAIDS budget share equations is given as follows:

$$W_i = \alpha_i \sum_j^k \gamma_{ij} Inp_j + \beta_i In\left[\frac{x}{a(p)}\right] + \lambda_i \backslash \left[In\frac{x}{b(p)}\right]^2 + \sum_S^L \delta_{is} Z_s + \varepsilon_i \ldots\ldots\ldots\ldots\ldots\ldots 7$$

Where;

$\alpha_i, \beta_i, \gamma, \lambda$ = parameters to be estimated

γ_{ij} = estimated coefficient of prices for food items in the food groups

W_i= Household's expenditure share of i^{th} food group, for i=1, 2, 3, 4, 5

w_1=share of grains and starch food group (GS)

w_2=share of animal and plant protein food group (AP)

w_3=share of fruits and vegetables food group (FV)

w_4=share of fats and oils food group (FO)

w_5= share of others (O)

p = translog price index

In p_j = is the nominal price of the jth food group $P_1 \ldots\ldots P_5$

In x=log of household's total expenditure on all food in the demand system (₦/week)

Z_s=Demographic variables: Z_s

z_1=Age (years)

z_2=Household size (no. of persons)

z_3=Education (highest level attained)

z_4=Marital status (1=married, 0 otherwise)

z_5=Major occupation (1=farmer, 0 otherwise)

ε= error term

4. Results and Discussion of Findings

Table 1 shows the description of the age, sex, marital status, educational level and household size of households in the study area. The study revealed that majority (57.4 and 52.5 percent) of the household heads were males and fall within the 51-60 years age bracket with a mean age of 55.4 years, while 56.5 percent were married while 1.3, 39.0, and 3.1 percent of the household heads are single, separated and widowed respectively. Furthermore, 6.7 percent household heads had no formal education while 15.3, 46.6, and 31.4 percent primary, secondary and tertiary education respectively. Most of the households had a household size of between 5-8 persons with a mean of 6 persons in the study area.

Table 1: Demographic Characteristics of Respondents.

Variables	Frequency	Percentage
Sex		
Male	384	57.4
Female	285	42.6
Age (years) Mean = 55 years		
30 – 40	39	5.8
41 – 50	186	27.8
51 – 60	351	52.5
61 – 70	75	11.2
>70	18	2.7
Marital Status		
Single	9	1.3
Married	378	56.5
Divorced	261	39.0
Widowed	21	3.1
Educational Level		
NFE	45	6.7
Primary	102	15.3
Secondary	312	46.6
Higher degree	210	31.4
Household size (persons) Mean = 7 persons		
1 – 4	128	19.1
5 -8	285	42.6
>8	256	38.3
TOTAL	**669**	**100.0**

Table 2 presents the food expenditure shares of the sampled households, including the differences across income groups, and rural and urban areas. Grains had the largest share of household total food expenditure, ranging from about 45 and 40 % among the high income quartiles and urban households to 63 and 52% among the low income quartiles and rural households. The share of grains in the households' budgets was found to be lower at higher income quartile.

The budget share of animal products, which is regarded as a more expensive source of calories, was revealed to be higher among the highest income quartiles (35%) and urban (22%) households than the rural households (10%). Table 2 revealed that the poorest households have lowest (29%) share of animal protein across all income quartiles, while the richest households have the highest (36%) share of animal protein, with the urban region having a higher (22%) share of animal protein. This can be attributed to high unit price of this food basket which limits the quantity; hence the share that can be afforded by the high income group, thus reflecting their nutritional knowledge and income status.

Fruits and vegetables food group had the higher (0.08%) budget share in the rural region, with the highest (0.21%) budget share in the lowest income quartiles across all income

groups. The urban region had higher (0.18%) share in the Fats and oils food basket, while the rural region had 0.13%.

However, the poorest households had the least (₦ 7817.35) mean food expenditure, with about 0.57% as food expenditure as percentage of income and the richest households had the highest (₦ 10,315.55) as expected. This provides empirical support to the assertion that relationship between demands for food commodities and income is not always linear in agreement with Fashogbon and Oni (2012).

Table 2: Average Expenditure Share on food group by income quartiles and region

Food share	Pooled Households	Income Quartiles				Region	
		1st	2nd	3rd	4th	Urban	Rural
W_{1GS}	0.5685 (0.0976)	0.5765 (0.0723)	0.5299 (0.1021)	0.4834 (0.1054)	0.4563 (0.0956)	0.40	0.63
W_{2AP}	0.3240 (0.0856)	0.2986 (0.0862)	0.3068 (0.0873)	0.3136 (0.0735)	0.3594 (0.0759)	0.22	0.10
W_{3FV}	0.2402 (0.0866)	0.2067 (0.0812)	0.2069 (0.0826)	0.2368 (0.0753)	0.1879 (0.0313)	0.05	0.08
W_{4FO}	0.0680 (0.0346)	0.0692 (0.0458)	0.0646 (0.0353)	0.0502 (0.0179)	0.0522 (0.0173)	0.18	0.13
$W_{5Others}$	0.06409 (0.0366)	0.0113 (0.0103)	0.0226 (0.1765)	0.0412 (0.0507)	0.0556 (0.0709)	0.15	0.06
Total food expenditure(₦)	8816.46	7817.35	7997.02	8134.80	10,315.55	8763.95	5324.54
Total Household income (₦)	33,616.49	13,630.05	35,325.42	40,347.15	55,163.33	35,397.38	11,352.64
Food Expenditure as % of income	0.26	0.57	0.23	0.20	0.18	0.25	0.47

Note: standard error in parenthesis, W1= Grain/starch, W2= Animal/plant protein, W3= fruits/vegetables, W4= fats/oils, W5= others (non-food inclusive)

Table 3, presents the factors influencing households' food demand in Osun state, using Quadratic Almost Ideal Demand System (QUAIDS) model. Only 5 and 2 of the 25 price effects are significantly different from zero at the 10% and 5% significance level respectively, suggesting that there is not much quantity response to movements in relative prices. The demand model was found to be significant at $p<0.01$. The R^2 values are 28.19%, 23.71%, 21.62% and 15.13% for grains/starch, animal protein, fruits/vegetables and fat/oil respectively.

Factors influencing households' demand for grains/starch in the study area as shown in Table 3 were prices of: grains/starch, animal protein, and fat/oil. At $p<0.05$, expenditure on grain/starch food group was significant, while, age and household size were however significant at $p<0.01$.

Budget share of households on grains/starch increases with increase in price of grains/starch ($p<0.01$), while it decreases with increase in prices of animal protein ($p<0.01$) and fat/oil ($p<0.05$). The higher the age of the household heads and increase in household size, increases the consumption of more grains/starch food group in the study area. This was found to be in agreement with Omonona *et. al.,* (2008), who reported that respondents that are older consume more of staple foods.

The demand for animal protein was also determined by prices of grains/starch and fat/oil, education, marital status and major occupation, were significant at one percent. Demand for animal protein increases with decrease in price of grains/starch and decreases with increase in prices of fat/oil. Households demand for animal protein was found to be lower in, households that spend more education; likewise households that have their major occupation as farmers and were married consumed less of animal protein. This is similar to the findings of Obayelu (2010); who reported that households that spend more on non-food items (education, health, rents, frequent and infrequent) consume less of animal protein, in similar vein, households that are farmers, married, demand less of animal protein. Preference for animal protein was however noticed in households that have attended school (Okoruwa *et. al.,* 2008).

Household budget share demand for fruits/vegetables is influenced by prices of fruits/vegetables and fats/oil; income and education at one percent, while, age and major occupation were however significant at 5 percent. The household demand for fruits/vegetables will increase by increase in price of fruits/vegetables, and decreased in price of fats/oil. Households that incur more expenses tend to consume less of fruits/vegetables. The demand for fruits/vegetables however increases with increase in age and with households whose major occupation is farming. Factors determining households' demand for fats/oil include: prices of grains/starch, fats/oil, age, education and marital status at $p<0.01$. Respondents that have older household heads consume less of fats, while households that are farmers and married have increase demand for fats/oil.

Table 3: Parameter estimates of the QUAIDS model

Variables	W_{1GS}	W_{2AP}	W_{3FV}	W_{4FO}
Constant	0.3010 (0.040)	0.6562** (0.185)	0.1864** (0.105)	0.0586 (0.064)
$InPW_{IGS}$	0.7386*** (0.185)	-0.6338*** (0.147)	-0.0738 (0.109)	-0.0181** (0.066)
$InPW_{2AP}$	-0.6338*** (0.147)	0.4796 (0.245)	-0.0603 (0.050)	-0.4520 (0.165)
$InPW_{3FV}$	-0.0738 (0.109)	-0.0603 (0.050)	0.0314** (0.029)	-0.4203** (0.172)
$InPW_{4FO}$	-0.0181** (0.066)	-0.4520 (0.165)	-0.4203** (0.172)	-0.0679*** (0.042)
In χ	-0.1658*** (0.175)	0.4028*** (0.1399)	0.0927 (0.123)	0.0802 (0.067)
$(\text{In } \chi)^2$	-0.2348** (0.084)	0.0250*** (0.007)	-0.0442*** (0.005)	-0.0570*** (0.067)
Age	0.5600*** (0.1394)	0.0046 (0.704)	0.5230*** (0.121)	-0.6015*** (0.101)
Household size	0.0155*** (0.004)	-0.0137 (0.002)	0.0035 (0.100)	0.0042 (0.007)
Education	-2.0012 (0.005)	-0.404*** (0.103)	0.5922 (0.025)	-0..0543*** (0.087)
Marital	-2.0018 (0.003)	0.5034*** (0.143)	0.2971 (0.249)	0.6250 (0.170)
Major occupation	0.0849 (0.101)	-0.0114*** (0.003)	0.1179** (0.067)	0.0124*** (0.051)
R^2	0.28195	0.24712	0.21621	0.19135
Adjust. R^2	0.27093	0.23523	0.20362	0.15137
Prob>F	0.0001	0.0001	0.0001	0.0003
Residuals (v)	0.1440 (0.062)	-0.1756 (0.048)	-0.0421 (0.056)	-0.0152 (0.029)

Source: Author's estimates of Result of Analysis.
Note: Standard error in parenthesis
***, **, *, Significant at 1, 5, and 10%.

5. Conclusion and Policy Recommendation

This study has made an attempt in modelling food consumption demand for households in Osun state. This study made use of QUAIDS model which has been described to have a rank of three, that is, it best approximates, spans and fits the Engel curve. Findings from this study revealed that there is high differential in the consumption expenditure share among food groups and more importantly, differential across income groups. This study concludes that different socioeconomic variables (age, household size, marital status) influence the

consumption and budget expenditure of the different food classes to maintain a balance diet for the households. The policy implication of these differences is that the design of opposing poverty and nutrient enhancement programs needs to be region-specific especially in low income earning states like Osun State and take into account these behavioral and socioeconomic differences in food expenditures.

REFERENCES

Abdulai A (2002). Household Demand for Food in Switzerland. A Quadratic Almost Local Demand System. Swiss *J. Econ. Stat. 1*38(1): 1-18.

Abdulai A, Jain DK (1999). Using micro level data to analyze consumption of milk and milk products in India, *Quar. J. I. Agric.* 38: 53-64.

Abdulai, A., Aubert, D. (2004). A cross-section analysis of household demand for food and nutrients in Tanzania. Agricultural Economics, 31, 67-79.

Adeyeye, V.A. (1992): "Assessment of food security in Nigeria". Final report of a study commissioned by FAO, Rome.

Akintola J. O, Udoh E. J. (2002): An analysis of beef demand in Nigerian urban city. *Glo J. Pure. Appl. Sci. 9(1):1-12*

Ashagidigbi Waheed .M, Sulaiman .A. Yusuf and Victor O. Okoruwa (2012):Determinants of Households' Food Demand in Nigeria. World Rural Observations 2012;4(4)

Banks J., Blundell. R, and Lewbel. A (1997): Quadratic engel curves and consumer demand. The Review of Economic and Statistics, 79(4):527–539, 1997.

Barnett WA, Jonas A. (1983). The Muntz-Szatz demand system: an application of a globally well-behaved series expansion. Economic Letters 11(4): 337-42.

Barnett WA, Lee WY, Wolfe MD. (1985). The three- dimensional global properties of the Minflex Laurent, Generalized Leontief, and Translog flexible functional forms. *Journal of Econometrics* 30: 3-31.

Barnett WA. (1983). New indices of money supply and the flexible Laurent demand system. *Journal of Business and Economic Statistics* 1: 7-23.

Barnett WA. (1985). The Minflex Laurent Translog flexible functional form. *Journal of Econometrics* 30: 33-44.

Barnett WA., Lee WY, Wolfe MD. (1987). The global properties of the two Minflex Laurent flexible functional forms. *Journal of Econometrics* 36: 281-98.

Barnett WA., Lee WY. (1985). The global properties of the Minflex Laurent, Generalized Leontief and Translog flexible functional forms. *Econometrica* 53: 1421-1437.

Barten AP. (1977). The systems of consumer demand functions approach: A Review. Econometrica 45: 23-51.

Blundell, R.W., P. Pashardes, and G. Weber (1993). "What Do We Learn About Consumer Demand Patterns from Micro Data." American Economic Review 83(3):570-597.

Blundell R.W, Duncan .A and Pendakur .K. (1998). Semiparametric Estimation and Consumer Demand. *J. Appl. Econometrics 13(5): 435-461*.

Christensen LR, Jorgenson DW, Lau LJ. (1975). Transcendental logarithmic utility functions. American Economic Review 65: 367-83.

CNN (2008): "Food prices rising across the world", CNN Student News Transcript http://edition.cnn.com/2008/LIVING/studentnews/03/23/transcript.mon/index.html. 24 March 2008

Cooper R.J, McLaren K.R. (1996). A system of demand equations satisfying effectively global regularity conditions. Review of Economics and Statistics.

Deaton, A., and Muellbauer, J. (1980). An Almost Ideal Demand System. American Economic Review, 70, 312-326.

Diewert WE. (1971): An Application of the Shephard duality theorem: a Generalized Leontief production function. *Journal of Political Economy* 79: 461-507.

Ezzati, M., Hoorn, S.V and Rodgers, A (2003); Comparative Risk Assessment Collaborating Group Estimates of global and regional potential health gains from reducing multiple major risk factors. The Laucet, 362 (9380); 271-80.

Food and Agriculture Organisation (2002). Anti-Hunger Programme: Reducing Hunger through sustainable Agricultural and Rural Development and Wider Access to Food, Second Draft, Rome Italy,pp.62

Food and Agriculture Organisation (2012). The state of food insecurity in the world 2012. Rome, (Available at http://www.fao.org/docrep/016/i3027e/i3027e.pdf).

Fashogbon A. E. and Oni O. A (2012): Heterogeneity in Rural Household Food Demand and Its Determinants in Ondo State, Nigeria: An Application of Quadratic Almost Ideal Demand System. Journal of Agricultural Science; 5(2):169-177.

Haddabi, A. S, Ndehfru N. J and Aliyu, A. (2019): "Analysis Of Food Security Status Among Rural Farming Households In Mubi North Local Government Area Of Adamawa State, Nigeria." *International Journal of Research - Granthaalayah*, 7(7), 226-246. https://doi.org/10.5281/zenodo.3358105.

Helene Delisle (1990): Pattern of urban food consumption in Developing countries: Perspective from the 1980"s. FAO, Rome. P2

Lewbel, A.(1991): "The Rank of Demand Systems: Theory and Nonparametric Estimation." *Econometrica* 59(1991):711-730.

McCalla, A. (2001) Challenges to World Agriculture in the 21st Century, J. *Agricultural Resource and economics* Vol. 4 No. 3.

Meenakshi, J.V., and R. Ray (1999). "Regional Differences in India's Food and Expenditure Pattern: A Complete Demand Systems Approach." *Journal of International Development* 11(Jan/Feb 1999): 47-74.

Moro, D. and Skokai, P.(2000): Heterogeneous preferences in household food consumption in italy. European Review of Agricultural Economics, 27(3):305–323, 2000.

Muellbauer, J. "Community Preferences and the Representative Consumer." *Econometrica* 44(1976): 525-543.

National Population Commission (2012) Bulletin

Obayelu A. E. (2010) Classification of households into food security status in the north-central Nigeria: an application of Rasch measurement model. *ARPN Journal of Agricultural and Biological Science*. 3: 26-41.

Olarinde L. O. and F. A. Kuponiyi (2005): Rural Livelihood and Food Consumption Patterns among Households in Oyo State, Nigeria: Implications for Food Security and Poverty Eradication in a Deregulated Economy. *J. Soc. Sci.*, 11(2): 127 132

Oyefara. J.L (2005): Poverty, Food insecurity and HIV/aids pandemic: Evidence of Relationship from Reproductive Behaviour of Commercial Sex Workers in Lagos Metropolis, Nigeria. Department of Sociology, Faculty of Social Sciences University of Lagos Akoka, Yaba, Lagos Nigeria.

Okoruwa V.O, Abiodun E. D and Ajai O.I.Y (2008): Cross Sectional Analysis of Food Demand in the North Central, Nigeria: The Quadratic Almost Ideal Demand System (QUAIDS) Approach 1(2): 173-173.

Olayemi J.K. (1998): Food Security in Nigeria. Research Reports No. 2. Development Policy Centre, Ibadan, Nigeria.

Poi, B. P. (2002): "From the Help Desk: Demand System Estimation." *Stata Journal* 2(4):403-410.

Rosen S., Shahla S. (2002): Food Security Assessment, Market and Trade Economics Division, Economics Research Service, U.S. Department of Agriculture, Agriculture and Trade Report. GFA-13.

Taljaard P.R, Alemu *Z. G,* van Schalkwyk H.D (2004): *The Demand for Meat in South Africa:* An Almost Ideal Estimation: Agrekon Vol. 43 (4): 430 – 443.

Theil H. (1965). The information approach to demand analysis. *Econometrica* 33: 67-87.