Household Poverty and Food Expenditure in Nigeria:
An Empirical Test of Engel's Law

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Abstract: Poverty and food consumption inadequacy are two major problems which have been afflicting the world over the years, particularly in recent times. Nigeria is evidently plagued by the two problems. This study analysed the association between household poverty and food expenditure in Nigeria. In particular, the study empirically tested the validity of Engel's Law within the framework of major poverty correlates. The study was based on the 2010 Harmonised Nigeria Living Standard Survey data set obtained from the National Bureau of Statistics, Abuja, Nigeria. The study used descriptive statistics and logistic regression technique in its analysis. The study found, among other things, that, in general, food expenditure share varied directly with poverty whereas food expenditure per capita varied inversely with poverty in Nigeria. This implies that while the poor have higher food expenditure share than the non-poor, the non-poor have higher food expenditure in absolute terms than the poor; this validates the Engel's Law. The government should take urgent and adequate steps to tremendously reduce poverty in Nigeria and guarantee adequate food expenditure for all and sundry in the country.

Key words: Food Expenditure · Household · Poverty · Logit · Nigeria

INTRODUCTION

Poverty and food consumption inadequacy are two major ways of describing economic adversity. These two principal socio-economic problems have been afflicting the world over the years, particularly in recent times. The less developed regions of the globe are evidently worst hit by the two problems [1-6]. The level of poverty and the magnitude of food consumption inadequacy are apparently most pronounced in Sub-Saharan Africa. In fact, the region has evidently made the slowest progress in combating the two problems in question when compared to other regions.

Food consumption is a major determinant of quality of life. Inadequate food consumption leads to significant reduction in physical ability, cognitive/intellectual development, emotional and spiritual balance, and life expectancy. Indeed, inadequate food consumption ultimately leads to tremendous reduction in productivity and reduction in productivity brings about decline in output, income and employment. With decline in output, income and employment, poverty is bound to increase, all other things being equal. Thus, inadequate food consumption and poverty are intricately linked. Suffice it to say that inadequate food consumption has negative impact on health status and this in turn brings about many undesirable/detestable socio-economic conditions such as low income, low life expectancy at birth, high infant and under-five mortality rates, and low human capability in general. It is worthy of note that adequate food consumption contributes immensely towards making a person remain a great and invaluable asset to the society. Among other things, it plays a crucial role in the maintenance of good health and in the prevention of morbidity and premature mortality throughout the life cycle [7, 8]. To show the critical importance of adequate food consumption, the first Millennium Development Goal and the second Sustainable Development Goal are on reducing/obliterating food consumption inadequacy (Hunger).

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In Nigeria, poverty has become pervasive in recent times, afflicting an overwhelming proportion of the country's population. Indeed, poverty has over the years continued to devastate Nigeria and the country has in recent times been shown to be one of the poorest in the world [3-6, 9-18]. Also, food consumption inadequacy is evidently highly pronounced in Nigeria and this is eloquently manifested in the high levels of severe and moderate underweight, wasting and stunting among children coupled with the high rates of infant and under-five mortality as well as low life expectancy at birth [3-6, 9, 13-23].

Objectives of the Study: The relationship between poverty and food expenditure is crucial for development policy formulation and implementation. It is noteworthy that food expenditure is usually used as a proxy for food consumption. The broad objective of this study is to analyse the association between household poverty and food expenditure in Nigeria. The specific objectives include the following.

- To empirically test the validity of Engel's Law in Nigeria by empirically testing whether or not the ratio of food expenditure to total expenditure is positively related to poverty in the country.
- To empirically test whether or not per capita food expenditure is inversely related to poverty in Nigeria.

Literature Review
Theoretical Literature on Poverty: The concept of poverty is very crucial to discussions in development studies [24]. Over the past few decades, experts in Development Economics have given great attention to the concept in their attempt to explain the paradox of the coexistence of high rate of economic growth and high incidence of poverty. Poverty is a situation that is characterised by economic hardship and degradation of human dignity. However, the conceptualisation of the phenomenon is highly problematic. This is largely due to the fact that the phenomenon affects multiple aspects of human condition including physical, psychological, social and even spiritual. This has made it impossible to have a general consensus on the definition of the phenomenon.

The literature is loaded with multifarious conceptualisations of poverty. Various criteria have been used to conceptualise the problem. Many analysts, however, follow the conventional view that poverty is a result of inadequate income for securing basic goods and services. The concern here is with an individual's or a household's ability to subsist and to reproduce himself/herself or itself as well as the individual's or the household's ability to command resources to achieve this [25]. Historically, this involves a transition from a situation where subsistence depends on wages with which to purchase food to a situation where subsistence depends on wages/money income with which to purchase food and basic non-food commodities and services. Anyanwu [25] further pointed out that many other experts have conceptualised the poor as that portion of the population that is unable to meet basic nutritional needs while others view poverty, in part, as a function of education, healthcare, life expectancy, child mortality and so on.

The commonest (and perhaps the most celebrated) practice is to conceptualise poverty in absolute terms. Absolute poverty, according to Pope John Paul II,[1] is a condition in which life is so limited by lack of food, malnutrition, illiteracy, high infant mortality and low life expectancy as to beneath any rational definition of human decency. In line with the foregoing papal definition, the World Bank considers absolute poverty as a condition of life degraded by diseases, deprivation and squalor, among other things [26]. In general, absolute poverty refers to lack of adequate resources to afford a commodity/consumption basket[2] that guarantees the attainment/ maintenance of an objective minimum acceptable standard of living [26]. Even though the above conceptualisation of poverty has some limitations, it is noteworthy that conceptualising poverty in absolute terms is most appropriate for the formulation and implementation of policies and programmes that are aimed at reducing the level of basic deprivation and misery [24].

As further observed in Ozughalu [24] absolute poverty is sometimes defined in terms of some approximate maximum proportion of total income (or total expenditure) that is spent by a household or an individual on certain subsistence commodity (or commodities). Thus, in obedience to Engel's Law, any household or individual that spends more than a specified maximum percentage of its or his/her income on basic needs like food, housing, clothing and healthcare is considered as poor.

It could be recalled that a celebrated Statistician – who later became interested in Economics, particularly in studying food demand - Ernst Engel, stated a major result from his observations and studies; this result is known as

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[1]This is contained in his address to the 21st Session of the Conference of Food and Agriculture Organization, 1981.
[2]This refers to a collection of goods and services.

Engel's Law. The law states that the poorer an individual, a family or a people, the greater must be the percentage of the income necessary for the maintenance of physical sustenance and of this a greater portion must be allowed for food [27, 28]. Put differently, the law says that as income rises, the proportion of income spent on food falls, but the absolute expenditure on food may rise. The law implies that the poor spend higher proportions of their incomes on food than the non-poor; thus, the ratio of food expenditure to total expenditure should vary directly with poverty whereas the absolute expenditure on food may vary inversely with poverty.

Another major way of conceptualising poverty is in relative terms. Relative poverty refers to the inability of certain segments of a society to earn adequate income or to command resources to satisfy their basic needs in line with what obtains in the better-off segments [29].

We also have material poverty and subjective poverty. Material poverty refers to lack of ownership and control of physical assets such as land, machinery and animal husbandry [29]. Subjective poverty conceptualisation, on the other hand, requires individuals – the poor inclusive – to define what they consider to be decent or minimally adequate standard of living [30].

We have the concept of exchange entitlement and capabilities as an aspect of poverty which has some similarities with material poverty. Exchange entitlement and capabilities as a poverty concept was designed in Sen [31] and Sen [32]. In a market economy, exchange entitlement refers to the set of all alternative bundles of commodities that can be acquired in exchange for what is owned. Given ownership, this exchange entitlement, among other things, depends on earned income, asset income, prices of consumption goods, prices of producer goods, prices of inputs used and government's social programmes and fiscal operations [31, 33]. On the other hand, capabilities have to do with such elements as standard of living and the broader aspects of the ability to be socially useful and influential. The interaction of entitlement and capabilities to a great extent determine what people do and what they are. Following this, a poor person can be said to be one who, given the ownership he actually has, has an exchange entitlement set that does not contain any feasible bundle of commodities satisfying minimum standard of living [33].

Poverty can be chronic (structural) or transient. Transient poverty relates to the contribution of consumption variability to anticipated poverty over time whereas chronic poverty is the poverty that remains after inter-temporal variability in consumption has been smoothed out [34, 35]. Chronic poverty implies persistent or permanent socio-economic deprivations and is linked to various factors such as limited productive resources, lack of education/skills for gainful employment and endemic socio-political and cultural factors. Transient poverty, on the other hand, is transitory or temporary and is linked to natural or man-made disasters such as wars, loss of jobs, conflagration, ill-health and flood [24, 36].

In the analysis of poverty it is customary to start by choosing an indicator of well-being. This may be based on consumption, expenditure or income [37]. Thereafter, a cut-off point, called "The poverty line" will be set. This is a measure of the minimum acceptable standard of living or welfare and it separates the poor from the non-poor [25]. Poverty lines can possess the attributes of specificity (or relevance) and comparability (or consistency). Specificity (or relevance) of a poverty line across space at a particular time implies that the poverty line reflects the specific characters of a region under study. It is held in many quarters that a poverty line should take into account various aspects of human condition in a region such as life pattern, culture, social condition, and norms prevailing in the region [38]. Inter-temporal specificity (or relevance) of a poverty line, which is similar to spatial specificity, implies that the poverty line reflects the specific conditions/characteristics of a particular region/area at a given time; it is popularly held that the derivation of poverty lines across time should consider changes in the life pattern, culture, social conditions, and norms prevailing in different years [38-40]. Consistency (or comparability) of poverty lines, on the other hand, refers to when poverty lines indicate the same standard of living [38, 40]. As pointed out in Asra and Santos-Franscisco [38], some kind of standardisation needs to be undertaken to ensure strict comparability. When money metric measures are used, they should be adjusted adequately for price differentials so that they maintain a fixed real value that will make valid spatial or even inter-temporal comparisons of poverty rates. In other words, to enable comparison, poverty lines based on money metric measures should be fixed in terms of standard of living across the entire domain of the poverty comparison [38].

The construction of poverty lines is relatively subjective and depends to a large extent on individual researchers' preferences and dispositions [41, 42]. However, the literature reveals that there are basically four approaches used in the setting of poverty lines namely: Direct Calorie Intake (DCI), Food-Energy-Intake (FEI), Cost-of-Basic Needs (CBN) and Arbitrary-Choice-of-Index (ACI) methods [38, 43,44]. It is instructive to state that the FEI and the CBN methods are apparently more popular and more scientific than the other two methods.

After a poverty line has been set, the next line of action will be to measure poverty. There are some axioms that a good and desirable poverty measure must satisfy. These include monotonicity, transfer and focus axioms [25, 45]. The monotonicity axiom states that given other things, a reduction in income (or expenditure) of a person that is below the poverty line must increase the poverty measure. The transfer axiom states that, given other things, a pure transfer of income (or expenditure) from a person that is below the poverty line to any one that is richer must increase the poverty measure. The focus axiom requires that the poverty measure be dependent only on the incomes (or expenditures) of the poor; thus the incomes (or expenditures) of the non-poor and any changes therein are irrelevant.

There are many poverty measures but four of them are commonly used namely: the headcount ratio, the poverty gap index, the Sen index and the Foster-Greer-Thorbecke (FGT) index [24, 46]. The headcount ratio is the commonest and simplest of all the existing poverty measures. It is simply the proportion of poor people in a population. The headcount ratio pinpoints variations in the percentage of the population living in poverty. But it is insensitive to the severity of poverty and to changes below the poverty line. The poverty gap index measures the difference between the poverty line and the mean income or expenditure of the poor expressed as a ratio of the poverty line. It is a good measure of the depth of poverty for it takes account of the extent to which households fall below the poverty line. But it is insensitive to the distribution of standard of living among the poor. The Sen index is a composite measure of poverty. It indicates the degree of impoverishment and the distribution of income among the poor as well as the number of the poor. It incorporates the headcount ratio, the poverty gap index and the Gini coefficient.[3] The Sen index satisfies the monotonicity, transfer and focus axioms. However, a major shortcoming of the index is that it is more responsive to improvements in the headcount than it is to reductions in the income gap or to improvements in the distribution of income among the poor; thus, it suggests that the best way to reduce poverty is to help the least needy first and the neediest last. This is not in line with moral justice and it is repugnant to equity and good conscience [24]. The FGT index is apparently the most popular/most widely used poverty measure because apart from satisfying the major axioms for a desirable poverty measure, it has an added advantage of being additively decomposable among population subgroups. The index is a composite measure

that contains the headcount ratio, the poverty gap index and a measure for poverty severity. The FGT index (P_α) is based on the following formula:

$$P_\alpha = \frac{1}{n} \sum_{i=1}^{q} \left[\frac{z - y_i}{z} \right]^\alpha \tag{1}$$

where: n is the total number of households/individuals in the population or sample; y_i is the income or expenditure of the ith poor household/individual; z is the poverty line; and α is the poverty aversion parameter. The poverty aversion parameter (α) is usually set at 0, 1 and 2 to measure poverty headcount, poverty depth and poverty severity respectively. As stated earlier, the FGT index has the peculiar advantage of being additively decomposable among population subgroups. Thus, the overall poverty (P_α) can be expressed as the sum of group measures weighted by the population share of each group [47, 48]. The decomposition may be given as follows:

$$P_\alpha = \Sigma K_j P_{\alpha j} \tag{2}$$

where j = 1, 2, 3 … m groups; K_j is the population share of each group and $P_{\alpha j}$ is the poverty measure of each group. Based on (2), the contribution of each group (CN_j) to overall poverty is calculated as follows:

$$CN_j = \frac{K_j P_{\alpha j}}{P_\alpha} \tag{3}$$

It is instructive to state here that money-metric measures are usually preferred to non-money-metric measures. This is because money-metric measures are less subjective and more scientific than non-money metric measures. Besides, money-metric measures cover economic deprivation which is regarded as the principal dimension of poverty.

It is regrettable to observe that despite the pervasiveness of poverty and the economic importance of the phenomenon, economists have not been able to formulate sophisticated and robust direct theories of the menace. However, what appears like a direct theory of poverty in Economics is the vicious cycle theory. This theory implies that poverty breads poverty, occurs through time and transmits its effects from one generation to another [49-51]. The vicious cycle theory has both demand and supply sides. The demand side shows that low productivity leads to low income and low income brings about low demand; low demand leads to low investment and low investment leads to capital deficiency

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[3] The Gini coefficient is a measure of dispersion and it is used in Economics to measure income inequality. It ranges from 0 (perfect equality) to 1 (complete inequality).

which in turn brings about low productivity. On the supply side of the cycle, low productivity leads to low income and low income leads to low saving which in turn leads to low investment; low investment brings about capital deficiency and this in turn brings about low productivity. Another dimension of the vicious cycle theory links market imperfections and underdeveloped human and natural resources. Development of a country's natural resources is a function of the productive capacity of the people in the country. If the people are backward and illiterate, and lacking in technical skill, knowledge and entrepreneurial ability, then the natural resources will tend to remain unutilised, or be underutilised or even be wrongly utilised; on the other hand, people are economically backward in a country due to underdeveloped natural resources [51]. It is noteworthy that underdeveloped human and natural resources pave the way for gross market imperfections.

Political economists and radical sociologists/psychologists have postulated some theories of poverty. These theories include the necessity theory, the individual attributes theory, the natural circumstantial theories and the power theory [52]. In contemporary literature, many theories are found. However, five of these are apparently most prominent. They are individual deficiencies theory; culture theory; economic, political and social distortions/discrimination theory; geographical disparities theories; and cumulative and cyclical interdependencies theory [53]. The foregoing theories, in general, show that poverty is multidimensional or multifaceted. They also show that poverty comes as a result of various forms of deprivation such as deprivations in output, employment, income, food expenditure, non-food expenditure, political power and environmental resources.

Food Consumption and Food Expenditure: Food consumption is the intake of all components[4] of food or part thereof. Food expenditure, on the other hand, refers to the action of spending funds to obtain food items for consumption purposes. Thus, food expenditure and food consumption are highly correlated; the former is indeed a function of the latter and vice versa. Total food expenditure is usually made up of purchased food and an imputed value for consumption of own food products [19, 20]. Total food consumption is also made up of purchased food and consumption of own food products. Sometimes food consumption and food expenditure are used interchangeably. Suffice it to say that food expenditure is monetary representation of food consumption.

A major concept associated with food expenditure is food security. Food security exists when all people, at all times, have physical, social and economic access to adequate, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [2, 54-56]; this may be said to be national or aggregate food security. Household food security is the application of the foregoing conceptualisation at the household level, with individuals within the household as the focus of concern [2]. It is important to point out here, following [54] that food security is not synonymous with food self-sufficiency as erroneously held in some quarters. Food self-sufficiency refers to a state of affairs in which food requirement is satisfied by a nation or household or individual through own production activities without recourse to augmentation through food imports, transfers or other external supply sources.

Food insecurity and food expenditure deficits are often considered to be mainly economic problems; thus, economic approaches are usually used in analysing them. There are many variables that can serve as indicators of food security in the measurement and analysis of the problem of food insecurity and food expenditure deficits. These include net food availability per capita; per capita calorie and/or protein intake; percentage of the population or of households with energy intake that is below the national average requirement; percentage of children that are underweight, stunting and wasting (as may be determined from anthropometric studies); food gap which may be measured as the percentage shortfall in the actual average energy intake relative to the average energy requirement; coefficient of variation in daily energy supply per capita; and index of food price inflation [54, 55, 57]. Indicators that are expressed in per capita terms may be expressed in per adult equivalence terms. Recent literature on analysis of household welfare is replete with the advocacy to always cater for variation in household size and composition in the analysis of various aspects of household wellbeing such as household food expenditure and household income and consumption poverty. Ways of addressing the issue of variation in household size and composition include the use of adult equivalence scales and economies of scale in household consumption [58-61]. However, when such measures are not available or reliable, then the use of per capita measures becomes inevitable.

One of the commonest measures of national food security status is net food availability per capita ($NFAC_t$) and it is defined as follows [See 54]:

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[4] The components of food are carbohydrates, proteins, fats, vitamins, mineral and water.

$$NFAC_t = [QY_t + FM_t + DNFS_t - TQF_t - FX_t - QPHF_t]\frac{1}{n}$$

$$(4)$$

where: $NFAC_t$ is net food availability per capita (in grain equivalence) in year t; QY_t is domestic output of food in year t; FM_t is quantity of food imported in year t; $DNFS_t$ is change in national food stock carry-over in year t; TQF_t is total quantity of food required as inputs and for non-food industrial use in year t; FX_t is quantity of food exported in year t; $QPHF_t$ is quantity of post-harvest loss in year t; and n is population size.

At the household level, food security and food expenditure adequacy can be measured directly by actual dietary intake of all household members or by household food expenditure, using standard household expenditure and income surveys; the degree of household food security depends, among other things, on the minimal nutritional requirements of individuals with the assumption that all households with in each expenditure/income stratum have the same entitlements to food [62, 63].

Due to the inadequacy of single variables as indicators of food security and food expenditure adequacy status, attempts have been made to construct composite food security status. For instance [64] has proposed that such indices should be constructed using the following variables: per capita food supply; national income per capita; index of income distribution which may be measured by Gini coefficient computed from a frequency distribution of national income or, as a proxy, the percentage of national income received by the lowest 40 per cent of the population; deviation of food production from trend; and index of food prices.

The Food and Agriculture Organization (FAO) has developed a sophisticated index for capturing food security and food consumption adequacy. The FAO index is called Aggregate Household Food Security Index (AHFSI) and is given as follows [See 54]:

AHFSI = [H[G + (1-G)] + ½σ [1-H[G+(1-G)I]]]100   (5)

where: H is proportion of undernourished people (or households) in the population; G is food gap measured as the proportion of the shortfall of average daily energy intake by the undernourished from the average national energy requirement; I is a measure of inequality in the distribution of food gap, represented by Gini coefficient obtained from the assumed distribution of per capita food consumption; σ is coefficient of variation in energy supply.

To access a household's food expenditure adequacy, one has to compare the household's actual food expenditure with a predetermined objective standard minimum requirement. If the household's actual food expenditure is less than the standard minimum requirement it will then be said that the household's food expenditure is inadequate. This approach is apparently very popular among researchers.

Standard consumption theories show a positive relationship between expenditure and income. For instance, the Keynesian absolute income hypothesis states that consumption is a positive function of disposable income [51]. Thus, when disposable income increases, expenditure – of which food expenditure is a major component – also increases. Standard consumption theories, in general, imply that expenditure (including food expenditure) is inversely related to poverty. Those that are poor spend less on food (and other consumption goods) in absolute terms than the non-poor; the poor are usually food insecure; indeed, the poor often lack adequate means to secure access to sufficient food [55, 65]. Inadequate food expenditure is truly a manifestation of poverty. However, as indicated earlier, though the poor may spend less on food than the non-poor in absolute terms, the proportion of income spent on food by the poor is in general higher than that spent by the non-poor, which is in line with Engel's Law [66].

Empirical Literature: Empirical studies on the relationship between poverty and food expenditure as well as on related issues across the world are relatively scanty. Such studies include [41, 42, 67-72]. Crawford and Thorbecke [67] used a low-cost diet and direct calorie intake approach to estimate the magnitude and regional distribution of food poverty among Kenyan smallholders. The study found, among other things, that one-fourth of all smallholder-households had a food intake that was below the recommended daily allowance and there were notable differences in the provincial incidence of food poverty. Greer and Thorbecke [41] and Greer and Thorbecke [42] used a novel methodology involving an empirically derived cost-of-calories function and a poverty measure associated with the Foster-Greer-Thorbecke (FGT) index to analyse food consumption shortfalls among Kenyan smallholders. Greer and Thorbecke [41] also used multiple regressions techniques to establish the correlates of calorie consumption. The study found, among other things, that there were regional differences in the severity of food poverty and household income (with expenditure used as proxy for it) per adult equivalence was the primary determinant of

calorie consumption. Greer and Thorbecke [42] found, among other things, that the methodology of the study was superior in some ways to least-cost approach and that at low expenditure level Kenyans appeared to be very cost efficient food consumers.

Kyereme and Thorbecke [68] like [41, 42] also used an empirically derived cost-of-calories function and a poverty measure associated with the Foster-Greer-Thorbecke (FGT) index to analyse food poverty using the Ghana Household Budget Survey data of 1974-1975. The study found, among other things, that the incidence of food poverty was more prevalent in rural areas and locations close to the Sahel as well as among households with many members and illiterates, females or self-employed heads. Kyereme and Thorbecke [69] employed multiple regression technique based on household production theory to identify the main determinants of food poverty in Ghana. The study found, among other things, that age of household head, sex of household head, educational level of household head, income, fertility and maturity indices significantly explained household calorie gaps. The study used the Ghana Household Budget Survey. Nyariki and Wiggins [70] used household data to analyse food security and food poverty. The study employed simple ratio techniques and showed that per capita food production was low in Kenya and varied with rainfall and food poverty; and insufficient food expenditure brought about food poverty. This implies that poverty and food expenditure are directly related. Kumar and Aggarwal [71] investigated the patterns of consumption and poverty in Delhi based on survey data. The study also employed simple ratio techniques. The study found, among other things, that the poor, in general, spent a highly significant proportion of their income on food. Mussa [72] used the 2005 Second Integrated Household Survey data on Malawi to examine how inequality in household expenditure components affected total inequality and poverty in the country. The study disaggregated total household expenditure into four mutually exclusive and exhaustive expenditure items namely expenditure on food, expenditure on health, expenditure on education and expenditure on non-food and non-human capital items. The study utilised within-component inequality and between-component inequality measures and found, among other things, that the elasticities of poverty with respect to inequalities in expenditure on food and health were positive and about the same in magnitude.

Empirical studies associated with poverty and food expenditure in Nigeria are also very scanty. They Include [73-79]. Omonona and Agoi [73] analysed the food security situation among urban households in Lagos State, Nigeria, based on primary data that were obtained from structured questionnaire in 2004. The study found, among other things, that the food insecurity incidence in the study area was 49%; it varied directly with age of household head, household size and dependency ratio; it varied inversely with level of education and income; it was higher in female-headed households than in male-headed households; it was found to be low for those engaged in professional occupation and highest for traders. Obayelu *et al.* [74] used food consumption data obtained from a household survey carried out between November 2006 and February 2007 to examine whether or not there were differences in food consumption patterns between the rural and urban households in North Central Zone of Nigeria. The study utilised descriptive statistics and Cragg double-hurdle model and found, among other things, that there was heterogeneity in food consumption and expenditure patterns across households in rural and urban areas. Obayelu *et al.* [75], used data obtained from a household survey conducted between 2006 and 2007 to analyse differentials in households' food expenditure between urban and rural households in Kogi and Kwara States of Nigeria. The study employed descriptive statistics and found, among other things, that households in urban areas spent higher proportions of their incomes on food than households in rural areas. The study further showed that female-headed households spent slightly higher proportions of their incomes on food than male-headed households; and food expenditure share increased with increase in household size but decreased with increase in household per capita income in line with Engel's Law. Babalola and Isitor [76] used data got from a household survey that was carried out in 2012 to analyse the determinants of food expenditure patterns among urban households in Lagos State, Nigeria. The study made use of descriptive statistics and a multiple regression model. The study found, among other things, that 60% of household income was spent on food and that the major determinants of food expenditure included household income, household size and household composition. Ozughalu and Ogwumike [77] used the 2004 Nigeria Living Standard Survey data to examine the incidence, depth and severity of food poverty in Nigeria, and to produce a food poverty profile for the country. The study utilised a linear programming technique in the spirit of the Food-Energy-Intake approach as well as the Foster-Greer-Thorbecke (FGT) index. The study, among other things, showed that food poverty was pervasive in Nigeria and varied significantly across the geo-political

zones of the country. Ozughalu and Ogwumike [78] used the 2004 Nigeria Living Standard Survey data and logistic regression technique to analyse the determinants of food poverty in Nigeria. The study found, among other things, that household size, proportion of children in the household, occupation in agriculture for household head and residing in the rural sector were positively related to food poverty whereas ownership of agricultural land, educational level of household head, occupation in professional/technical group and in administration/clerical group for household head, access to credit and access to regular remittances were inversely related to food poverty. Olubukunmi *et al*. [79] used the 2010 Harmonised Nigeria Living Standard Survey data, descriptive statistics, a multiple regression model and an ordered probit model to analyse food and non-food expenditure differentials across poor and non-poor households in South East Zone of Nigeria. The study, found among other things, that there were significant variations in food and non-food expenditures across poor and non-poor households in South East Zone of Nigeria; the non-poor spent far more on both food and non-food items in absolute terms than the poor.

It is pertinent to note that none of the studies reviewed comprehensively analysed the relationship between household poverty and food expenditure using a nationally representative data. Suffice it to say that analysing the relationship between household poverty and food expenditure is crucial for both theoretical and policy purposes.

MATERIALS AND METHODS

To analyse the association between household poverty and food expenditure in Nigeria, we employ some descriptive statistics as well as a logit model, and we utilise the 2010 Harmonised Nigeria Living Standard Survey (HNLSS) data set obtained from the National Bureau of Statistics, Abuja, Nigeria. The descriptive statistics that will be used are arithmetic mean (or simply the mean), standard deviation and coefficient of variation. The mean is a measure of central tendency; standard deviation is a measure of absolute dispersion or variability; and coefficient of variation is a measure of relative dispersion or variability. Coming to logit model, it involves a maximum likelihood estimator of stated parameters given the non-linear probability distribution of the random error. The logit model is mathematically very convenient thus it may generally be preferred to its rivals such as Probit Model. The logit model can be applied as

a simple approximation to other probability models; the model is known to produce results that can easily be interpreted and the method is simple to analyse; it even permits interpretations in utility terms [80]. The logit model is known to produce statistically sound results [81, 82]. In fact, the parameter estimates of the logit model are asymptotically efficient, consistent and normal and the analogue of the regression t-test can be applied.

The logit model for this study is specified explicitly as follows:

$$L_i = \left(\frac{P_i}{1 - P_i} \right) = \alpha_0 + \alpha_1 SHH + \alpha_2 AHH + \alpha_3 AHH^2$$
$$+ \alpha_4 HS + \alpha_5 HS^2 + \alpha_6 RUR + \alpha_7 NN$$
$$+ \alpha_8 EHH + \alpha_9 RFT + \alpha_{10} PFE + \varepsilon \qquad (6)$$

where: L_i is the logit (that is, the natural logarithm of the odds ratio); $P_i = 1$ if household is poor and $P_i = 0$ if household is not poor; $\left(\frac{P_i}{1 - P_i} \right)$ is simply the odds ratio in favour of being in poverty; a household is said to be poor if its per capita expenditure is less than two-thirds of mean per capita household expenditure in regionally deflated prices; α_0 is the constant term; SHH is sex of household head (male = 1, female = 0); AHH is age of household head (in years); AHH^2 is square of age of household head; HS is household size; HS^2 is square of household size; RUR is residing in rural sector (yes=1, no=0); NN is residing in Northern Nigeria (yes=1, no=0); EHH is educational level of household head (in terms of years of formal schooling); RFT is ratio of food expenditure to total expenditure (in %); PFE is per capita food expenditure; and ε is the random error term. The a priori expectations are as follows:

α_0, α_1, α_3, α_5, α_6, α_7 and $\alpha_9 > 0$; α_2, α_4, α_8 and $\alpha_{10} < 0$. Suffice it to say that SHH, AHH, AHH^2, HS, HS^2, EHH, RUR (or area of residence) and NN (or region of residence) are major determinants of poverty [see 83-85]. RFT and PFE are included in order to analyse the effects of food share (in total expenditure) and absolute food expenditure on poverty.

RESULTS AND DISCUSSION

Table 1 shows the mean, standard deviation and coefficient of variation of ratio of food expenditure to total expenditure and per capita food expenditure for core

Table 1: Descriptive Statistics of Ratio of Food Expenditure to Total Expenditure and Per Capita Food Expenditure for Core Poor, Moderately Poor and Non-Poor

	Mean(₦)	Standard Deviation	Coefficient of Variation (%)
CORE POOR			
Ratio of Food Expenditure to Total Expenditure	59.68	25.12	42.09
Per Capita Food Expenditure	11,593.85	7,001.05	60.39
MODERATELY POOR			
Ratio of Food Expenditure to Total Expenditure	52.13	27.34	52.45
Per Capita Food Expenditure	24,530.97	13,780.81	56.18
NON-POOR			
Ratio of Food Expenditure to Total Expenditure	36.80	29.69	80.68
Per Capita Food Expenditure	48,936.39	53,948.84	110.24

Source: Computed by the author from 2010 HNLSS

Table 2: Logistic Regression Estimates for Equation 6

Variable	B	S.E	Sig	Exp (B)
SHH	1.306*	0.045	0.000	3.692
AHH	-0.788*	0.010	0.000	0.455
AHH^2	0.009*	0.000	0.000	1.009
HS	-1.537*	0.057	0.000	0.215
HS^2	0.087*	0.005	0.000	1.091
RUR	2.642*	0.045	0.000	14.040
NN	0.681*	0.052	0.000	1.976
EHH	-0.023*	0.004	0.000	0.977
RFT	135.798*	0.744	0.000	9.469E+58
PFE	-0.203*	0.001	0.000	0.816
Constant	17.060*	0.246	0.000	25638608.39

Cox & Snell R^2=0.728; Likelihood Ratio Statistic=120,865,292; P-value for Likelihood Ratio Statistic(which follows the x^2 distribution) =0.000

Source: Computed by the author from 2010 HNLSS. The single star (*) indicates that the parameter estimate is statistically significant at 1%. Note: B represents each of the parameter estimates; S.E stands for standard error associated with each parameter estimate; Sig stands for significance level or the probability value associated with each parameter estimate; Exp(B) represents the odds ratio associated with each parameter estimate (This is obtained by taking the natural antilogarithm of each of the parameter estimates)[7].

poor[5], moderately poor[6] and non-poor. The table indicates that the ratio of food expenditure to total expenditure varies inversely with poverty whereas per capita food expenditure varies directly with poverty. The core poor have the highest mean ratio of food expenditure to total expenditure followed by the moderately poor; the non-poor have the least mean ratio of food expenditure to total expenditure. This validates the Engel's Law. On the other hand, the non-poor have the highest mean per capita food expenditure followed by the moderately poor; the core poor have the lowest mean per capita food expenditure. With regard to variability, the table shows that the core poor have the lowest coefficient of variation associated with ratio of food expenditure to total expenditure followed by the moderately poor; and the non-poor have the highest coefficient of variation associated with ratio of food expenditure to total expenditure; this implies that the distribution of food share in total expenditure is least variable and most consistent for the core poor whereas it

is most variable and least consistent for the non-poor. The table further shows that the non-poor have the highest coefficient of variation associated with per capita food expenditure followed by the core poor; and the moderately poor have the lowest coefficient of variation associated with per capita food expenditure; this implies that the distribution of per capita food expenditure is most variable and least consistent for the non-poor while it is least variable and most consistent for the moderately poor.

Table 2 shows the logistic regression estimates of Equation 6. The estimates are generally robust; all the explanatory variables, on aggregate, have significant impact on poverty in Nigeria. This is shown by the fact that the likelihood ratio statistic is statistically significant at 1%. A pseudo R^2 - the Cox & Snell R^2 – is presented; its value is 0.728 and it indicates satisfactory goodness of fit for the model. However, as noted in Gujarati and Porter [82], in models with binary dependent variables, goodness

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[5] This refers to any household whose per capita expenditure is less than one-third of household mean per capita expenditure in regionally deflated prices.

[6] The refers to any household whose per capita expenditure is up to and above one-third of household mean per capita expenditure but less than two-thirds of household mean per capita expenditure in regionally deflated prices.

[7] The Logit becomes negative and increasingly large in magnitude as the odds ratio decreases from 1 to 0 and becomes increasingly large and positive as the odds ratio increases from 1 to infinity [see 82].

of fit is of secondary importance. What matters are the signs of the regression coefficients and their statistical and/or practical significance. Virtually all the parameter estimates have the expected a priori signs.

As can be seen from Table 2, the ratio of food expenditure to total expenditure (RFT) is positively related to poverty; it increases the odds in favour of being in poverty. This implies that poor households, on the average, have higher ratio of food expenditure to total expenditure than non-poor households; this also validates the Engel's Law. Per capita food expenditure is inversely related to poverty; it reduces the odds in favour of being in poverty. This implies that, in general, non-poor households have higher food expenditure in absolute terms than poor households; this is in line with expectation.

The table also shows that being a female has lower odds associated with being in poverty compared to being a male. Age of household head is inversely related to poverty, while the square of age of household head is directly related to poverty. This means that as the age of household head increases, the odds in favour of being in poverty decrease; but at a later stage (perhaps after retirement), as the age of household head increases, the odds in favour of being in poverty also increase. Household size is inversely related to poverty whereas the square of household size is directly related to poverty. This implies that as household size increases, the odds in favour of being in poverty decrease; but beyond a certain size, as household size increases, the odds in favour of being in poverty also increase. Educational level of household head is inversely related to poverty. As educational level of household head increases, the odds in favour of being in poverty reduce. Living in Northern Nigeria has higher odds in favour of being in poverty than living in Southern Nigeria. Also, living in rural areas has higher odds in favour of being in poverty than living in urban areas. The constant term is positive. All the parameter estimates are statistically significant at 1%.

RECOMMENDATIONS AND CONCLUSION

Given that poverty has been pervasive in Nigeria over the years and that the poor spend less on food in absolute terms and have higher food share in total expenditure than the non-poor, the government should take urgent and adequate steps to tremendously reduce poverty in the country. Policies that will adequately increase food supply and drastically reduce food prices should be put in place so that food will become affordable to all and sundry in the country; this will guarantee adequate food expenditure by the poor and it will go a long way in reducing the incidence of poverty in the country. Agricultural production should be adequately boosted and mechanisms for optimal distribution of agricultural products should be put in place. Indeed, agriculture should be made to become highly lucrative and agriculturalists should be adequately supported. Nigeria aims at becoming one of the twenty leading economies in the world within a short time. Achieving this objective cannot be guaranteed when there is pervasive poverty and when food expenditure is inadequate. Thus, to break the yoke of underdevelopment in Nigeria the government should ensure that absolute poverty is obliterated and that adequate food expenditure for all and sundry in the country is guaranteed. In addition to the foregoing, other steps such as ensuring that household heads have adequate education, ensuring that households have optimum sizes as well as ensuring adequate rural sector development and development of Northern Nigeria should be taken.

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