IMPACT OF PRICE AND TOTAL EXPENDITURE ON FOOD DEMAND IN SOUTH-WESTERN NIGERIA

Ojogho O*[1] and GO Alufohai[1]

Mercy Ojogho

*Corresponding author email: igomercy@yahoo.com

[1]Department of Agricultural Economics, University of Benin, Edo State, Nigeria.

ABSTRACT

This study examined the impact of price and total expenditure on food demand in Edo, Delta and Lagos states of Nigeria. A multistage sampling technique was used to collect cross-sectional data from eight hundred and twelve (812) households for the study. Both descriptive statistics and the Linear Approximate Almost Ideal Demand System (LA/AIDS) model as inferential statistics were used to estimate the responsiveness of demand for food to changes in prices, expenditures and incomes. The study found out that the majority of the household heads were young male, with small (1-5 members) to medium (6-10 members) family size and lived in urban centers. Though rice constituted the largest share of the household total food expenditure, in both rural and urban centres, income did not have much weight in its consumption, with less substitutability in response to changes in own-price and has changed from being a luxury to being a necessity. While the low-income and rural households spent more of their income on food, the share of rice and yam in the household's budgets was higher at higher income levels while that of cassava, a less expensive source of calories, was lower among the high income and relatively affluent urban households. The budget share of meat and fish, a more expensive source of calories, being mainly protein sources, was higher among the low-income and less affluent households in the urban centres. The result of the LA/AIDS showed that, in terms of own-price elasticity, the compensated own-price elasticity for rice (-1.0659) was the most elastic, followed by *garri* (-0.9655), yam (-0.5792), other cereals (-0.5611), and meat/fish (-0.4440). Rice, *garri* and yam were the main Nigerian staples. The demand for these food items in Nigeria is not so much a matter of price, rather, it is a phenomenon linked with the ease of preparation, household characteristics and urban lifestyles. To meet with the present demand, Nigeria needs to increase the production of these food items.

Key words: food, budget, LA/AIDS, income, elasticities

INTRODUCTION

The structure of the Nigerian Food Consumption has been undergoing dramatic change for some years now. Dietary energy consumption (kcal per *capita* per day) for the periods 1990-1992, 1995-1997 and 2001-2003 was 2540, 2750 and 2700, respectively (using aggregate national production and trade data). Also, there was decrease in dietary protein consumption (gm per *capita* per day) for the period 1995-1997 and 2001-2003. The per *capita* protein intake was 62 in 1995-1997 but dropped to 61 in 2001-2003 [1]. As there are wide disparities between cities of the developing world, so is reference to an "average" Nigerian consumer misleading. The identification of consumer groups having different cultural backgrounds, socio-economic status, lifestyles and, consequently, different consumer behaviours and needs, is preferred. Although general trends in food consumption patterns have been documented, such analysis underscores serious gaps in our knowledge and understanding of which foods are consumed by which consumer groups, in which form, where and why. Consequently, the food demand of the various strata of Nigeria populations deserves more attention than they have been given so far, not only for their implications on food and agriculture planning, but also for determining remedial actions and preventive measures. Food is a basic necessity of life. Its importance at the household level is indicated by the fact that it is a basic means of sustenance [2]. The adequacy of which in quantity and quality is a key requirement for healthy and productive life. Food strategies must not merely be directed at ensuring food security for all but must also achieve the consumption of adequate quantities of safe foods for healthy life [3]. Several studies have explored the food habits of specific regions throughout the world; however, few have focused specifically on South-western Nigeria meal patterns and cooking practices [4, 5, 6]. The handful of published studies include [7] and [8] on Nigeria; [9] on *Cote d'Ivoire*; and [10] on Burkina Faso. The early empirical studies of demand were characterized by the extensive use of single equation methods centered on the measurement of elasticities since they are easily understood and conveniently dimensionless. It is well known that partial measures, commonly used in a single-equation context are not valid for obtaining elasticities among endogenous variables in a system framework because indirect effects are not accounted for by standard partial measures. This partial measure applies to elasticities with respect to exogenous variables but does not apply to structural elasticities. This study, therefore, examined the impact of price, expenditure and income on food demand in Nigeria. The study updates the earlier demand studies on Nigeria as it presents estimates of price, expenditure and income elasticities for 10 different commodities using cross-sectional household data.

METHODOLOGY

The study was carried out in Edo, Delta and Lagos States in the South-western part of Nigeria. The location is specifically chosen for its high population density in Nigeria. According to the 2006 census [11], the three states account for 11.76% (16,330,257) of the total population of the country. Both primary and secondary data were used for the study. The primary data were collected with the use of a structured questionnaire for information on quantity consumed of each food item, income of households, total

expenditure, and cost of quantity of each commodity. Data were also collected on the demographic variables, such as age, education level, household size, and sex, location (rural or urban), age of members, and other socio-economic characteristics of households (consumers). The secondary data were sourced from National Bureau of Statistics (Federal Office of Statistics), Central Bank of Nigeria, World Bank Report and Journals, Research Institute, Universities and Government Parastatals. A multi-stage sampling technique was used to select households within the study area in the three states. The first stage involved a simple random sampling of two (2) Local Government Areas from each state. The second stage involved a simple random sampling of three communities in each Local Government Area (LGA). The sampled communities in the Local Government Areas were Useh, Uselu and Ogida communities in Egor Local Government Area; Uzama, Ugbiyiokho and Adesogbe communities in Oredo LGA of Edo state; Victoria Island, Lekki and Isele-Eko in Lagos Island, LGA and Itire, Lawansi and Igamu in Surulere LGA of Lagos state; and Eku, Abraka, and Isiokolo in Ethiope-East LGA, and Sapele, Amukpe and ugborikoko in Sapele LGA, of Delta state. The third stage involved a simple random sampling of 50 households in each community form each L.G.A, making up a total of 300 households from each state. The study, therefore, used a sample size of nine hundred (900) households. However, only eight hundred and twelve (812) complete questionnaires were retrieved, representing a response rate of 90.2%. Data collected were subjected to both descriptive and inferential statistics. The descriptive statistics used were frequency counts, and percentages, while the inferential statistics employed the multiple regression analysis to estimate the complete demand functions for the selected food commodities using the Linear Approximate Almost Ideal Demand System (LA/AIDS) [12] subject to the two-stage expenditure allocation method, and price and income elasticities were then calculated [13, 14, 15]. The LA/AIDS model has been widely used for demand analysis because of its linearity and flexibility, and because it satisfies the axioms of the demand theory [16]. The model used, in budget share form is given as

$$\omega_i = \alpha_i + \sum_j \gamma_{ij} In P_j + \beta_i In\left(\frac{X}{P}\right) + \varepsilon_i \qquad [1]$$

Where α_i is constant coefficient in the ith share equation or the value of the budget share when price and income both equal zero, ω_i is $\frac{p_i q_i}{X}$ the ith budget share, P_j is price of the jth commodity (by dividing expenditures by corresponding quantities and use them as a direct substitute for market prices [9]), γ_{ij} is price coefficients, or the slope coefficient associated with the jth commodity in the ith share equation, β_i is the expenditure coefficient, ε_i = the error term, X is total expenditure on all commodities given as $\sum_{i=1}^{n} p_i q_i$ in which q_i is the quantity demanded of ith commodity, P is price index defined as

$$\ln p = \sum_{i=1}^{n} \omega_i \ln p_i \qquad [2]$$

where p_i is the price of the ith commodity.

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The Marshallian demand elasticities were then computed using

$$\varepsilon_{ij}^{m} = -\delta_{ij} + \frac{\gamma_{ij}}{\omega_i} - \frac{\beta_i \omega_j}{\omega_i} \qquad [3]$$

$$\varepsilon_{ij}^{H} = -\delta_{ij} + \frac{\gamma_{ij}}{\omega_i} - \frac{\omega_i \omega_j}{\omega_i} \qquad [4]$$

Where δ_{ij} is the Kronecker delta ($\delta_{ij} = 1$ for i=j and $\delta_{ij}=0$ for i≠j) However, using Slutsky equation, the compensation or Hicksian demand price elasticities is derived as follows:

$$\varepsilon_{ij}^{H} = \varepsilon_{ij}^{m} + \omega_j \eta_i \qquad [5]$$

where $_i$ is the expenditure elasticities, computed using:

$$\eta_i = 1 + \frac{\beta_i}{\omega_i} \qquad [6]$$

To estimate the unknown parameters of the budget share equations, this study employed the Iterative Zellner estimation procedure. Berndt and Christensen used this procedure to estimate a version of flexible translog model. This procedure produces maximum likelihood estimate for linear equation system [17].

RESULTS

The summary of the socio-economic characteristics of the respondents are as presented in Table 1. The table shows that 89.2% of the respondent households were headed by males with a large proportion (67.4%) of the respondents from households with married heads. This is also shared by the three states of the study areas with 70.8%, 69.1% and 62.0% for Lagos, Delta and Edo states respectively. Lagos state has the largest number (33%) of respondents with tertiary education level or attending tertiary institutions However, a larger proportion of the respondents have either primary or secondary level of education. Delta state has a larger proportion of female headed households than the other states in the study area. About 63.4% of the total male-headed households are in the urban area while only 36.6% live in the rural area. The table also shows that majority of the respondents are in the medium-and large-size households amounting to 66.3% in the study area.

Summary statistics of household demographic characteristics are presented in Table 2. On average, urban households are of smaller household size (5.13), headed by younger males with high levels of education. Most of these characteristics are shared by high-income households, except the middle-income households with larger family sizes. The rural and low-income groups comprise mainly of households with larger family sizes, lower education level and older household heads.

The small family size and high level of education are shared by households in Lagos with a high proportion of male-headed families but older household heads (54.15years). Delta state households, on the other hand, have low education level of

heads, larger family size and younger household heads that are mainly females (proportion of 0.61), who mainly reside in the rural area. In Edo state, the households are of large size with older household heads and high level of education. On the average, the low-and middle-income groups are rural dwellers, with older household heads dominated by male but a lower education level.

Table 3 presents a summary of the food expenditure shares of the sampled households, including the differences across income groups, and rural and urban areas. Rice constitutes the largest share of the household total food expenditure, accounting for a smaller share for urban (21%) than rural (24%) households, and a smaller share for low income (20%) than high income (28%) households. The budget share of cassava, a less expensive source of calories, is lower among the high income and relatively affluent urban households. The budget share of yams, however, is higher among the high income households. The budget share of meat and fish, a more expensive source of calories, is higher among the low income and less affluent households, and also higher among the urban households. The budget share of plantains is also higher among the high income and urban households while cassava and cassava products follow rice closely having a higher budget share among the low income and urban households. The low income and rural households spent more of their income on food. However, the proportion of income spent on food reduces as income rises. Households located in the rural areas allocate larger shares of the food *naira* to such foods as rice, maize, fruits/vegetables and yam than households located in the urban centres. The case of rice is expected as majority of the households are at the subsistence level needing not just a calorie food but a substitute for the usual energy-giving source, mainly *garri*. This is corroborated by their low expenditure share (0.10%) on meat/fish and beans (0.6%) compared to households in the urban areas.

According to Table 4, most of the uncompensated own price elasticities are negative and less than 1. The uncompensated or Marshallian price elasticities contain both the income and price (substitution) effects. In terms of own-price elasticity, the demand for rice (though inelastic) is close to unity implying that it is more necessary in the Nigerian diet than the other food items. This is also true of *garri*. In absolute terms, the value of elasticity is found to be lowest for fruits/vegetables followed by those for 'other foods', and beans. This implies that the demand for beans, fruits/vegetables and the demand for 'other foods' seem to be the least sensitive to its own price changes while rice has the highest sensitivity to its own price change. Of all the food items, rice is the most expensive per Kg followed by *garri* while fruits/vegetables are the least expensive. As such the results can be regarded as expected since the most expensive item is found to have the highest absolute elasticity.

Uncompensated cross-price elasticities are mostly negative indicating complementary type of food groups. However, a few goods are substitutes. The extent of substitutability is highest between maize and rice (0.0490, using the relationship of maize with the rice price) followed by those between *garri* and rice (-0.0485), and plantain and other cereals. The values of Hicksian own-price and cross-price

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Email: oniango@iconnect.co.ke OR info@ajfand.net   www.ajfand.net

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elasticities as given in the Table 4 are all negative. The compensated own-price elasticity for rice (-1.0659) is the most elastic, followed by the own-price elasticity for *garri* (-0.9655), yam (-0.5792), other cereals (-0.5611), and meat/fish (-0.4440). The elasticity of -1.0659 for rice means that a price increase of 1% will cause a reduction in the demand for rice of 1.0659%. The compensated price elasticity is a better measure of substitutability between two commodities because it measures only the substitution effect, leaving out the income effect. All compensated own-price elasticities are negative and greater than the corresponding uncompensated price elasticities. Based on the uncompensated own-price elasticity estimates, all food categories are price inelastic. However, when only the substitution effects are considered, rice becomes price elastic with the compensated own-price elasticity estimate (-1.0659) of greater than unity. This shows that the demand for rice is more responsive to its own price than cross-prices. This also indicates the less substitutability for rice in response to changes in own-price compared to other food items. Own-price elasticity of rice was most elastic followed by those of *garri* and yam. The estimates of cross-price elasticities, being negative, show no level of substitutability among the food items, but complementarity between beans and rice (-0.5283), bean and yam (-0.4700), plantain and rice (-0.5700), meat/fish and rice (-0.3370), and also between rice and beans (-0.1093), and between rice and yam (-0.1962). Expenditure elasticities are all positive, implying all ten food categories are normal goods. The expenditure elasticities of rice (0.8831), maize (0.6183), other cereals 0.6533), *garri* (0.7950) and fruits/vegetables (0.7800) are necessities while other food items like yam (1.0208), beans (1.1717) and meat/fish (2.579) are luxuries. It should be noted that food group indicated as luxury/necessity good is regarded as luxury/necessity commodity according to total food expenditure and not according to total household expenditures. Thus when food expenditures increases, the expenditure shares of meat, fish, bean and yam will increase while the shares of rice, maize, *garri*, fruits/vegetables and 'other foods' (0.6433) decrease. Because the expenditure elasticity of rice has the highest elasticity in addition to it highest expenditure share among the food items considered as necessity, from the result, the importance of rice in the Nigerian diet will increase as economic growth continues.

DISCUSSION

Socio-economic and demographic characteristics
Nigeria culture and tradition is conservative and families are generally male-headed. The findings of the study shows that a large proportion of the households, mainly in the medium-size and large-size households, has male as the head with either primary or secondary level of education. Also, a large proportion of the respondents are from households with married heads. The Nigerian urban households are of smaller size, headed by younger males with high levels of education and income except the middle-income households with larger family size. However, the rural centres comprise mainly of households with larger family size, low, education level and older household heads.

Food consumption pattern

The low income and rural households spent more of their income on food. However, the proportion of income spent on food reduces as income rises. Households located in the rural areas allocate larger shares of the food *naira* to such foods as rice, maize, fruits/vegetables and yams than households located in the urban centres. Rice constitutes the largest share of the household total food expenditure and this is higher at higher income levels. The budget share of yam and plantain, however, is higher among the high income households while cassava and cassava products follow closely behind rice having a higher budget share among the low income and urban households. The budget share of meat and fish, a more expensive source of calories, is higher among the low income and less affluent households and also higher among the urban households.

Rice and *garri* are more necessary in the Nigerian diet than the other food items. The demand for beans, fruits/vegetables and the demand for 'other foods' is fairly stable with their prices changes while rice responds rapidly to its own uncompensated price change. Also, of all the food items, rice is the most expensive followed by *garri* while fruits/vegetables are the least expensive per Kg. The extent of substitutability is highest between maize and rice followed by those between *garri* and rice, and plantain and other cereals.

Expenditure elasticities are all positive, implying all ten food categories are normal goods. Rice, maize, other cereals, *garri* and fruits/vegetables are necessities while other food items like yam, beans and meat/fish are luxuries. It should be noted that food group indicated as luxury/necessity good is regarded as luxury/necessity commodity according to total food expenditure and not according to total household expenditures. Thus when household total food expenditure increases, the expenditure shares of meats, fish, bean and yam will increase while the shares of rice, maize, *garri*, fruits/vegetables and 'other foods' decrease. Besides having the highest expenditure elasticity among the food items considered as necessity from the result, it is a normal good whose consumption will continue to increase with per capita GDP growth, thus implying its importance in the Nigerian diet as a major food item for food security will increase as economic growth continues.

CONCLUSION

The study was carried out in Edo, Delta and Lagos states in the South-western part of Nigeria. Both descriptive and inferential statistics were used in the analysis. The inferential statistics used the LA/AIDS model to estimate the own- and cross-price, income and expenditure elasticities. The study found out that the Nigerian main staples are rice, *garri* and yam whose demands are greatly affected by price of commodity, and total food expenditures. This implies that a change in these quantities will cause a change in the demand for rice, *garri* and yam. Rice constitutes the largest share of the household total food expenditure, in both rural and urban centres, with less substitutability in response to changes in own-price and has changed from being a luxury to being a necessity and that rice has become a major food staple in the

Nigerian economy. This implies that policies towards increased rice production and productivity will have a greater effect on the availability, affordability and accessibility of rice in the Nigerian economy. The expenditure elasticity of rice has the highest elasticity among the food items considered as necessity, from the result, the importance of rice in the Nigerian diet will increase as economic growth continues.

Table 1: Socio-economic characteristics of respondents

Socio-economic characteristics	Lagos State		Delta State		Edo State		Total
	Freq.	% of Total	Freq.	% of Total	Freq.	% of Total	
Male	242	91	246	86	236	90	724
Female	22	9	39	14	27	10	88
Size of Family							
1-5 (small)	99	35	73	28	102	38	274
6-10 (medium)	121	42	114	43	146	56	381
More than 10 (large	65	23	77	29	15	6	157
Sector of residence							
Rural	111	42	168	59	170	65	321
Urban	153	58	117	41	93	35	491
Age of household head (yrs)							
21-30	10	4	20	7	13	5	43
31-40	55	21	79	28	70	27	204
41-50	77	29	85	30	88	33	250
51-60	68	26	60	21	56	21	184
More than 60	54	20	41	14	36	14	131
Marital status							
Single	60	23	58	20	75	29	193
Married	187	71	197	69	163	62	547
Widowed	12	5	20	7	10	4	42
Separated	5	2	10	4	15	6	30
Education level of household head							
Primary Education	104	39	114	40	108	41	326
Secondary Education	74	28	90	32	89	34	253
Tertiary Education	86	33	81	28	66	25	233
Income group of household head							
Low	92	32	68	26	59	22	219
Middle	120	42	157	59	151	57	428
High	73	26	39	15	53	20	165

Table 2: Household Characteristics by Income Group and Region

Variable	Entire Sample			Income Groups			Region	
	Lagos	Edo	Delta	Low	Middle	High	Rural	Urban
Household size	5.51	5.72	6.73	6.38	7.17	6.52	7.24	5.13
Education of head (yrs)	18	12	5	4.15	5.24	10.17	3.89	9.19
Age of household head (yrs)	54.15	50.12	44.22	54.81	54.97	55.53	53.14	42.19
Proportion of rural households	0.24	0.35	0.73	0.27	0.53	0.20	-	-

Table 3: Average Expenditure share on various foods by Income Group and Region

Variable	Entire Sample	Income Groups			Regions	
		Low	Middle	High	Rural	Urban
Rice	0.29	0.20	0.26	0.28	0.24	0.21
Maize	0.06	0.08	0.02	0.01	0.03	0.01
Other cereals	0.09	0.03	0.04	0.02	0.01	0.03
Cassava (Garri)	0.20	0.26	0.20	0.14	0.23	0.28
Beans	0.06	0.02	0.03	0.01	0.05	0.07
Fruits/Vegetables	0.05	0.04	0.10	0.15	0.08	0.02
Plantain	0.02	0.01	0.05	0.11	0.08	0.17
Meat/Fish	0.10	0.19	0.14	0.10	0.10	0.15
Yam	0.12	0.06	0.07	0.11	0.12	0.05
Other Foods	0.03	0.13	0.08	0.07	0.09	0.05
Total household food Expenditure (₦)	11773.29 ($78.48)	12123.81 ($80.83)	16751.14 ($111.67)	10474.52 ($69.83)	5129.27 ($34.20)	8643.84 ($57.63)
Total household Income (₦)	35678.29 ($237.86)	15952.38 ($106.34)	35640.72 ($237.60)	55129.07 ($367.53)	13151.98 ($87.68)	39290.17 ($261.93)
Food expenditure as % of income	33%	76%	47%	19%	39%	22%

values in parentheses are the Dollar equivalent

Table 4: Estimated Elasticities on Food Consumption Pattern in the Study Area

Parameter	Marshallian/Uncompensated Price Elasticities									
	Rice	Maize	Other cereal	Beans	Yam	Garri	Plantain	Meat/fish	Fruit/veg	Other food
	$i=1$	$i=2$	$i=3$	$i=4$	$i=5$	$i=6$	$i=7$	$i=8$	$i=9$	$i=10$
Rice	0.7420	0.0057	0.0067	0.0423	0.0622	0.0158	0.0170	0.0045	0.0290	0.0063
Maize	0.0490	0.2738	0.0973	0.0054	0.0158	0.0113	0.0007	0.0568	0.0041	0.1052
Other cereals	0.0883	0.0670	0.4399	0.0103	0.0795	0.0316	0.0042	0.0976	0.0616	0.0063
Beans	0.2881	0.0386	0.0621	0.0853	0.3706	0.0577	0.0301	0.1688	0.0303	0.0918
Yam	0.1902	0.0163	0.0972	0.1763	0.4617	0.0208	0.0363	0.0479	0.0202	0.0165
Garri	0.0485	0.0072	0.0015	0.0053	0.0146	0.7245	0.0006	0.0490	0.0233	0.0139
Plantain	0.0100	0.0350	0.0400	0.0100	0.0950	0.2700	0.1050	0.0900	0.0350	0.1350
Meat/fish	0.5050	0.0665	0.1332	0.1857	0.2445	0.4548	0.0336	0.5019	0.1840	0.0884
Fruits/veg	0.1382	0.1668	0.1222	0.0128	0.0196	0.0900	0.0016	0.1880	0.0410	0.0046
Other food	0.0634	0.2120	0.0179	0.0419	0.1239	0.0620	0.1029	0.1010	0.0145	0.0460
Hicksian/Compensated Price Elasticities										
Rice	1.0659	0.0728	0.0938	0.1093	0.1962	0.2076	0.0393	0.1162	0.0848	0.0341
Maize	0.3517	0.3567	0.2217	0.0883	0.0900	0.2650	0.0283	0.1950	0.2000	0.1467
Other cereals	0.3022	0.1478	0.5611	0.0911	0.2411	0.2378	0.0311	0.2322	0.1289	0.0467
Beans	0.5283	0.0883	0.1367	0.1350	0.4900	0.2233	0.0467	0.2517	0.0717	0.1167
Yam	0.4742	0.0750	0.1808	0.2350	0.5792	0.2167	0.0558	0.1458	0.0692	0.0458
Garri	0.3010	0.0795	0.1070	0.0670	0.1300	0.9655	0.0235	0.1695	0.0835	0.0500
Plantain	0.5700	0.0850	0.1400	0.1400	0.3350	0.6700	0.1450	0.1100	0.0650	0.1950
Meat/fish	0.3370	0.1170	0.2090	0.1510	0.1750	0.3390	0.0220	0.4440	0.1550	0.0710
Fruits/veg	0.4920	0.2400	0.2920	0.0860	0.1660	0.3340	0.0260	0.3100	0.1020	0.0320
Other food	0.3300	0.2933	0.1400	0.1233	0.2867	0.2340	0.1300	0.2367	0.0522	0.0867
i	0.8831	0.6183	0.6533	1.1717	1.0208	0.7950	0.0000	2.5790	0.7800	0.6433

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