

## Effect of Quality on the Demand for Rice in Nigeria

P.O.I. Erhabor and O. Ojogho

Department of Agricultural Economics, University of Benin,  
Benin, Edo State, Nigeria

**Abstract:** The study examined the effect of quality on the demand for in South-Western agro-ecological zone of Nigeria. To achieve this, the study examined the socio-economic characteristics of rice-consuming households, the share of rice expenditure in total household expenditure and quantity and the quality elasticities of rice in the study area. Both primary and secondary data were used to generate information for this study. A multi-stage sampling procedure, involving four stages was used to select 812 households. Data collected were analysed, using both descriptive and inferential statistics. The result of the descriptive statistics showed that rice consumption/demand was more in the urban centres than the rural centres of the study area, mostly among the married and the medium-size male-headed households with tertiary-education. Rice constituted the largest share of the household, total food expenditure which is 24% for the high-income and 28% for the low-income households but 21% among the urban households and 24% among the rural households. The result of the multiple regressions showed that rice was quality elastic. Rice demand in Nigeria is affected by the total expenditure of household and quality. Rural households also value quality and respond more than urban households for every 1% increase in their income. Quality is important in the demand for rice, even in the rural areas. Nigeria must improve on the processing, storage, marketing services and safety attributes of rice particularly, the locally produced with a view to improving the quality of rice consumed and cut-down on importation if it is to attain food security in rice. Government, community based organization and non-governmental organizations can help in this direction.

**Key words:** Rice, expenditure share, food expenditure, quantity elasticity, quality elasticity, food security

---

### INTRODUCTION

Food is a basic necessity of 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 (Olayemi, 1998). Rice is not an exception. The largest use of rice of course, is food. It is the world's most important staple food crop consumed by more than half of the world population as represented by >4.8 billion people in 176 countries with >2.89 billion people in Asia, >150.3 million people in America and >40 million people in Africa (FAO, 1996; Bruntrup, 2006; IRRI, 2004; Gulati and Narayanan, 2002). It has been an important food commodity for most people in sub-Saharan Africa particularly West Africa where the consumption of cereals, mainly sorghum and millet has decreased from 61% in the early 1970's to 49% in the early 1990's while that of rice has increased from 15-26% over the same period (Jones, 1995; Rosegrant *et al.*, 2002). According to Ojogho and Alufohai (2009), rice is a sustainable food for Nigeria. In Nigeria, the demand for rice has been increasing since, the mid-1970 (Awe, 2006; Daramola,

2005). During the 1960's, Nigeria had a per capita annual rice consumption of 3 kg which increased to an average of 18 kg during the 1980's, reaching 22 kg in the latter half of the 1990's (FAO, 2002; Akpokodje *et al.*, 2001). Since, the mid-1980's, rice consumption has increased at an average annual rate of 11% with only 3% explained by population growth. Also within the decade of the 1990's, Erenstein *et al.* (2004) reported a 14% annual increase in the demand for rice in Nigeria. Currently, the status of rice in the average Nigerian diet has transformed from luxury food item to a staple food which were previously cassava and yam. Also, it was noted that the poorest 3rd of urban households obtained 33% of their cereal based calories from rice. The average Nigerian now consumes 24.8 kg of rice year<sup>-1</sup>, representing 9% of total caloric intake. This research therefore, examined the effect of quality on the demand for rice in Nigeria. To achieve this, the study examined the socio-economic characteristics of the rice consuming households, the share of rice expenditure in total household expenditure and the quantity and the quality elasticities of rice in the study area.

## MATERIALS AND METHODS

The study was carried out in Edo, Delta and Lagos states in the South-Western agro-ecological zone of Nigeria. Administratively, the three states are divided into 68 blocks (local government areas) with 18 in Edo, 25 in Delta and 25 in Lagos state and each state has three Senatorial districts. The location was specifically chosen for its high rice consumption in Nigeria, the three states being among the states in Nigeria with an average percentage rice share of 8-12% (accounting for about 34% of the total consumption) in food expenditure (IRRI, 2004) and rain-fed upland, rain-fed lowland and mangrove swamp production system. According to the 2006 census (www.nigerianstat.gov.ng), the three states has a population of 16,330,257 representing 11.7% of the nation's population who individually consume about 24.6 kg of rice annually (IRRI, 2004).

In addition, there are high economic activities in the region which are reflected in the living conditions of the people of the region in comparison with those in Northern Nigeria (Adamu, 2003). Besides, agriculture as the predominant occupation of the people in the region, it is a commercial centre with many industries and hotels for a vibrant economy. It is the nation's nerve centre with >2000 industries and 65% of the county's activities are carried out in the region. In this study, the two local government areas chosen were Egor and Oredo in Edo state, Ethiope-East and Sapele in Delta state and Lagos Island and Surulere in Lagos state. The target population for this study was the set of households that consume rice whether the local or the imported rice types in the study area.

Both primary and secondary data were used to generate information for this study. The secondary data were obtained from among other sources, the National Bureau of Statistics (Federal Office of Statistics), Central Bank of Nigeria, World Bank report, Journals, Agricultural Development Programme office (ADP), Research Institute, Universities and Government Parastatals. The primary data were collected with the use of a structured questionnaire for information on quantity consumed of rice, income of households, total food expenditure and cost of rice quantity consumed/purchased. Data were also collected on the demographic variables such as age, education level, household size, sex, location (rural or urban), age of members and other socio-economic characteristics of households.

A multi-stage sampling procedure was used in this study to select households within the study area in the three states and four stages were involved: selection of Senatorial zone, selection of the local government areas, selection of the cells and the selection of households. The

1st stage involved a simple random sampling of one Senatorial district from each state, using the lucky-dip approach. The 2nd stage involved a simple random sampling of two Blocks (L.G.As) from the Senatorial district, using the lucky-dip approach. The 3rd stage involved a simple random sampling of three cells in each block using the lucky-dip approach. As a last stage, a list of the all households in the study area was obtained from the National Population Commission. This list was based on the Enumeration Areas (EA) used for 2006 census purposes. A simple random sampling of 50 rice-consuming households, using the random number table in each cell from the list of the Enumeration Areas (EAs) developed for the 2006, population census by National Population Commission as the sample frame for each block, making up a total of 300 households from each state. The study therefore, used a sample size of 900 households. However, only 812 copies of questionnaire were retrieved from the respondents making a response rate of 90.2%.

Data collected were analysed, using both descriptive and inferential statistics. The study used the Log-Log-Inverse (LLI) form of the Engel equation, on the basis of the Pioneer research of Hicks and Johnson (1968) and Gale and Huang (2007) to estimate the expenditure and quality elasticities for rural and urban areas:

$$\ln q_{ij} = \alpha_i + \beta_i \left( \frac{1}{y_j} \right) + \gamma_i \ln y_j + \mu_{ij} \quad (1)$$

where, the dependent variable  $q_{ij}$  represents the per capita quantity of the  $i$ th food consumed by the  $j$ th household. The independent variable  $y_j$  represents the per capita income of  $j$ th household and  $\mu_{ij}$  is a random disturbance term. The quantity elasticity of the  $i$ th food category,  $\eta_i$  is calculated:

$$\eta_i = \frac{\beta_i}{y_j} + \gamma_i \quad (2)$$

Equation 1 was estimated for rice in both rural and urban areas of the study areas in Nigeria. An expenditure equation was specified in the LLI functional form as:

$$\ln e_{ij} = \alpha_i + \beta_i \left( \frac{1}{y_j} \right) + \gamma_i \ln y_j + \mu_{ij} \quad (3)$$

where, the dependent variable  $e_{ij}$  represents per capita expenditure on the  $i$ th food by the  $j$ th household. The independent variable  $y_j$  represents per capita income of the  $j$ th household and  $\mu_{ij}$  is a random disturbance term.

Equation 1 and 3 were estimated, using OLS regression. Expenditure elasticities were then calculated. The estimated expenditure elasticity was calculated from the estimated coefficients:

$$\varepsilon_i = -\frac{\beta_i^*}{y} + \gamma_i^* \quad (4)$$

Finally, the quality elasticity was estimated as the difference between the estimates of  $\eta_i$  and  $\varepsilon_i$  where,  $\alpha^*$ ,  $\gamma^*$  and  $\beta^*$  are the parameter estimates of the expenditure equation:

$$\theta = \varepsilon - \eta \quad (5)$$

## RESULTS AND DISCUSSION

**Socio-economic characteristics of respondents:** The distribution of households according to the socio-economic characteristics of households is shown in Table 1. The results showed that the area had more of the male-headed households (89.2%) than female-headed households (10.3%) with more male-headed households (93.5%) in the urban centres of the study area. Among the 56.5% of the male-headed households among the urban respondents, 21.8, 20.9 and 20.3% were respectively in the urban centres of Delta, Edo and Lagos states. The implication is that there is possibly a higher consumption

of rice by the male-headed households in urban Delta, Lagos and Edo in particular and the entire sample in general than the rural centres. However, there was higher rice consumption in rural Delta among the female-headed households than in other areas of the study area.

The study area had a younger population who were mainly children and teenagers with a large proportion of them in the urban centres than rural centres. This is supported by the large proportion (79.2%) of children and teenagers with 49.4% (representing 64.1% of the total children and teenagers) of them in the urban centres. This implies that rice consumption in the study area is mainly by children and teenagers. However, youths consumed rice more in urban Edo (16.9%) and Delta (20.1%) while rice consumption was more in urban Lagos (66.8%) and Delta (20.0%) by adults in the study area. In the study generally, rice was a function of the average age of household (family age structure) and decreased with increase in the age of a member.

Rice consumption/demand was mostly among the married (67.4%) and was higher in the urban centre than the rural of the study area. The proportion of widows/widowers was smaller in the rural areas than the urban centres accounting for only 5.2% in the sample. However, the proportion of widow/widower was highest in the urban Delta (31.0%). Rice consumption is likely to

Table 1: Summary statistics of socio-economic characteristics of households

Characteristics	Entire sample							Lagos				Delta				Edo			
	Rural		Urban		Total		Mean	Rural		Urban		Rural		Urban		Rural		Urban	
	Freq.	(%)	Freq.	(%)	Freq.	(%)		Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)
Urbanization	321	39.5	491	60.5	812	100.0	-	105	39.8	159	60.2	117	41.1	168	58.9	99	37.6	164	62.4
<b>Sex</b>																			
Male	265	32.6	459	56.5	724	89.2	-	95	36.0	147	55.7	88	30.9	158	55.4	85	32.3	151	57.4
Female	56	6.9	32	3.9	88	10.8	-	10	3.8	12	4.5	29	10.2	10	3.5	14	5.3	13	4.9
<b>Age group (years)</b>																			
Children	1074	22.0	1914	39.3	2988	61.3	11.2	336	21.2	624	39.4	414	24.2	648	37.9	324	20.7	642	40.7
Teenagers	378	7.8	492	10.1	870	17.9	15.4	138	8.7	156	9.8	120	7.6	174	10.2	120	7.6	162	10.3
Youth	420	8.6	504	10.3	924	18.9	37.8	120	7.8	138	8.7	150	8.8	186	10.9	150	9.5	180	11.4
Adult	54	1.1	36	0.7	90	1.8	51.3	36	2.3	36	2.3	18	1.1	-	-	-	-	-	-
<b>Marital status</b>																			
Single	82	10.1	111	13.7	195	24.0	-	21	8.0	39	14.8	32	11.2	26	9.1	32	12.2	43	16.3
Married	222	27.3	325	40.0	547	67.4	-	80	30.3	107	40.5	76	26.7	121	42.5	66	25.1	97	36.9
Widowed /widower	15	1.8	27	3.3	42	5.2	-	4	1.5	8	3.0	7	2.5	13	4.6	1	0.4	9	3.4
Separated	2	0.2	28	3.4	30	3.7	-	-	-	5	1.9	2	0.7	8	2.8	-	-	15	5.7
<b>Household size</b>																			
Small (1-5)	88	10.8	186	22.9	274	33.7	2.54	32	11.2	67	23.5	24	8.4	75	26.3	32	12.2	44	16.7
Medium (6-10)	133	16.4	249	30.7	382	47.0	7.41	46	17.4	68	25.8	36	12.6	78	27.4	51	19.4	103	39.2
Large (>10)	100	12.3	56	6.9	156	19.2	10.23	27	10.2	24	9.1	57	20.0	15	5.3	16	6.1	17	6.5
<b>Education</b>																			
Primary education	170	20.9	156	19.2	326	40.1	-	61	23.1	43	16.3	70	24.6	44	15.4	39	14.8	69	26.2
Secondary	121	14.9	132	16.3	253	31.2	-	32	12.1	54	20.5	44	15.4	35	12.3	45	17.1	43	16.3
Tertiary education	30	3.7	203	25.0	233	28.7	-	12	4.5	62	23.5	3	1.1	39	31.2	15	5.7	52	19.8
<b>Income group (Naira)</b>																			
Low (<25 000)	119	54.0	100	46.0	219	27.0	-	40	15.2	43	16.3	50	17.5	44	15.4	29	11.0	13	4.9
Middle (25000-50000)	141	33.0	287	67.0	428	53.0	-	53	20.1	74	28.0	42	14.3	78	27.4	46	17.5	135	51.3
High (>50000)	61	37.0	104	63.0	165	20.0	-	12	4.5	42	15.9	25	8.8	46	16.1	24	9.1	16	6.1

increase among widows/widowers in the state in particular and the study area at large if the proportion of this group increases. The mean household size was 3, 8 and 10 for the small, medium and large-household sizes, respectively. However, the sample had a medium-size household range that lived in the urban centres of the study area.

This distribution by household size was also shared by the three states in the study area. It not only implied that rice consumption is mainly among the urban population but that consumption is largely among the medium-size households. However, large-size households also consumed rice but the consumption was largely in rural areas. It means that as household size increased, rice consumption/demand shifted from urban to rural.

The education level distribution of household heads was mainly tertiary education and they lived in the urban centres of the study area. Rice consumption was more prominent among the tertiary-education, household heads and mainly in the urban centres. This increase was more in urban Delta than in the other states. The implication is that increase in urbanization and improvement in education level of a household head increase demand for rice.

Table 1 showed that over half (53%) of the household heads were in the middle income class and were mainly concentrated (67%) in the urban centres of the study area while only 20% of them were high income earners with 63% of this high income earners in the urban centres. The implication is that the number of rice consumers first increased as income increased but decreased as income increased further. This decrease is probably due to the effects of economies of scale since, households will buy rice in bulk as income increases. Also as income increased, consumption shifted from high in rural to high in urban centres of the study area.

**Average income of households, quantity of rice consumed and expenditure share of rice:** Table 2 shows a summary of the income, quantity and expenditure shares of households including differences across income groups and rural and urban areas. The households had a mean monthly income of ₦39678.29 k in the study area and ₦13151.98 k and ₦49290.17 k, respectively in the rural and urban centres of the area. The mean annual quantity of rice consumed was 32.0 kg per capita represented by 36.3 kg in the urban centres and 25.8 kg

in the rural centres of the study area. The quantity consumed was highest in urban Lagos (32.5 kg) followed by urban Delta (29.3 kg) and closely followed by urban Edo (28.4 kg). Among the rural dwellers, rice consumer in rural Delta had the highest per capita (33.1 kg) and least in rural Edo (23.4 kg).

Among the income category, the middle income earners had the highest annual per capita rice consumption (37.5 kg) while the low income earners had the least per capita rice consumption (15.9 kg). This suggests that annual per capita rice consumption increased with increase in income to a certain level of income and then decreased.

The average annual rice consumption in the sample of 812 rice consuming households from the three states can be put at 0.026 million kg and a total of 1.12 million metric ton for the population of 35 million (NPC, 2006) in the South-Western Nigeria. With the population of Nigeria currently put at 148 million people (NPC, 2006), the annual per capita rice consumption is 4.74 million metric ton and will be about 5.42 million metric ton, besides industrial uses by 2015 if the population growth rate of 2.7% is sustained.

The expenditure share of rice increased from 21% in the rural to 24% in the urban with a mean share of 23% in the study area. Rice constituted a larger share of the household total food expenditure which is 24% for the high-income and 28% for low-income households but is 21% among the urban household and 24% among the rural households. Also, the low-income and rural households spent more of their income on food. However, proportion of income on food reduced as income was raised. The share of rice in the household's budgets was higher at lower income levels and decreased at high income levels. This suggests that as income increased, the expenditure share of rice decreased in the study area. Also, expenditure share of rice is higher in the urban centres than the rural centres. The decrease in rice expenditure is probably due to preference for less energy-source food items as income increased, besides the life style in the urban centres.

**Quality on rice consumption:** The results of the estimated equations along with diagnostic statistics (t-ratio and  $R^2$ ) are shown in Table 3. Table 3 shows the estimated

Table 2: Average income and expenditure share of rice

Variables	Entire sample			Lagos		Delta		Edo		Income		
	Rural	Urban	Mean	Rural	Urban	Rural	Urban	Rural	Urban	Low	Middle	High
Expenditure rice share	0.24	0.21	0.23	0.20	0.25	0.21	0.23	0.19	0.22	0.28	0.25	0.24
Household income (₦)	13151.98	49290.17	39678.29	16308.46	47148.20	16945.42	48326.91	15124.78	46951.73	15952.38	35640.72	55129.07
Household food exp (₦)	5129.27	8643.84	16393.84	5707.96	15087.42	5253.08	17397.69	6352.41	17841.65	12123.81	16751.14	10474.52
Percentage income on food exp. (₦)	39	22	33	35	32	31	36	42	38	76	47	19

Table 3: Estimated parameters of the regression for quality elasticity

Variables	Parameters	Entire sample		Rural		Urban	
		Estimates	SE	Estimates	SE	Estimates	SE
Constant	$\alpha$	1.309	1.201	1.210	0.937	1.012	0.512
Reciprocal of income	$\beta$	-16984.549	10.012	-1241.520	13.271	-1014.370	11.321
lny.	$\gamma$	-0.469	0.0135	-0.309	0.137	-0.292	0.457
	$R^2$	0.346	0.578	0.421	-	-	-
Constant	$\alpha^*$	-1.109	0.501	-1.018	0.498	-1.010	0.493
Reciprocal of income	$\beta^*$	$3.105 \times 10^{-8}$	$0.1 \times 10^{-9}$	$2.212 \times 10^{-8}$	$0.3 \times 10^{-9}$	$2.301 \times 10^{-8}$	$0.4 \times 10^{-9}$
lny.	$\gamma^*$	0.956	0.500	0.847	0.702	0.828	0.423
	$R^2$	0.527	-	0.632	-	0.742	-
Expenditure elasticity	$\varepsilon_e$	0.956	-	0.847	-	0.828	-
Quantity elasticity	$\varepsilon_q$	-0.837	-	-0.405	-	-0.317	-
Quality elasticity	$\Theta$	1.793	-	1.252	-	1.145	-

parameters of household income and the household expenditure and quantity, respectively. Table 3 concerns how household quantity of rice changes when there is a change in the income. Table 3 shows how household expenditure of rice changes with changes in income.

The coefficients  $\beta$  and  $\beta^*$ , explained in Eq. 1 and 3 have turned out to be statistically significant suggesting that Log-Log-Inverse (LLI) formulation of the model validate the non-linear behavior of Engel curve for rice consumers in Nigeria. The quantity of rice consumed by household decreased by 46.9% when income increased by 1%. The expenditure on rice decreased by 95.6% as income increased.

The quantity and expenditure at mean value of income were respectively, -0.8374 and 0.956. These imply that there is a less than proportional change in quantity of rice consumed and expenditure on rice, respectively with a change in income. These values (-0.8374 and 0.956) also indicate that rice is a necessity. The quantity elasticity, the difference between the expenditure and quantity elasticities, is 1.793 as shown in the Table 3.

The quality elasticity is thus positive. The positive sign of the quantity elasticity implies that household will purchase rice of higher value when their income increases.

The 1.793 quality elasticity shows that households respond more than proportionate (8% in excess of income change) change in quality when income changes by 10%. However, the quality elasticity for rice was higher among the rural dwellers (1.252) than for urban dwellers (1.145). The implication of this result is that rural households also value quality and respond more than urban households for every 1% increase in their income. Quality is important in the demand for rice, even in the rural areas.

Thus, household will purchase rice of higher value when their income increases. When household income increased, the expenditure shares of rice decreased. Rice is a necessity good rather than a luxury good but quality is important in the demand for rice, even in the rural areas.

## CONCLUSION

Rice demand in Nigeria is quality elastic but quantity and expenditure inelastic. Quality is important in the demand for rice in Nigeria, even in the rural areas. Thus, household will purchase rice of higher value when their expenditure/income increases. Nigeria must improve on the processing, storage, marketing services and safety attributes of rice, particularly the locally produced with a view to improving the quality of rice consumed and cut-down on importation if it is to attain food security in rice. Improved quality implies a high value for domestic rice. This implies an outward shift of the domestic rice demand curve, thus creating an economic surplus for the economy typically shared between producers and consumers depending on the slope of the supply and demand curves. This economic surplus will allow for a structural increase in the market share of domestic rice and could conceivably amount to some income earnings.

## REFERENCES

- Adamu, F.L., 2003. Globalisation and economic localization in Northern Nigeria. A Paper Presented at the Development Studies Associations annual conference on Globalisation and Development, Sept. 9-12, Scotland.
- Akpokodje, G., F. Lancon and O. Erenstein, 2001. Nigeria's rice economy: State of the art. The Nigeria Rice in a Competitive World: Constraints, Opportunities and strategic choices. Final Report Presented to West Africa Rice Development Association (WARDA), Ouake, Cote'Ivoire. pp: 55.
- Awe, O., 2006. Ban on Rice Importation Depresses Global Trade. Punch 3. 20 May 2006.
- Bruntrup, M., 2006. The rice market in Senegal. Agric. Rur. Dev., 13: 1-23.
- Daramola, B., 2005. Government policies and competitiveness of nigerian rice economy. Proceedings of the Workshop on Rice Policy and Food Security in Sub-Saharan Africa, Nov. 7-9, WARDA, Cotonou, Republic of Benin, pp: 1-18.

- Erenstein, O., F. Lancon, O. Osiname and M. Kebbeh, 2004. Operationalizing the strategic framework for rice sector revitalization in Nigeria. The Nigerian rice economy in a competitive world: Constraints, opportunities and strategic choices, Project Report, pp: 38, [http://pdf.usaid.gov/pdf\\_docs/PNADB854.pdf](http://pdf.usaid.gov/pdf_docs/PNADB854.pdf).
- FAO, 1996. African Rice Economic Prospect. Food and Agriculture Organization, Rome.
- FAO, 2002. African Development Indicator. Food and Agriculture Organization, Rome.
- Gale, F. and K. Huang, 2007. Demand for food quantity and quality in China. US Department of Agriculture, Economic Research Service, ERR Report.
- Gulati, A. and S. Narayanan, 2002. Rice Trade Liberalization and Poverty. MSSD Discussion Paper, No. 51. <http://ideas.repec.org/p/fpr/mssddp/51.html>.
- Hicks, W.W. and S.R. Johnson, 1968. Quantity and quality components for income elasticities of demand for food. *Am. J. Agric. Econ.*, 50: 1512-1517.
- IRRI, 2004. World Rice Statistics. International Rice Research Institute, Manila, Philippines.
- Jones, M.P., 1995. The Rice Plant and its Environment. West African Rice Development Association, Cote d'Ivoire.
- NPC, 2006. Post Enumeration Survey. National Population Commission, Abuja, Nigeria.
- Ojogho, O. and G.O. Alufohai, 2009. Rice consumption pattern in Nigeria: A road to sustainable food consumption. Proceedings of International Conference on Research and Development, November 24-27, Universite Nationale Du Benin, Cotonou, Republic of Benin.
- Olayemi, J.K., 1998. Food security in Nigeria. Research Report Prepared for the Development Policy Centre, Ibadan, Nigeria, pp: 1-86.
- Rosegrant, M.W., X. Cai, S. Cline and N. Nakagawa, 2002. The role of rainfed agriculture in the future of global food production. Environment and Production Technology Division, International Food Policy Research Institute, Washington, DC. 20006 USA. <http://www.ifpri.org/divs/eptd/dp/papers/eptdp90.pdf>.