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Multinomial logistic regression in examining factors driving consumer preference for locally produced rice in Nigeria

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This study applied a multinomial logistic regression in examining factors driving consumer preference for locally produced rice in Nigeria. The data for the study were collected in Niger and Ekiti states in 2008 under the post harvest study programme of Africa Rice (EX-WARDA). Results of the various analyses underscored the significance of socio-economic factors as major drivers of consumer preference for local rice in Nigeria. Five of the coefficients of the explanatory variables (age, marital status, education of household head, primary activity of household head and sex of household head) significantly influence the consumer preference for Pategi relative to Aroso (imported rice). Similarly, five variables (age of household head, educational status of household head, and sex of household head) influence significantly, consumer preference for Igbemo relative to Aroso. Aside socio-economic variables, other factors found to have influence on consumer preference are frequency of purchase and price. In spite of the various types of local rice available in the markets, majority of consumers can identify different types based on their physic-chemical characteristics. Nevertheless, the two most highly rated criteria for selection of rice bought in the market are whiteness and absence of foreign materials. Further analysis also confirmed that about 82% of Nigerian eats rice at least once in a day. The significance of the socio-economic variables is an indication that policies and programmes for the development of the Nigerian rice sector should, in addition to enhancing the physico-chemical characteristics of rice, include value reorientation and sensitization of the people on the nutritional qualities of local rice.

Key words: Factors influencing, socio-economic, local rice, Nigeria.

INTRODUCTION

There are quite a range of diverse socio-cultural factors underlining the consumption pattern and consumer preference for rice in Nigeria. These factors, however, vary across the various geo-political zones in the country. Aside, the significance of physical and organoleptic characteristics of rice can also not be under-emphasized in this respect as they often determine different types of menu that can be prepared from rice . Thus, several dishes are known to be prepared from different types of local rice in Nigeria. The consumption and utilization of various types of local rice also vary across the country depending on the divers' traditional food consumption patterns in the country. Different local dishes prepared from rice also have different type of rice suitable for its preparation. Probably for the choice of taste, colour and stickiness after cooking some consumers prefer certain

Table 1. Study areas and number of samples.

State	No of LGA	No of community per LGA	No of sample per community	No of samples per state
Ekiti	2	2	50	200
Niger	2	2	50	200
Total	4	8	200	40

type of local rice for a particular dish. However, information as regards what informed consumer choice of a particular type of local rice is still lacking. Aside, information of the effects of various factors that are likely to influence the choice of local rice selected by consumers is also not available. Yet, such information is necessary not only for the purpose of rice quality improvement but also for strategic planning of rice sector in Nigeria. Different physico-chemical characteristics of rice are usually considered by rice consumers when making their choice of different types of rice bought in the market. This study, therefore, investigates the criteria that are normally considered when making the decision of the type of rice to be purchased in the market.

METHODOLOGY

Data collection

The underlying data used for this study was derived from a survey carried out as part of the post harvest study conducted under the programme of increasing the quality and competitiveness of locally produced rice in sub-Saharan Africa through the use of New Rice for Africa (NERICA) and the promotion of improved post-harvest technologies sponsored by the **Africa Rice (EX-WARDA).** This study adopted a systematic random sampling technique for the selection of the representative samples from two states in Nigeria (Ekiti and Niger states) bearing in mind the divers' socio-cultural and traditional food consumption patterns in the country and also ensure geographical representation of the samples. Ekiti is situated in the Southern part of the country while Niger state is located in the Northern part. The traditional consumption patterns across the country is such that the Northern states are mainly cereal based while the Southern states are mainly tuber based though rice consumption across the country is fast increasing. Thus, from each state, two rice producing Local Government Areas (LGAs) were purposively selected. From each LGA, one urban and one rural community were chosen. From each community, representative samples of 50 rice consumers were selected using systematic random sampling approach. Thus, at least 100 samples were drawn from each LGA making a total of 200 respondents per state as shown in Table1.

ANALYTICAL TECHNIQUE AND MODEL SPECIFICATION

Model specification and estimation procedure

Estimating multinomial logistic regression requires that one category of the dependent variables is chosen as the comparison category. Separate relative risk ratios are determined for all independent variables for each category of the independent variable with the exception of the comparison category of the dependent variable, which is omitted from the analysis. Hosmer and Stanley,

2000; Hilbe, 2009). In this case, 'Aroso' which is a brand of imported rice was chosen as the base category and all other type of the local rice are compared with the base outcome. The empirical form of the multinomial logic model is given below.

Model

$$\Pr(y_i = j) = \frac{\exp(X_i \beta_j)}{1 + \sum_{j=1}^{J} \exp(X_i \beta_j)} \quad \text{1 and}$$

$$\Pr(y_i = 0) = \frac{1}{1 + \sum_{j=1}^{J} \exp(X_i \beta_j)}, \qquad 2$$

Where the ith is individual, y_i is the observed outcome (different types of local rice) and X_i is a vector of explanatory variables. The unknown parameters β_j was typically estimated by maximum likelihood using STATA package. The explanatory variables used in this study included; income, price, physico-chemical characteristics of rice, frequency of consumption, sex, age, level of education, marital status, primary activity, and length of residency in the community among others.

Marginal effects (MEs)

For an unordered multinomial model, there is no single conditional mean of the dependent variable, y. Instead there are m alternatives, and the probabilities of these alternatives can be modelled (Cameron and Trivedi, 2009). Interest lies in how these probabilities change as regressors change. For the multinomial logit model, the MEs can be shown to be:

$$\frac{p_{ij}}{x_i} \quad p_{ij} (\quad \overline{_{ji}} \quad) \qquad 3$$

Where $\quad l \quad _{ill}$ is the probability weighted average of the p
l. The marginal effects vary with the point of evaluation, x_i because P_{ij} varies with x_i. The signs of the regression coefficients do not give signs of the MEs. For a variable x, the ME is positive if $\overline{_{ij}} \quad _i$.

RESULTS AND DISCUSSIONS

Socio-economic characteristics of rice consumers in Nigeria

Sex of respondents: The sex of the head of the house

hold, play a significant role not only in the quantity of food consumed by the household but also in the type and quality and form in which such food is consumed. A female- headed household is likely to be more conscious of the quality and the combination of different variety of food consumed by the household than male-headed household. There is a significant variation between the North and the South as indicated by the data from Niger and Ekiti states. While virtually all the sampled household in Niger state are male-headed (99.0%), a significant proportion of sampled households from Ekiti state are female-headed (30.2%).

Age of respondents: The average age of rice consumers as shown by the analysis of samples from the two states in Nigeria ranges from 49 years in Ekiti state to 43 years in Niger state with a national average of 46 years. In both cases, however, the average age of respondents falls within the actively working population. While younger children will prefer food with high protein nutrients for growth, those in the active working age may prefer calorie supplied food such as carbohydrates. The old age group on the hands may just require a maintenance ration.

Marital status of respondents: Marital status plays a major role in the household feeding patterns. A single or unmarried individual may or may not have any feeding pattern as he or she can choose to eat away from home and the choice of food may be dictated by whatever is available at the eating point. A married person cultivates the habit of eating at home as a way of socializing with the family members. This will definitely affect the type and quantity of food consumed by the household. Analy-sis of data shows that over 90% of the representative samples of rice consumers from the two states are married. About 8% of representative samples from Ekiti state are single while insignificant proportion of 1.5% are widows or widowers.

Year of residence of respondents: It is possible for consumption patterns to change over time with year of residence of individual in a particular community. Even though individuals will have preference for their traditional foods, taste and preference change with location over time. Thus, a northern resident of southern origin in Nigeria may change his or her consumption pattern from tuber-based to cereal-based having stay for some time in the north. In this study, it was found that the average residency period of respondents was about 33 years which is long enough for them to have imbibed the food consumption tradition of their respective communities.

Level of education of respondents: The level of education of household head has serious implication for the type and quality of food consumed by the households. A highly educated household head will prefer a small

quantity of variety of foods with different nutritional contents (balance diet) to a bigger quantity of low nutritional components. The survey revealed that a significant proportion (36%) of the respondents in Niger state had no education compared to (1%) for Ekiti state. A sizeable proportion of the respondents, however, had secondary and post secondary education while about one-third of the respondents had primary education.

Primary activity of respondents: People in wage employment do mix and interact with people in the public almost on daily basis, the tendency to acquire knowledge of various kinds of food and nutrition is high. In most cases, such knowledge influences their food consumption pattern. Available evidence from this study showed that majority of the respondents (about 84%) from Niger state are farmers as against 16% recorded for Ekiti state. A significant proportion of the respondents in Ekiti state are traders (37%) and government workers (17%). For those who engage in non-farm as their primary activities, are close to 40% of them also took up farming to augment their income and household food consumption. A detail of socio-economic characteristics of respondents is pre-sented in Table 2.

Identification of different types of rice by the consumers

One of the major objectives of this study is to find out the ability of rice consumers to identify different types of rice in the market based on some of their physico-chemical characteristics. Ability of consumers to identify a particular type of rice will depend on whether such consumer have eaten that type at least in the last 12 months, frequency of consuming that particular type and the source of such rice. This study investigated these criteria and some other related ones and the result of the analysis is pre-sented in Table 3. From Table 3, virtually all the respon-dents (99.5%) can identify the different rice types they consumed as they have all eaten them in the last 12 months. In terms of frequency of consuming this rice type the table shows that about 82% of the respondents consume them on daily basis while another 14% even consume them about twice in a day. There was no signi-ficant variation in responses among respondents from both states. The sources of the various types of rice consumed by the respondents, however, presented a different picture. While, all the respondents from Niger state claimed they produce the type of rice they eat, virtually all respondents from Ekiti state buy from the market. In terms of the internal market dynamics for local rice in country, Niger can be classified as one of the net rice producing states while Ekiti is usually considered as one of the net rice consuming states. This is a true reflection of the marketing channel for local rice in Nigeria as most of the local rice consumed in the south is brought

Table 2. Summary of socio-economic characteristics of rice consumers.

Socio-Economic Variables	Ekiti	Niger	Average
Sex of respondents (%)			
Male	69.8	99.0	84.4
Female	30.2	1.0	15.6
Age (mean) years	49	43	46
Marital status			
Married	90.9	99.5	95.2
Single	7.6	0.5	4.0
Widow/Widower	1.5	0.0	0. 8
Year of residence in the community (mean)	33	32	32.5
Level of Education			
Primary	39.9	23.6	31.7
Junior secondary	7.1	2.0	4.5
Senior secondary	30.3	12.6	21.5
Post secondary	10.1	9.5	8.8
No Education	1.0	35.7	18.3
Can read and write	7.1	5.5	6.3
	4.5	11.1	7.8
Primary activity of respondents			
Agriculture	16.1	83.7	48.9
farm manager	7.8	0.5	4.1
trade	37.3	0.0	18.6
artisan	4.7	3.6	4.1
government workers	16.6	9.7	13.1
nothing	5.2	0.0	2.6
student	6.7	2.6	4.6
others	5.7	0.0	2.8

Source: Field Survey, 2008

from the north even though some of the states in the south also produce rice in appreciable quantities.

Criteria for selection of rice bought by respondents

Different rice physico-chemical characteristics have been chosen by rice consumers as a way of identifying and recognizing different types of rice bought in the market. This study investigated the criteria that are normally considered when making the decision of the type of rice bought in the market. The distribution of respondents by first criterion for selection of rice bought in the market is presented in Table 4. Two of these criteria rated high in both states. While almost half of the respondents in Ekiti state indicated absence of foreign matter as their first criteria, 48% of respondents in Niger state rated whiteness as their first criteria. Above all, these two criteria have to do with the physical appearance (pre-cooking properties) of the commodity. Surprisingly, price

is one of the list criteria usually considered in the selection of local rice bought by the consumers. The reason why price was not rated high among the criteria may be due to the fact that there is usually no significant difference in prices of the various types of local rice sold in the market. The above criteria were applied to the selection of different types of rice consumed in both states and the result is presented in Table 5 for Ekiti state and Table 6 for Niger state. For the consumers of Aroso, the most significant criterion for selection is absence of foreign matter. The consumers of Pategi and Igbemo, however, considered their taste as the most important criterion for selection. It should be noted that Aroso is imported rice while pategi and Igbemo are local rice in Ekiti state. Thus, it is obvious that the most important discriminating factor between imported and local rice is the absence of foreign matter as consumers of local rice found a better taste in the its consumption. Similar result is observed in Niger state where, those who consumed Manbechi, Lalangba, Malelisa, Bisilayi and Nnagbati considered taste as the most important criterion for selection and those who consumed Ebangichi and Dokochi considered ease of cooking and whiteness as the most important criteria respectively. Thus, in terms of the physical characteristics of local rice in Nigeria, absence of foreign matter and whiteness were generally consi-dered as most important criteria for selection by the consumers while for the chemical characteristics, taste and ease of cooking were considered as most important criteria.

Income distribution and type of rice consumed

Income dictates to a large extent the consumers' choice of goods. A rational consumer will make a right choice of superior and high quality goods as income increases. Similarly, there is a high tendency that rice consumers in Nigeria are likely to consume more of high quality imported rice as their income increases. In this study, therefore, efforts were made to investigate the type of rice consumed by consumers in various income classes and the result is as shown in Table 7. The classification of income into three groups is to reflect the three socio-economic classes in the country. The minimum wage in Nigeria is currently at N18, 000 per month and anybody below or within this income bracket is usually regarded as belonging to the low income class. The middle income class earns between N12, 000 and N50, 000 per month while anybody earning more than N50, 000 per month in Nigeria is classified as belonging to the high income group. This classification was applied to the data and the result showed that majority of the consumers of imported rice falls within the middle and the high income class. This is represented by 60.2% of the respondents. Inte-restingly too, a little above one-fifth of the respondents who fell within the low income class also consume impor-

Table 3. Identification of different types of local rice consumed (% of Respondents).

Variables	Ekiti	Niger	Average
Can identify rice type?	99.0	100.0	99.5
Eaten rice in the last 12 months	99.0	100.0	95.5
Frequency of consumption			
One in a day	82.9	81.4	82.2
Twice in a day	9.0	18.1	13.6
Three times in a day	8.0	0.5	4.2
Source of Rice			
Self produce	0.0	98.0	49.0
Bought	100.0	1.5	50.7
Combination	0.0	0.5	0.3

Source: Field Survey, 2008

Table 4. First criteria for selection of rice bought (% of Respondents).

Criteria	Ekiti Frequency	Valid Percent	Niger Frequency	Valid percent	Average
Absence of Foreign Matter	97	**49.7**	26	13.4	31.6
Whiteness	45	23.1	93	**47.9**	**35.5**
Rate of Breakage	1	.5	3	1.5	1.0
Shape of Grain	1	.5	10	5.2	2.7
Ease of Cooking	5	2.6	20	10.3	6.5
Stickiness After Cooking	1	.5	1	.5	0.5
Taste	42	21.5	4	2.1	11.8
Good Aroma	2	1.0	31	16.0	8.5
Price	1	.5	6	3.1	1.8
Total	195	100.0	194	100.0	100.0

Source: Field Survey, 2008

ted rice. This group probably might receive such rice as gift or are simply attempting to keep on with the joneses.

Distinguishing between imported and local rice in Nigeria

Notwithstanding, the superiority of imported rice to local rice in terms of quality, some rice consumers in Nigeria still found it difficult to differentiate between the two brands of the commodity. This may be particularly so considering the fact that the quality of some locally produced rice when properly processed using modern processing equipments, not only match that of the imported ones but in some cases, is actually better than imported rice. Quite a significant level of progress have been made by some large scale rice processors in Abaliki, Minna ,Ebonyi and Niger states respectively such that the quality of locally produced rice coming out of

these mills can actually compete with those of the imported rice in the country. Figure 1 represents the ability of respondents to distinguish between local and imported rice. On the average, 88% of the respondents can distinguish between the two brands of the commodity while about 12% found it difficult to do that. Those respondents who could not distinguish between local and imported rice were found mainly in Niger state.

Determinants of consumer preference for local rice in Nigeria

In this study, the determinant of consumer preference for rice in Nigeria is modelled around the socio-economic variables of local rice consumers, household income, prices of local rice and the physico- chemical characteristics of rice. In estimating the model using multinomial logit, Aroso, which is the only imported rice among all the rice samples, was set as the natural base category and

Table 5. Type of rice consumed by criteria for selection in Ekiti.

First Criteria for Selection	Name of rice Consumed in Locality		
	Aroso	Pategi	Igbemo
Absence of Foreign Matter	**73.11**	0.0	6.7
Whiteness	5.4	0.0	0.0
Rate of Breakage	1.1	0.0	0.0
Shape of Grain	1.1	0.0	0.0
Ease of Cooking	3.3	0.0	6.7
Stickness After Cooking	1.1	0.0	0.0
Taste	15.1	**88.9**	**80.0**
Good Aroma	0.0	11.1	6.7
Total	100.0	100.0	100.0

Source: Field Survey, 2008

Table 6. Type of rice consumed by criteria for selection in Niger.

Name of rice	First Criteria for Selection of Rice if Bought								Total
	Absence of Foreign Matter	Whiteness	Shape of Grain	Ease of Cooking	Non Stickiness of Grain After Cooking	Taste	Rising Capacity	Price	Absence of Foreign Matter
manbechi	6.7	6.7	6.7	20.0	0.0	**46.9**	6.7	6.7	100.0
ebangichi	0.0	9.1	9.1	**45.5**	0.0	36.4	0.0	0.0	100.0
lalangba	0.0	22.2	11.1	0.0	11.1	**44.4**	11.1	0.0	100.0
malelisa	22.2	11.1	0.0	0.0	11.1	**55.5**	0.0	0.0	100.0
Bisilayi	18.2	9.1	0.0	**27.3**	9.1	**27.3**	9.1	0.0	100.0
Nnagbanti	6.7	20.0	6.7	13.4	13.4	**40.0**	0.0	0.0	100.0
dokochi	0.0	**50.0**	0.0	25.0	0.0	25.0	0.0	0.0	100.0

Source: Field Survey, 2008

Table 7. Income distribution by types of rice utilize for dishes.

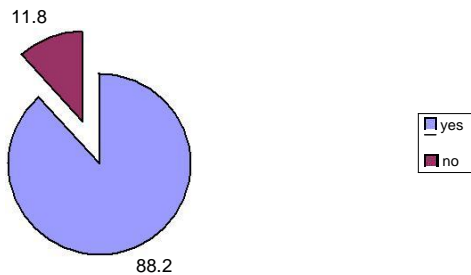| Income class/month	Local		Imported	
	Frequency	Valid percent	Frequency	Valid percent
<= N18, 000	2	1.1	42	22.6
>N18, 000<=N50,000	30	16.1	101	**54.3**
> N50,000	0	0.0	11	5.9
Total	32	17.2	154	82.8

Source: Field Survey, 2008

Figure 1. Ability to distinguish between local and imported rice.

the result of the analysis is presented in Table 8. This result is, therefore, interpreted in relation to imported rice (Aroso). For this reason, only the data from Ekiti state was utilize for this analysis since all the respondents from Niger claimed they only consumed local rice. The model shows some modest level of fitness with a Pseudo R-square of 42%. This, however, is an indication that there are still others variables beyond those included in this model that further explain the consumer preference for local rice in the country. Nonetheless, the regressors are jointly statistically significant at the 0.05 level, because the LR chi2(20) = 86.35. Two set of regression estimates are given having used the normalization $_1 = 0$. Five of

Table 8. Multinomial logistic regression for local rice preference in Nigeria.

Rice type	Coef	Std. Err.	Z	P>|z|
Pategi				
Income	2.18e-06	0.0000308	0.07	0.944
Age	0.1501559*	0.0547444	2.74	0.006
Marital	-16.52089*	3.669827	-4.50	0.000
Howlong	-0.037004	0.0228061	-1.62	0.105
Eduate	-0.661697	0.286929	-2.31	0.021
Primactiv	0.620210*	0 .2075199	2.99	0.003
Freg	c	0.7489914	-1.43	0.154
Price	0.0078617	0.0053935	-1.46	0.145
Firstecr	0.208088**	0.1067368	1.95	0.051
Sex	0.23546*	9022692	3.59	0.000
Cons	4.608975	-	-	-
Igbemo				
Income	0.0000541	0.0000384	1.41	0.159
Age	0.1448862*	0.0685851	2.11	0.035
Marital	0.5153597	0.8481717	0.61	0.543
Howlong	-0.0378402	0.026376	-1.43	0.151
Educate	-2.009622*	0.7973646	-2.52	0.012
Primactiv	0.3057458	0 .2222881	1.38	0.169
Frg	19.122910	3.744939	-5.11	0.008
Price	-0.017928*	0.006781	-2.64	0.008
Firstcr	0.2132729**	0.1137525	1.87	0.061
Sex	1 .974674*	1.000667	1.97	0.048
Cons	11.75444	-	-	-

(Rice type==Aroso is the base outcome) * Significant @ 5% ** @ *10 per cent*

Number of obs = 176
LR chi2(20) = 86.35
Prob > chi2 = 0.0000
Log likelihood = -60.091757
Pseudo R2 = 0.4181
* Wald Test of the Joint Significance of Regressors
Chi2(20) = 1507.15 Prob > chi2 = 0.0000

Table 9. Marginal effects of the regressors.

Variable	dy/dx	Std. Err.	Z	P>z
Income	0.84e-10	0.00000	0.50	0.614
Age	4.90e-07	0.00000	0.50	0.615
Marital	2.10e-06	0.00001	0.38	0.705
Howlong	-1.28e-07	0.00000	-0.45	0.653
educat	-6.83e-06	0.00001	-0.48	0.628
primac	1.03e-06	0.00000	0.47	0.641
freq	-0.0000651	0.00014	-0.46	0.642
price	-6.09e-08	0.00000	-0.45	0.651
firstc	7.22e-07	0.00000	0.45	0.655
sex	6.66e-06	0.00001	0.50	0.619

effect of a unit change in these factors on consumer preference for local rice in Nigeria is very negligible.

CONCLUSION

This study greatly underscored the significant influence of socio-economic characteristics of rice consumers on their preference for local rice in Nigeria. More importantly, the significance of the socio-economic variables is an indication that policies and programmes for the development of the Nigerian rice sector should, in addition to enhancing the physico-chemical characteristics of rice, include value reorientation and sensitization of the people on the nutritional qualities of local rice. This is very important in order to encourage consumers to further develop good taste in local rice. It is obvious from this study that cleanliness of local rice is one major way of promoting local rice consumption as such; more attention will be required right from the harvesting stage to the milling stage. Between these two stages, the two major criteria (absence of foreign matter and whiteness or colour) can be successfully handled.

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the coefficients of the explanatory variables (age, marital status, education of household head, primary activity of household head and sex of household head) significantly influence the consumer preference for Pategi relative to Aroso (imported rice). Similarly, five variables (age of household head, educational status of household head, frequency of purchase, price and sex of household head) influence significantly, consumer preference for Igbemo relative to Aroso. Since the result of individual test of variable will vary with the omitted category (Aroso) a joint test of significance of the explanatory variables (Wald Test) was carried out. The result of the Wald test further shows that the significant variables are also jointly significant and have strong implication for consumer preference for local rice in Nigeria. Meanwhile the marginal effects of the regressors presented in Table 9 showed that the