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# CONSUMERS POTENTIAL DEMAND ANALYSIS FOR LOCAL RICE CONSUMPTION IN SOUTH- WEST, NIGERIA

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## ABSTRACT

*The study assessed consumers' demand for local rice in Nigeria. The study specifically described the socioeconomic characteristics of rice consuming households in the study area; assess attributes perception of respondents on local rice consumption in the study area. Data were collected from 150 rural household heads using well-structured questionnaire based on the specific objectives of the study. Data collected were analyzed using descriptive statistics, Tobit regression model, Double Bound Contingent Valuation Method. The double bound logit model estimation of the potential demand for local rice revealed that the potential demands was N559.92. This falls below the price of foreign rice, the substitute for local rice in the study area showing a weak potential demand. The double bound logit model used to test for the determinants of the potential demand among local rice consumers in the study area showed that grain ease of preparation, grain quality and quantity of local rice consumed, positively influenced potential demand for local rice in the study area, while household size, household income, year of formal education and bid amount significantly affect the potential demand for local rice but in a negative direction. The double bound logit model used to test for the determinants of the potential demand*

among local rice consumers in the study area is statistically significant at 5% level of significance as indicated by the log like-hood test of significance (Wald  $\chi^2(16) = 29.80$ ) and  $Prob > \chi^2 = 0.019$ .

**Keywords:** Demand Analysis for Local Rice.

**Cite this Article:** Ajiboye Babatunde, Aminu Tobi, Adeyonu Abigail and Afolabi Jimoh, Consumers Potential Demand Analysis for Local Rice Consumption in South-West, Nigeria, *International Journal of Mechanical Engineering and Technology*, 10(2), 2019, pp. 837-846.

<http://www.iaeme.com/IJMET/issues.asp?JType=IJMET&VType=10&IType=2>

## 1. INTRODUCTION

Among the commodities imported in Nigeria, food stands highest owing to the burgeon in Nigeria's population as well as increasing effective demand on food with an estimate of \$22 billion yearly (Punch, September 12, 2016). Rice importation, a major contributor to the hike in commodities importation is considered a waste of foreign exchange based on the comparative advantage the country has in rice production. The importation of rice in Nigeria had been estimated to stand at ₦356 billion naira annually with an average of ₦1 billion worth daily consumption, and as such ranking highest among the food commodities imported after wheat at ₦637 billion in 2010 (Akinwumi, 2012). The high demand for imported rice in the country purportedly stems from the average Nigerian consumer's desire for white polished rice unlike most African countries like Ghana where there is a preference for brown rice which is cheaper in cost than polished rice and richer in nutrients (Aondoakaa, 2013).

In order to reduce the rate of rice importation, Saka and Lawal (2009) were of the opinion that disseminating improved varieties and other modern inputs as a composite package to rice farmers is very important. Nwite, Igwe and Wakatsuki (2008) indicated that the adoption of technologies and improved management practices should lead to substantial yield increase in rice production.

**Table 1** Major features of Nigerian Rice Production System

| Production System   | Major States Covered   | Estimated share of national rice area | Average yield (Ton/ha) | Share of rice production |
|---------------------|--|---------------------------------------|------------------------|--------------------------|
| Rainfed Upland      | Ogun, Ondo, Abia, Imo, Osun, Ekiti, Oyo, Edo, Delta, Niger, Kwara, Kogi, Sokoto, Kebbi, Kaduna, FCT and Benue States.  | 30%                                   | 1.9                    | 28                       |
| Rainfed Lowland     | Adamawa, Ondo, Ebonyi, Ekiti, Delta, Edo, Rivers, Bayelsa, Cross River, Akwa Ibom, Lagos, all major river valleys, e.g shallow swamps of Niger Basin, Kaduna Basin, and inland of Abakaliki and Ogoja areas. | 52%                                   | 2.2                    | 43                       |
| Irrigated           | Adamawa, Niger, Sokoto, Kebbi, Borno, Benue, Kogi, Adamawa, Enugu, Ebonyi, Cross River, Kano, Lagos, Kwara, Akwa Ibom, Ogun State  | 16%                                   | 3.7                    | 29                       |
| Deep Water Floating | Flooded areas: Rima Valley in Kebbi State and deep flooded areas of Delta State  | 53                                    | 1.3                    | 2.5                      |
| Mangrove Swamp      | Ondo, Delta, Edo, Rivers, Bayelsa, Cross River, Akwa Ibom, Lagos   | 1%                                    | 2.0                    | 1                        |

Source: Ezedinma, (2008); Oikeh *et. al.*, (2008)

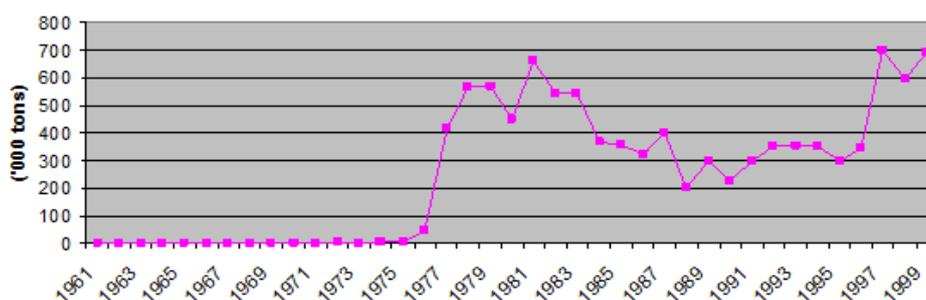
**Table 2** Comparison between Nigeria and the Rest of West Africa in Rice Production and Importation (1961 – 1999)

| Indicators                         | Means<br>1961 – 75 | Means<br>1976 – 83 | Means<br>1984 – 95 | Means<br>1996 – 99 |
|------------------------------------|--------------------|--------------------|--------------------|--------------------|
| <b>Nigeria</b>                     |                    |                    |                    |                    |
| Production (tonnes)                | 332,800            | 806,222            | 2,306,794          | 3,189,833          |
| Import (tonnes)                    | 2,036              | 420,756            | 334,974            | 525,307            |
| Self-reliance ratio                | 99%                | 54%                | 77%                | 79%                |
| Total Consumption (kg)             | 178,199            | 833,640            | 1,599,609          | 2,248,113          |
| Per capita consumption (kg)        | 3                  | 12                 | 18                 | 22                 |
| <b>West Africa without Nigeria</b> |                    |                    |                    |                    |
| Production                         | 1,779,376          | 2,344,073          | 2,822,635          | 4,041,384          |
| Import                             | 416,183            | 894,073            | 1,760,884          | 2,107,146          |
| Self-reliance ratio                | 65%                | 56%                | 42%                | 50%                |
| Total Consumption                  | 1,178,753          | 1,950,821          | 2,973,885          | 3,985,721          |
| Per capita consumption             | 21                 | 27                 | 30                 | 34                 |

Source: Akande, (2002); Okorowa and Ogundele, 2005; Bamidele, Abayomi and Esther, (2010)

Although rice production in Nigeria has boomed over the years, there has been a considerable lag between production and demand levels, with imports making up the shortfall. The quantity of rice imports in recent time soared from 300,000 Mt in 1995 to 794,000 Mt in 2000 at a cost of US\$ 300 million (Akpokodje *et. al.*, 2003). In order to meet the increasing demand, Nigeria has had to resort to importation of milled rice to bridge the gap between domestic demand and supply. Figure 1 gives an indication of rice importation by Nigeria.

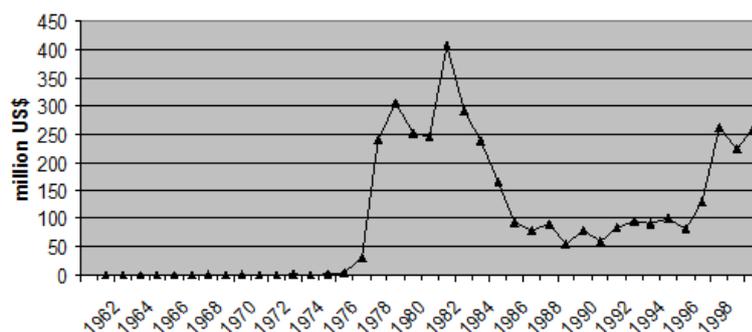
Phenomenal rise in imports had been recorded since the mid-1970s. However, rice imports began to decline in 1981 as a result of measures put in place to check the importation of the commodity. Even then, the quantity imported on an annual basis was over 300 thousand tons. Nonetheless, imports dropped significantly from 1985 when an embargo was instituted.



**Figure 1** Quantity of Nigeria's Rice Imports in Metric tons between 1961-1999

Source: Computed from FAOSTAT

Nigeria's rice import is paid for in foreign currency. Given the precarious balance of payment position of the country especially in the late 1980s, rice import became a major source of concern. Figure 2. Shows that whereas Nigeria spent about \$0.1 million on rice importation in 1970, by 1999, the value of import was \$259 million. This implies that between 1961 and 1999, Nigeria had spent \$4 billion on rice importation alone, an average annual import value of \$102 million.



**Figure 2** Value of Nigeria’s Rice Import (1962-1998)

**Table 3** Rice Production Trends in Nigeria (1961 – 2014)

| Period (years) | Average area cultivated (ha) | Average output (tons) | Average yield(tons/ha) |
|----------------|------------------------------|-----------------------|------------------------|
| 1961 – 1965    | 179,200                      | 207,200               | 1.156                  |
| 1966 – 1970    | 234,000                      | 321,000               | 1.372                  |
| 1971 – 1975    | 288,800                      | 470,200               | 1.628                  |
| 1976 – 1980    | 332,000                      | 596,200               | 1.796                  |
| 1981 – 1985    | 630,000                      | 1, 300,200            | 2.064                  |
| 1986 – 1990    | 1,060,200                    | 2,216,064             | 2.087                  |
| 1991 – 1995    | 1,678,000                    | 2,979,600             | 1.776                  |
| 1996 – 2000    | 1,742,582                    | 3,011,028             | 1.728                  |
| 2001 – 2005    | 2,270,800                    | 3, 139,400            | 1.383                  |
| 2006 – 2010    | 2,365,502                    | 3,885,154             | 1.642                  |
| 2011 – 2014    | 2,790,106                    | 5,400,718             | 1.936                  |

Source: Computed from FAOSTAT (2012)

Source: Computed from FAO Statistics (2017) and Project Coordinating Unit – Federal Ministry of Agriculture and Rural Development (PCU-FMARD, 2002)

## 2. METHODOLOGY

Primary data was used for the study. The use of well-structured questionnaire was employed to elicit relevant information from the respondents. Data was collected on socio-economic characteristics, attribute perception of respondents on local rice, preference for local rice, factors influencing the preference, willingness of rice consumers in the study area to pay for local rice. Multistage sampling procedure was employed in this study to select the respondents.

### 2.1. Data Analytical Tools

#### 2.1.1. Double Bound Dichotomous Contingent Valuation Method (DB-CVM)

Double bound dichotomous contingent valuation method was used to examine (objective v) the potential demand of respondents for local rice. Research has shown that double-bounded dichotomous choice contingent valuation methods provide statistically superior outcomes than single bounded methods, given appropriate sampling design as it provides more information than single bounded (Hanemann *et al.*, 1991, Adekunle, Akerele, Adekunle and Amodemaja, 2016).

In this model, potential demand (the dependent variable) is specified as 1 if willing to pay and 0, otherwise. If “yes” in the first question, higher bid amount was given in the second

question; otherwise, lower amount with “no”. Therefore, one of four purchase abilities of consumer can be: 1. Yes–Yes (YY), 2. Yes–No (YN), 3. No–Yes (NY), 4. No–No (NN).

According Hanemann, *et al.* (1991), Hai, *et al.* (2013) and Adekunle, *et al.* (2016) the probability of answering “Yes” for both questions is expressed as

$$Pr_{yy} (B, ) = [B \leq PD, B_u \leq PD] \tag{1}$$

$$= [B \leq PD / B_u \leq PD][B_u \leq PD] \tag{2}$$

$$= Pr_{B_u \leq PD} = 1 - F(B_u) \tag{3}$$

Where;

$Pr_{yy}$  = the probability of answering “Yes” “Yes”

$B$  = the price in the first question

$B_u$  = the higher price in the second question

$PD$  = Potential Demand

$F$  = Cumulative Distribution function (CDF)

The probability of answering “Yes” followed by “No” in question (2) is:

$$Pr_{yn} (B, ) = Pr[B \leq PD < B_u ] = F(B_u) - F(B) \tag{4}$$

Similarly, probabilities for answering “No–Yes” and “No –No” are:

$$Pr_{ny} (B, ) = Pr[B_d \leq PD < B] = F(B) - F(B_d) \tag{5}$$

$$Pr_{nn} (B, ) = Pr[B > PD, B_d > PD] = F(B_d) \tag{6}$$

where  $B_d$ = lower price in the second question

The maximum likelihood estimation was applied to estimate the likelihood of either of the responses. Given a sample size of 150 consumers, where  $B_i, B_{iu}, B_{id}$ , were bids used for the  $i$ th consumer, the log–likelihood function is specified as:

$$\ln L = \sum_{i=1}^n y_i \ln Pr_{yy} (B_i, B_{iu}) + \sum_{i=1}^n y_n \ln Pr_{yn} (B_i, B_{iu}) + \sum_{i=1}^n y_{ny} \ln Pr_{ny} (B_i, B_{id}) + \sum_{i=1}^n y_{nn} \ln Pr_{nn} (B_i, B_{id}) \tag{7}$$

where  $y_y, y_n, y_{ny}$  and  $y_{nn}$  are dummy variables. If one consumer answer yes–yes ( $y_y$ ) for two questions, then  $y_y = 1$ , so others will be zero.

In order to explain potential demand, standard double bounded model by Hanemann *et al.*, (1991) was used. Therefore,  $PD$  is expressed by the function:

$$PD_{ij} = \alpha + \sigma Bid_{ij} + \lambda_1 X_1 + \lambda_2 X_2 + \lambda_3 X_3 + \lambda_4 X_4 + \lambda_5 X_5 + \lambda_6 X_6 + \lambda_7 X_7 + \lambda_8 X_8 + \lambda_9 X_9 + \lambda_{10} X_{10} + \lambda_{11} X_{11} + \lambda_{12} X_{12} + \lambda_{13} X_{13} + \lambda_{14} X_{14} + \lambda_{15} X_{15} + \lambda_{16} X_{16} + \lambda_{17} X_{17} + \lambda_{18} X_{18} + \varepsilon_i \tag{8}$$

Where:

$\alpha$  = intercept of the model

$Bid$  = proposed price given to consumer

$\sigma$  = the coefficient of  $Bid$

$X_1$  = Age (years);

$X_2$  = Sex of respondent (Dummy: male=1, otherwise=0);

$X_3$  = Marital status (Dummy: married=1, otherwise=0);

$X_4$  = Household size (head count);

$X_5$  = Years of formal education (years);

$X_6$  = Household monthly income (₦);

- $X_7$  = Rice brand consumed (Dummy: yes=1, no=0);  
 $X_8$  = Grain quality (Dummy: yes=1, no=0);  
 $X_9$  = Grain length (Dummy: yes=1, no=0);  
 $X_{10}$  = Ease of preparation (Dummy: yes=1, no=0);  
 $X_{11}$  = Grain colour (Dummy: yes=1, no=0);  
 $X_{12}$  = Grain price perception (Dummy: yes=1, no=0);  
 $X_{13}$  = Grain aroma (Dummy: yes=1, no=0);  
 $X_{14}$  = Grain packaging (Dummy: yes=1, no=0);  
 $X_{15}$  = Health consideration (Dummy: yes=1, no=0);  
 $X_{16}$  = Local rice quantity consumed (Dummy: yes=1, no=0);  
 $X_{17}$  = Monthly local rice expenditure (₦);  
 $X_{18}$  = Bid price of local rice (₦);  
 $\lambda$  = the coefficients of  $X_i$   
 $i$  = individual  $i$ th consumer  
 $j$  = type of local rice

The five (5) of local rice used in this study were Igbemo rice, Abakaliki rice, Lake rice, Ofada rice and Buhari rice because of their prevalence in the study location as revealed by reconnaissance survey.

### **2.1.2. Payment vehicle designing (Designing Bid Amount)**

In this study, the design of hypothetical prices (bids) is based on the questionnaire pretest and the prices of foreign rice in the markets (₦600/congo) as at the time the study was conducted. Each consumer was asked to answer one of the four random bid questions set to minimize the bias of starting bids

## **3. RESULTS AND DISCUSSION**

The double bounded contingent valuation method estimated respondents' potential demand under different bid amounts. ₦650 was the initial bid amount given to respondents while their responses to this bid amount will determine if the bid amount will be reviewed up to ₦700 or downward to ₦600, and otherwise, asked to mention the amount they are willing to pay at the worst case scenario.

### **3.1. Distribution of Bid Amounts among Respondents**

From Table 18, the study showed that 58.6% of the respondents were not willing to pay the initial bid amount of ₦650 set for respondents while 41.4% of the respondents were willing to pay the set initial bid amount. This distribution suggests that potential demand for local rice at the set price of ₦650 might not be effective.

The study also revealed that 75.8% of the respondents who were willing to pay ₦650, the initial bid amount responded positive to the higher bid amount of ₦700. While 85.2% of the respondents who responded negatively to the initial bid were likewise not willing to pay the lower bid amount set for local rice in the study area.

**Table 4** Distribution of Bid Amounts among Respondents

| Amounts (₦)     | No Response | P(%) | Yes Response | P(%) | Total | P(%) |
|-----------------|-------------|------|--------------|------|-------|------|
| Initial bid 650 | 88          | 58.6 | 62           | 41.4 | 150   | 100  |
| Higher bid 700  | 15          | 24.2 | 47           | 75.8 | 62    | 100  |
| Lower bid 600   | 75          | 85.2 | 13           | 14.8 | 88    | 100  |

**Source:** computed from field survey, 2018

**P** represents percentages of consumers’ responses on the lower and higher bid amounts

**3.1.1. Double Bound Logit Model Estimation of Potential Demand**

The double bound logit regression model estimation of potential demand for local rice in the study area was ₦559.92 and it’s statistically significant at 1%. This value represents consumer’s potential demand for local rice when faced with purchase decisions at the present level of local rice development in the study area. This shows that the potential demand for local rice as demonstrated by consumers is weak. This is revealed by the potential demand that falls below the price of conventional rice (foreign brands) which was ₦600 in the study area as revealed by reconnaissance survey.

**Table 5** Double Bound Logit Model Estimation of Potential Demand for Local Rice

|                  | Coefficient | Standard Error | t-statistic | P> t    |
|------------------|-------------|----------------|-------------|---------|
| Potential Demand | 559.92***   | 115.03         | 4.868       | 0.00102 |

**Source:** computed from field survey, 2018 \*\*\* Significant at 1%,

**3.1.2. Determinants of Respondents Willingness to Pay for Local Rice**

The results of the estimated double bound logit model of the factors determining the potential demand for local rice are presented in Table 20. The double bound logit model is statistically significant at 5% level of significance as indicated by the log likelihood test of significance (Wald  $\chi^2(16) = 29.80$ ) and Prob >  $\chi^2=0.019$ . This then implies that the entire explanatory variables jointly influence potential demand for local rice in the study area.

From Table 20. Grain ease of preparation, grain quality, grain Aroma, and quantity of local rice consumed, positively influenced potential demand for local rice in the study area. Also, Household size, household income and bid amount significantly affect potential demand for local rice but with a negative impact.

Grain ease of preparation was significant at 5%. This implies that as local rice becomes easier to prepare, the potential demand for local rice has the likelihood of increasing. Grain quality was significant at 5%. This explains that as improvement in grain quality continues, the potential demand for local rice has higher likelihood of increasing in the study area by 1.24. This explains that local rice quality improvement has the potential to reduce importation of rice and strengthen food security in agreement with Bamba *et al.*, (2010).

The quantity of local rice consumed was significant at 5%. This shows that every additional congo of local rice consumed will increase the probability of paying premium by 11.55% (see Table 20).

Household income shows a strong negative relationship with the potential demand for local rice at 1% significant level in the study area. That implies, a naira increase in household income has the probability of resulting into fall in the potential demand for local rice in the study area. This as well classifies local rice as an inferior good in the study area. This could owe due in part to the perception that local rice is not as attractive, neat and easy to prepare as the imported polished rice brands making its perceived expensive rate non admissible.

Year of formal education was significant at 10%. The negative relationship with potential demand indicates that as year spent acquiring formal education increases, potential demand has the probability of declining in the study area. This could be as a result of the present level of innovation of the product which is still low and as such not competitive enough to drive effect demand for it.

Bid amount mentioned, the price respondents state as their subjective potential demand for local rice after responding negatively to the lower bid amount set was significant at 1% with a coefficient of -0.859. The implication of this is that, as consumers increase the bid they subjectively set to pay, the less likely they are to pay a premium for local rice in the study area.

The study also shows that household size is statistically significant at 5%. This implies that a unit increase in household size may likely make potential demand for local rice dwindle by 12.87. This is consistent with the findings of Samuel (1999) that food expenditure declines with increased household size. Also, given the conventional view that larger households tend to be poorer with reduced purchasing power as opined by Hassan and Babu (1991) it supports the findings of this study that due to low purchasing power, increase in household size will likely reduce potential demand for local rice.

Table 6: Double Bound Logit Model Estimation of the Determinants of Potential Demand for Local Rice

| Variables                    | Coefficient  | S.E      | t-statistics | P> t  |
|------------------------------|--------------|----------|--------------|-------|
| Age                          | -0.206       | 1.901    | -0.110       | 0.914 |
| Sex                          | -40.167      | 30.557   | -1.310       | 0.189 |
| Marital status               | 49.598       | 41.818   | 1.190        | 0.236 |
| Household size               | -12.876**    | 6.047    | -2.130       | 0.033 |
| Year of formal education     | 2.391*       | 1.360    | 1.758        | 0.109 |
| Household Income             | -5.24e-06*** | 2.12e-06 | 2.377        | 0.008 |
| Rice Brand Consumed          | 45.183       | 28.150   | 1.605        | 0.510 |
| Grain Quality                | 1.214**      | 0.4093   | 2.960        | 0.003 |
| Grain Length                 | -0.275       | 0.4062   | -0.682       | 0.499 |
| Grain Preparation Ease       | 0.2641**     | 0.1341   | 1.970        | 0.046 |
| Grain Colour                 | -0.3968      | 0.3829   | -1.040       | 0.300 |
| Grain Aroma                  | 0.6116       | 0.3610   | 1.699        | 0.128 |
| Grain Price                  | 0.3928       | 0.3835   | 1.020        | 0.306 |
| Grain Packaging              | 0.0447       | 0.3905   | 0.110        | 0.909 |
| Health consideration         | -0.0416      | 0.3571   | -0.121       | 0.907 |
| Local Rice Quantity Consumed | 11.545**     | 5.3247   | 2.173        | 0.030 |
| Local Rice Expenditure       | 0.0082       | 0.005    | 1.521        | 0.128 |
| Bid Amount                   | -0.8586***   | 0.1739   | -4.942       | 0.000 |
| Constant                     | 1023.40      | 23864.3  | 0.043        | 0.966 |

Source: computed from field survey, 2018: \*Significant at 10%, \*\* Significant at 5%, \*\*\* Significant at 1%

Log likelihood = -97.216519  
Prob > chi<sup>2</sup> = 0.0191  
Wald chi<sup>2</sup>(16) = 29.80  
First-Bid Variable: Bid1  
Second-Bid Variable: Bid2  
First-Response Dummy Variable: r1  
Second-Response Dummy Variable: r2

#### 4. CONCLUSION

The potential demand for local rice is low as revealed by a lesser amount consumers are willing to pay compared to the market price of foreign rice in the study area. This implies that consumers will not pay premium for local rice. The result of the study largely identifies a great market potential for the local rice industry only if effort could be geared towards converting the already existing preference to effective demand in the study area. As revealed by the study, 58.6% of the respondents were not willing to pay the initial bid amount of ₦650 set for respondents while 41.4% of the respondents were willing to pay suggesting that potential demand for local rice at the set price of ₦650 might not be effective. Majority of the respondents (75.8%) who were willing to pay ₦650, the initial bid amount also responded positive to the higher bid amount of ₦700. While 85.2% of the respondents who responded negatively to the initial bid were likewise not willing to pay the lower bid amount set for local rice in the study area.

The double bound logit model estimation of the potential demand for local rice in the study area was ₦559.92 and statistically significant at 1% showing a good fit of the model for the data set.

The double bound logit model used to test for the determinants of the potential demand among local rice consumers in the study area is statistically significant at 5% level of significance as indicated by the log like-hood test of significance (Wald chi<sup>2</sup>(16) = 29.80) and Prob > chi<sup>2</sup>=0.019. This then implies that the entire explanatory variables jointly explain and influence the potential demand for local rice in the study area.

Grain ease of preparation, grain quality and quantity of local rice consumed, positively influenced potential demand for local rice in the study area. Also, Household size, household income, year of formal education and bid amount significantly affect the potential demand for local rice but in a negative direction.

Grain ease of preparation was significant at 5% implying that as local rice becomes easier to prepare, the potential demand for local rice has the likelihood of increasing. Grain quality was significant at 5% showing that as improvement in grain quality continues, potential demand for local rice has the likelihood of increasing in the study area. Quantity of local rice consumed was significant at 5%. This shows that every additional congo of local rice consumed will increase the probability of paying premium. Household income shows a strong negative relationship with the potential demand for local rice at 1% significant level in the study area indicating that increase in household income has the probability of weakening the potential demand for local rice in the study area. Year of formal education was significant at 10%. The negative relationship with the potential demand for local rice indicates that as year spent acquiring formal education increases, potential demand for local rice has the likelihood of decreasing in the study area. Bid amount was significant at 1%. The signals that, as consumers increase the bid they subjectively set to pay, the less likely they are to pay a premium for local rice in the study area. The study also shows that household size is

statistically significant at 5% implying that a unit increase in household size will reduce the probability of paying premium for local rice.

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