Determinants of Farmers' Choice among Alternative Rice Output Markets in Kano State, Nigeria

S. Abdulrahman[1*], M. A. Abdullahi[1], O. S. Adejoh[2], A. S. Onwuaroh[1] and G. Binuyo[3]

[1]*Department of Agricultural Economics and Rural Sociology, Faculty of Agriculture, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.*
[2]*Kogi State Community and Development Agency, Lokoja, Kogi State, Nigeria.*
[3]*Forestry Research Institute of Nigeria, Federal College of Forestry, Jos, Plateau State, Nigeria.*

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

Original Research Article

ABSTRACT

The aim was to analyze the output market outlets accessible to rice farmers and determinants of farmers' choice among alternative rice production in Kano State, Nigeria. Primary data were collected from 164 rice farmers with the aid of structured questionnaire. This study was conducted in Kura, Garun Malam and Bunkure Local Government Areas of Kano State during 2015 cropping season. A multistage sampling techniques were used for data collection through the use of structured questionnaire. The ordered probit model was used to estimate the parameters of the determinants of farmers' choices among alternative rice output market outlets by rice farmers in Kano state. The generalized likelihood ratio statistics was -113.401. This ratio exceeds the critical chi-square values at $p < 0.01$ level of significance. The log likelihood ratio value represents the value that maximizes the joint densities in the estimated model. This shows that at least one of the predictors' regression coefficient is not equal to zero in the model. The Prob > chi^2 was (50.03) and statistically significant at $p < 0.01$ level of probability. The probability of obtaining this chi-square

_____

Corresponding author: E-mail: arsan4u@gmail.com;

statistic shows the effect of the predictor variables on specified alpha level. This implies that at least one of the regression coefficients in the model is not equal to zero. farmers' choices among alternative rice output market outlets was significantly determined by educational status of the farmers, access to credit, cooperative membership, distance to market, quantity of output produced by the farmers and market price of rice (P<0.10). Based on the findings of this study, it could be concluded that the most commonly used output markets by rice farmers was rural assembler (82.3%). Despite increasingly competitive markets, pricing issues for rice remains a concern for farmers.

1. INTRODUCTION

Rice is an annual crop and the most important staple food crop in the tropical countries. Commercially, the crop is the most important cereal after wheat [1]. It is widely consumed and there is hardly any country in the world where it is not utilized in one form or the other. In Nigeria, rice is one of the few food items whose consumption has no cultural, religious, ethnic or geographical boundary. It is available in five-star hotels in the big cities and towns, as well as in the "most local" of the eating places in the remotest villages throughout the country [1]. It is highly priced and widely accepted for festivities. In some rural areas, it is so adored that it is eaten only on Sundays and sometimes on market days [2].

Generally Agricultural products in many developing countries are often lost after production due to spoilage and inability to access markets. This can be attributed to several influencing factors in marketing that tend to reduce and discourage farmer participation in formal markets. Ever since the evolution of economic (agricultural) reforms that led to the abolition of commodity boards, introduction of free market pricing policy and encouraging private sector participation, there has been an increase in the number of buyers and marketers of agricultural produce. This has resulted in wider alternatives in terms of marketing channels available for selling rice unlike before privatization when specific markets or channels existed (marketing boards) [3].

Local rice demand is growing quickly due to population growth and urbanization. Nigeria's estimated annual rice demand is put at 4.8 million metric tonnes while annual production on the average, was about 2.8 million tonnes of milled rice product leaving a deficit of 2 million tonnes which is bridged by importation (Uchei, 2014). Domestic demand for rice is projected to rise to 7.5 million tons by 2013, on the assumption that demand rises at 10% per annum, with demand for local rice growing at half the rate of the imported rice [4]. This increase in demand is because rice has changed from being an elitist to a staple food for many Nigerians [5]. Many local dishes are prepared with rice because of its relative ease in terms of storage and preparation. In terms of local production, rice is now one of the main cereals produced by Nigerian farmers; it is cultivated in virtually all the agro-ecological zones of Nigeria. It covers both the upland and the swamps, depending on the variety [5].

Farmers not only need to be more efficient in their production activities, but also need to be responsive to market indicators, so that scarce resources are utilized efficiently to increase productivity as well as profitability, and ensure supply to the urban market. In Nigeria, rice is important, not only as food crops but even more as a major source of income for rural households. Efficiency in the use of financial resources in growing crops is an important factor. This can be expanded by emphasizing the need to market the crops in such a way as to maximize returns [6].

Agricultural marketing assumes greater importance in the Nigeria economy because the excess production from the farm must be disposed off in order to earn some income with which farmers can purchase their goods and services not produced by them [7]. The link between the producers and the consumers is the market. Marketing therefore plays a central role in the development process. However, the marketing system of Nigeria's food and staple failed to address price stability from time to time due to information asymmetry [7].

Marketing plays a significant function in the performance of supply chains. Farmers require relevant and reliable infrastructure, labour,

technology and coordinated markets in order to effectively market their agricultural products. Farmers benefit from markets if their participation minimizes transaction costs, hence they should focus on production, which they have a comparative advantage [8].

2. MATERIALS AND METHODS

2.1 Study Area

The study was carried out in Kano State which is located in the Northern part of Nigeria between latitudes 13° N and 11° S and longitude 8° W and 10° E. The State has a land mass of about 20760 square km (NAERLS, 2011). Based on NPC [9], the State has a projected population of 11,716,688 at 2013. The State is considered to be agrarian as more than 55% of the working adults are engaged in farming and related activities as a means of livelihood. The average annual rainfall is 700 mm with the mean daily maximum and minimum temperatures of 35°c and 19°c, respectively. The major crops grown in the State include rice, maize, millet, cowpea, groundnut and vegetables (NAERLS, 2011).

2.2 Sampling Procedure

A multi-stage sampling technique was used to select the rice farmers. In the first stage, the three major rice producing Local Government Areas (LGAs) (Kura, Garun Malam and Bunkure) were purposively selected out of 44 LGAs in the State. Secondly, a major and accessible rice producing village was purposively chosen from each LGA. Thirdly, 16% of the given sample frames of rice farmers in each chosen village was randomly selected using random numbers from the list of the farmers. The sample frame of each village was obtained during a reconnaissance survey with the help of Hadejia Jama'are River Basin Development Authority (HJRBDA) field staff. Thus, a total of 164 rice farmers served as the sample size for the study.

2.3 Data Collection and Analysis

Primary data were obtained from the sampled rice farmers. The data were collected using a structured questionnaire. The information collected from the farmers include socioeconomic characteristics of rice farmers and types of rice output markets and outlets available to the rice farmers.

2.4 Model Specification

2.4.1 Market outlet choice model

Ordered probit model was applied to explain variation among the farmers in the choice of a specific marketing outlet. This study assumes that farmer's decision is generated based on utility maximization.

$$Prob\big(Choice_{ij} = j\big) = \frac{e^{\alpha_j X_i}}{\sum_{j=1}^{j} e^{\alpha_j X_i}} \qquad (1)$$

Where:

i represents ith rice farmer, and i=1,2,3,…,n.
j represents different marketing outlets,
Prob represents the probability of rice marketing outlet j to be chosen by rice farmer i;
$Choice_{ij}$ = j means that rice marketing outlet j is chosen by rice farmer i;
X_i is independent variables

Unbiased and consistent parameter estimates of the model in equation (1) require the assumption of independence of irrelevant alternatives (IIA) to hold. More specifically, the IIA assumption requires that the probability of using a certain output market by a given farmer needs to be independent from the probability of choosing another output market outlet. The premise of the IIA assumption is the independent and homoscedastic disturbance terms of the basic model in equation (1).

Therefore, the model was tested for the validity of the independence of the irrelevant alternatives (IIA) assumptions by using both the Hausman test for IIA and the seemingly unrelated post-estimation procedure (SUEST).

$$h_I = ln\left\{\frac{p}{1-p}\right\} = \alpha_0 + \beta_1 Z_1 + \alpha_2 Z_2 + \alpha_3 Z_3 + \cdots$$
$$+ \alpha_8 Z_8 + e_i \qquad (2)$$

h_i= It is measured by the probability of selling rice to either of the market outlets. The outlet choices might be along farmers' decision involving available alternative markets. It is represented in the model as for rice farmers who choose to sell rice mainly to wholesalers, for producers that mainly sell their rice output to assemblers, for producers who mainly sell rice output to retailers, for producers who mainly sell rice output for processors, h_4 for producers who

mainly sell rice output to consumers and h_5 for producers who mainly sell rice output to many outlets.

h_i= market outlets
Z_1= years of education (years)
Z_2= Amount of credit obtained (₦)
Z_3= Years of membership in farmers' cooperative
Z_4= Distance to output market (km)
Z_5= Quantity of rice produced (kg)
Z_6= Price of rice (₦)
α_s= a vector of parameters to be estimated
e_i= disturbance term

The parameter estimates of the model provide only the direction of the effect of the independent variables on the dependent (response) variable, but estimates do not represent either the actual magnitude of change nor probabilities. Differentiating equation (1) with respect to the explanatory variables provides marginal effects of the explanatory variables given as:

$$\frac{\partial Prob_j}{\partial X_i} = Prob_j\left(\alpha_{ji} - \sum_{j=1}^{j-1} Prob_j\alpha_{ji}\right) \qquad (3)$$

The marginal effects or marginal probabilities are functions of the probability itself and measure the expected change in probability of a particular choice being made with respect to a unit change in an independent variable from the mean (Green 2000; Koch 2007).

3. RESULTS AND DISCUSSION

3.1 Output Market Outlets Accessible to Rice Farmers

Rice producers have many alternatives when selling their produce. Their possible channels are directly or indirectly to collectors (rural assemblers), wholesalers, processors, retailers and to consumers. Output market in this study refers to the first stage of buying paddy rice from the farmers. It is the most competitive stage of the rice output, where key players intensively compete in terms of price and the timing of purchasing from the farmers. These key players include wholesalers who operate input and output shops, rural assemblers, retailers and large processing companies.

The result in Table 1 shows that about 82% of the rice farmers sell their produce to rural assemblers. This may be the fact that rural assemblers pay the farmers immediately upon delivery. This is a preferred option for farmers that tend to be in desperate need for cash, even

when the price offered is lower than the prevailing market price. Sometime, the farmers receive the cash even before harvesting the rice. In such arrangements, it is the traders that determine when to buy, at what price to buy, and to a greater extent, the quantity bought from farmers. This category of assemblers tends to maintain large market shares. They have over the years established markets beyond the domestic rural market, through business partnership with other traders in the neighbouring states. This finding agrees with Rhoda (2013). In Katete district, for example, one large-scale agro-input/output trader bought up to 10% of the rice produced in the district in 2011.

Table 1 shows that 50% of the rice farmers sold their produce to wholesalers in the study area and these wholesalers assemble the paddy rice from the farmers using different methods. The result presented in Table 1 also revealed that 31.1% of the rice farmers sold their produce to retailers. This may be due to the fact that retail outlet, which comprises mainly of local shops, provides significant markets for both unprocessed and processed rice products. While 18.9% of the rice farmers sold their produce to processors. After harvesting, paddy rice goes through a process of boiling and shelling. Shelling is a form of value addition although the value-added is minimal. There is a higher demand for shelled paddy rice than for unshelled paddy rice because most buyers do not want to invest in the high labour demand and cost of shelling in the study area.

Table 1. Output market outlets accessible to rice farmers

Outlet markets	*Frequency	Percentage
Rural assembler	135	82.3
Wholesalers	82	50.0
Retailers	56	31.1
Processors	31	18.9

Multiple responses

3.2 Determinants of Farmers' Choices among Alternative Rice Output Market Outlets

The ordered probit model was used to estimate the parameters of the determinants of farmers' choices among alternative rice output market outlets by rice farmers in Kano state. The generalized likelihood ratio statistics was -113.401. This ratio exceeds the critical chi-square values at p<0.01 level of significance. The log likelihood ratio value represents the

value that maximizes the joint densities in the estimated model. This shows that at least one of the predictors' regression coefficient is not equal to zero in the model. The Prob > chi^2 was (50.03) and statistically significant at p<0.01 level of probability. The probability of obtaining this chi-square statistic shows the effect of the predictor variables on specified alpha level. This implies that at least one of the regression coefficients in the model is not equal to zero. The significant chi-square value of 50% indicates that the explanatory variables jointly influence the farmers' choices among alternative rice output market outlets (Table 2). Farmers' choices among alternative rice output market outlets is significantly determined by educational status of the household head, access to credit, cooperative membership, distance to market, quantity of output produced by the farmers and market price of rice. Numerically and statistically, quantity of output produced by the farmers, market price and education were the most significant determinants of farmers' choices among alternative rice output market in the study area.

Education was positively associated with the probability of farmers' choices among alternative rice market outlets. For household heads that are educated, the probability of farmers' choices among alternative rice market outlets was higher than uneducated household heads by 0.06. This implies that the educated farmers use his educational advantages in making choice of alternative market to maximize their profit. The result is in line with the findings by Tambo and Abdoulaye, (2011); Enete and Igbokwe, (2009). According to them, education enhances access to information processing for technology uptake and higher farm productivity.

Access to credit is associated with a positive effect on farmers' choices among alternative rice output market outlets. This enable the farmers to choose from alternative market outlet that will yield better opportunities in terms of price advantage, due to his financial capability. The result is consistent with the findings by Asante et al. (2011); Nzomoi et al. [10] and Mussei et al. (2001). Access to credit enables farmers to overcome their financial constraints associated with production and adoption of innovations and transportation of produce to available markets.

The results presented in Table 2 show that cooperative membership was negatively associated with lower probability of farmers' choices among alternative rice market outlets

and not significantly influence the choice of market by rice farmers in the study area. Low participation (76%) in cooperative activities by farmers could be attributed to the insignificant influence on the choice of outlet market. This finding is at variance with Odebiyi [11] who found that cooperative groups ensure that their members derive benefits from the groups such as they could not derive individually.

The results presented in Table 2 shows that distance to market significantly influence the choice of market by rice farmers in the study area. This is because distance enables the farmers to choose from alternative market outlet that will maximize his profit through reduction in transportation cost. The negative signs will lead to a reduction in the odds in favour of the farmers choosing a distance market outlet due to its cost implication. The result is consistent with the finding of Nzomoi et al. [10] who opined that distance to market significantly influence choice of an individual farmers/marketers in terms of transportation of produce to available market outlet.

Quantity of output produced by rice farmers was associated with a positive effect on farmers' choices among alternative rice output market outlets. A unit increase in farmers output of rice results in an increase in the probability of choosing from the alternatives outlets by 0.03. Farmers output is the most influential determinant of farmers' choices among alternative rice output market, an outlet market with promising relative higher price will influence farmers choice to supply more of his output because output price is an incentive for farm households to supply more produce for sale which subsequently result in higher income.

Market price was associated with a positive effect on farmers' choices among alternative rice market outlets. A unit increase in the market price of rice results in an increase in the probability of choosing from the alternatives outlets by 0.06. According to economic theory, output price is an incentive for farm households to supply more produce for sale which subsequently result in higher income. Studies by Olwande et al. [12], Enete and Igbokwe (2009) and Omiti et al. (2009) support this theory. A major challenge of the farmer is to produce to meet the demands of the market. Higher market price guarantees the income of the household head. In order to take advantage of the market price, household heads may choose from alternative market based on higher market price.

Table 2. Ordered Probit estimates of determinants of farmers' choices among alternative rice output market outlets

Variable	Coefficient	Standard error	T-value	Marginal effect
Constant	-19.625	11.376	-1.725*	0.083
Education	0.151	0.059	2.559***	0.066
Credit	0.319D-05	0.538D-05	0.378	0.705
Cooperative membership	-0.644	0.6531	-0.819	0.413
Distance	-0.301	0.101	-2.980***	0.795
Output	0.549D-05	0.224D-05	3.851***	0.031
Price	0.0045	0.0024	1.875*	0.063
Numbers of observation		164		
Log likelihood function		-113.401		
Restricted log likelihood		-117.128		
McFadden Pseudo R-square		0.51		
Chi-square χ^2		7.25		
DF		7		
Prob (chi-square > value)		0.503		

$***p<0.001**p < 0.05$ and $*p < 0.10$

4. CONCLUSION

Based on the findings of this study, it could be concluded that the most commonly used output markets by rice farmers was rural assembler (82.3%). Despite increasingly competitive markets, pricing issues for rice remains a concern for farmers. Furthermore, the probit model results show that the factors found to significantly affect rice producer's decision to sell their rice were education, rice output, and distance to market except the price variables the later variables negatively affected decision to sell. Meaning that price variable is very important in stimulating selling decisions and that it is very important to make it available to farmers.

5. RECOMMENDATIONS

Distant to markets as a result of poor road conditions and high transport costs were identified as factors affecting access to market for paddy rice farmers. Therefore, rural markets should be linked to the urban market to attract good value for rice products thereby enhancing profitability and living standard of the farmers especially those in the rural areas.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Gnanamanickam SS. A review and description of rice production system in Nigeria. Journal of World Economics. 2009;2:185-250.

2. Omofonmwan SI, Kadiri MA. Problems and prospects of rice production in Central District of Edo State, Nigeria. Journal of Human Ecology. 2007;22(2):123-128.

3. Sunga C. Factors influencing bean producers' choice of marketing channels in Zambia. A Thesis Submitted to University of Zambia. 2011;1-50.

4. National Rice Development Strategy (NRDS). A Working Document Prepared for the Coalition for African Rice Development; 2009.

5. Kano State Agricultural and Rural Development Authority (KNARDA). The planning in upgrading of rice production in Kano State. A package prepared by Marditech Corporation Sdn. Bhd. Malaysia for KNARDA. 2007;1-44.

6. Harper F. Principles of Arable crop production; 1999.
   Available:www.Blackwellscience.com

7. Oladapo MO, Momoh SY, Awoyinka Y. Marketing margin and spatial pricing efficiency of pineapple in Nigeria. Asian Journal of Marketing. 2007;1:14-22.

8. Porter ME. Competitive advantage. The Free Press, New York. Premilinary Survey on Cabbege Dealers (2013); 1985.

9. National Population Commission NPC. Provisional Census Figure, Abuja, Nigeria; 2006.

10. Nzomoi JN, Byaruhanga JK, Maritim HK, Omboto PI. Determinants of technology adoptionin the production of horticultutral

export produce in Kenya. Afr. J. Bus. Manage. 2007;1(5):129-135.

11. Odebiyi OC. Impact of microfinance bank loan on aquaculture development in Ogun State Nigeria. A Project Report Submitted to the Department of Aquaculture and Fisheries Management, Federal University of Agricuture Abeokuta; 2010.

12. Olwande J, Mathenge M. Market participation among poor rural households in Kenya. Tegemeo Institute of Agricultural Policy and Development; 2010.