SPATIAL PRICING EFFICIENCY OF RICE MARKETING IN NORTH CENTRAL, NIGERIA

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ABSTRACT

*This study examined the spatial pricing efficiency of rice marketing in North central, Nigeria. Data collection involved the use of primary data and a multi-stage random sampling technique was used the selection of 200 marketers. Data analytical techniques involved the use of descriptive statistics, the model of spatial price relationship as well as Ordinary Least Square (OLS) regression model. The results on spatial pricing efficiency revealed that consumers were void of exploitative behavior of middlemen in most of the markets. The result on the factors affecting rice prices showed the estimated R^2 for Kwara and Niger States of 98.3% and 42%, respectively. The main constraint facing rice marketing in the area was cost of transportation***. *Based on these results, it is recommended that the negative price spread in Owode market should gear up the local government authorities in the provision of more market outlets in Owode market.*

Key words: Spatial, efficiency and price-spread

1. Introduction

In a free market economy, the price system and competition provides the coordinating mechanism for determining the flow of resources into production and the flow of goods and services into use. It is within the marketing system that prices, allocation of resources, income distribution and capital formation are determined. Hence, a good efficient marketing system accelerates the pace of economic development of any nation, especially, Nigeria (Olukosi and Isitor, 1990)

Rice (*Oryza sativa*) is a staple crop with a wide acceptability in most families in Nigeria. Though this is true, yet the recent flooding, insecurity of lives and properties due to incessant terrorist attacks, and bombing has affected the production and trading of rice especially in the northern part of Nigeria. Movement of traders has been hampered by poor infrastructural state of the road network and high cost of transportation. Also, many traders and farmers are apprehensive when engaging in marketing activities (United State Agency for International Development (USAID, 2013). All of these have increased the demand-supply gap, low income and eventual poverty of the farmers. To reduce this vicious circle of poverty, there is need to for improvement in the time, place and, more importantly the form local milled rice reaches both the rural and the urban-based consumers at the lowest cost possible. This will contribute to the income accrued to the farmers thereby improving the food security status and livelihood of the rural populace while reducing the post-harvest losses of the commodity. According to Bassey *et al.*, (2013), increasing production without a corresponding efficient marketing strategy being put in place to ensure its accessibility would not stimulate farmers to enhance production since the excess would be wasted through post harvest loses. Therefore this study is aimed at determining the spatial pricing efficiency of rice marketing in the study area, determine the factors affecting rice price in the study area as well as the constraints facing the marketers in the study area.

2. Conceptual Framework

Two types of marketing efficiencies could be distinguished. These are operational and pricing efficiencies. Operational efficiency assumes that the quantum and quality of commodities and services are constant while efforts are directed at reducing their costs. The operational efficiency of a marketing system is enhanced when marketing costs are reduced at the same level of output (Mauyo *et al*. 2007). Cost analysis is therefore, central to the notion of operational efficiency**.** Pricing efficiency however can be defined as the ability of a marketing

system to efficiently allocate resources and coordinate the food production and marketing process in accordance with consumer directives (Kohls and Uhl, 1985). In essence, it is concerned with how effectively prices reflect the costs of moving the outputs through the marketing system. The prices that consumers pay for goods delivered by the marketing system should adequately reflect all marketing and production costs. According to Olukosi and Isitor (1990), prices will reflect all such costs in a perfectly competitive economic environment. Where pricing efficiency exists, marketing margin should reflect values being delivered. Marketing margin is the difference in prices at two different points in a marketing chain. A commonly reported marketing margin is the farm-to-retail spread, which measures the difference between the retail price and the farm level price for a commodity (Kähkönen and Leathers, 1999). The margin must cover the costs of moving the product from one stage to the next and provide a reasonable return to the marketers (Crawford, 1997). For a given market, the equality of the net margin and marketing costs could be tested via paired sample t-test. This could serve as an indicator of pricing efficiency in the market. Specifically, spatial pricing efficiency could be tested using the model of spatial price relationship developed by Hays and McCoy (1977) If the market is perfectly competitive, as the commodity moves from the jth to the ith market, PP_{ij} will be equal to P_i and thus the actual price spread would be equal to zero. A positive price spread would provide a potential opportunity for middlemen to realize excessive profit, while negative spreads indicate losses.

3. Methodology

3.1. Study Area

This study was conducted in Niger and Kwara States, Nigeria. The two States are in the North-central zone of the country. Niger State is located between latitudes $8^{o}11'$ N and 11° 20′ N and longitudes 4° 30′ E and 7° 20′ E. It is bordered on the north-east by Kaduna State and on the south-east by the Federal Capital Territory, Abuja. It is also bordered on the north, west, south-west and south by Zamfara, Kebbi, Kogi and Kwara States, respectively. It shares an international border with the Republic of Benin in the north-west. The State covers an estimated land area of 86,000 square kilometers representing about 9.3% of the total land area of the country (Alhassan, 2012). According to the 2006 census, the State has a population of 3,950,249 people which is projected to be increasing at an annual population growth rate of 2.38%. The vegetation, soil and weather patterns are favorable for the production of a wide spectrum of food and cash crops of various types. The major crops grown in the State include

rice, maize, millet, sorghum, yam, potato, soybean, groundnut, cashew, beniseed and cassava. The amount of rainfall is between 1100mm – 1600mm per annum with average monthly temperature ranges from 23°C to 37°C. The vegetation consists mainly of short grasses, shrubs and scattered trees. Kwara State, with a population of 2,591,555 (which is projected to reach 3,080,544 in 2013 at an annual growth rate of 2.5%) (World Bank, 2012), was created on the 27th May, 1967 and covers a total land area of 332,500 square kilometers. It lies within latitude $7^{0}45'$ N - $9^{0}30'$ N and longitudes $2^{0}30'$ E - $6^{0}23'$ E (Fakayode, Babatunde and Ajao, 2008). It is bordered in the north by Niger State; Kogi State in the east; Oyo, Osun and Ekiti States in the south and the Republic of Benin along its north-western part. The climatic conditions of the State divides it into wet and dry seasons with the temperature ranging from 33^{0}C to 37^{0}C. According to Abidoye (2012), agriculture is the predominant economic activity in the State. The crops mainly grown include maize, yam, cassava, rice and tomatoes.

3.2. Sampling Techniques

A multistage sampling technique was used to select the rice marketers in the study area. The first stage involved the random selection of two States out of the six States in the North-central zone. The second stage involved the random selection of five markets from each State while the third stage involved the selection of twenty rice marketers from each market making a total of two hundred marketers in all. Primary data were obtained for a period of one year through the use of structured questionnaires to elicit information from the respondents.

3.3. Analytical Techniques

Descriptive and inferential statistical analysis such as frequency was used to identify the problems of rice marketing in the study area while pricing efficiency of the marketers was analyzed using the model of spatial price relationship and Pearson product correlation analysis. Multiple regression analysis was used in the analysis of the determinants of rice price in the study area.

The model of spatial price relationship developed by Hays and McCoy (1977) which was also adopted by Nuhu *et al*, (2009) was computed follows:

$$PP_{ij} = P_i - (HC_{ji} + TC_{ji} + AS_{ji}) \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where,

PP_{ij} = The calculated parity price of one ton of rice from the ith market (State1) in relation to the jth markets (₦) (State 2).

P_i = The actual wholesale price of one ton of rice at the ith market (₦).

HC_{ij} = Handling costs involved in moving one ton of rice from the ith to the jth market (₦).

TC_{ij} = Transport cost of moving one ton of rice from the ith to the jth market (₦).

AS_{ij} = The charge for the assemblers service in moving one ton of rice from the ith to the jth market (₦).

The actual price spread between any two markets would be:

$PS_{ij} = PP_{ij} - P_j$ ……. (2)

Where,

PS_{ij} = The price spread for one ton of rice between the ith and the jth market (₦).

P_j = The actual wholesale price of one ton of rice in the jth market (₦).

If the market is perfectly competitive, as rice moves from the jth to the ith market, PP_{ij} will be equal to P_i and thus the actual price spread would be equal to zero. A positive price spread would provide a potential opportunity for middlemen to realize excessive profit, while negative spreads indicate losses.

Pearson correlation coefficient (r) was computed for the urban and rural markets in line with the method of Bassey et al (2013) and Oladapo et al (2007). The formula used was:

$$r_{ij} = \frac{\sum_{i-j}^{n}(P_{it} - \overline{P_{it}})(P_{jt} - \overline{P_{jt}})}{\sum_{i-j}^{n}\sqrt{(P_{it} - \overline{P_{it}})}\sum_{i-j}^{n}\sqrt{(P_{jt} - \overline{P_{jt}})^2}} \quad \text{……(1)}$$

Where,

i = State 1

j = State 2

P_{it} and P_{jt} are the prices of rice in the two States and i and j are measured at time t.

$\overline{P_{it}}$ *and* $\overline{P_{jt}}$ = means of each rice price

n = number of observations

r_{ij} = Correlation between State i and State j

T-Test for Difference of Means between Markets: This was used to compare the mean wholesale prices between Kwara (each taken at a time) and Niger State. The equation is given as:

$$T_{cal} = \frac{\overline{X_1} - \overline{X_2}}{\sqrt{\frac{S_1^2 + S_2^2}{n_1 + n_2}}} \quad \text{.....(2)}$$

Where,

tcal = calculated value of t distribution

$\overline{X_1}$ = mean of wholesale price for State 1 (Kwara) taken at a time

$\overline{X_2}$ = mean of wholesale price for the State 2 (Niger) taken at a time

S_1 = Standard deviation of sample mean of urban market in a given Local Government Area

S_2 = Standard deviation of sample mean of rural market in a given Local Government Area

n = number of observations

The factors affecting rice prices in the study was achieved using a multiple regression analysis. The regression model is expressed as follows:

$$P_i = a + \beta_{i1}SC + \beta_{i2}TR + \beta_{i3}PK + \beta_{i4}LB + \beta_{i5}CC + \beta_{i6}EDU + \beta_{i7}EXP + \beta_{i8}COM + \varepsilon_i \quad (3)$$

Where,

P_i = Price of rice in Market A or B market (₦).

a = constant

$\beta_{i1} - \beta_{i8}$ = Coefficients to be estimated

SC = Storage cost (₦)

TR = Transportation cost (₦)

PK = Packaging cost (₦)

LB = Labour cost (₦)

CC = Capital cost (Depreciations) (₦)

EDU = Education (Years)

EXP = Experience (Years)

COM = Cost of communication facility (₦)

ε_i = Error term

The a priori expectation is that all the marketing costs contained in the model will have a positive and significant influence on the price of rice in either of the markets. In other words, the higher the marketing costs, the higher the price of rice should be in the study area.

4. Results

4.1 Spatial price analysis

Table 1 reveals the result of the annual price spreads of rice between Niger and Kwara States markets. The analysis revealed that most of the markets had negative price spread except in Owode market where there was positive price spread. When negative price spread occurs, it is an indication that the difference in price is less than transfer cost which implies that the markets were competitive and void of exploitative behavior of middlemen. According to Daan (2008), if two markets are trading a commodity in a particular period, these markets are integrated if the price in one market equals the simultaneous price in the other plus transfer costs. If this holds then there is no incentive to trade. But that arbitrage will occur when the price difference is greater than the transfer cost. Conversely, when positive price spread occurs, it is a pointer to the fact that the marketers made more than normal profit, the market was not competitive, and that there was prevalence of market imperfections in Owode market. This according to economic theory, which was also buttressed by Nuhu *et al.* (2009), gives the middlemen occasion of excessive exploitation of the potential buyers/consumers. Nuhu *et al*. (2009) noted however, that positive price spreads may not only result from exploitative practices of marketers but could likely be as a result of the nature of production and defects in the marketing system. For instance, rural markets are assumed to lack market information on changes in supply and demand conditions in the other neighbouring markets. However, in the urban consuming centers, there is an increasing improvement in the communication system through the introduction of Global System for Mobile communication (G.S.M). This makes for an effective arbitrage among markets, decrease uncertainties on market supplies and demands in different locations as well as decrease the risk associated with inter-market trade (Roche and McQuinn, 2003). Spatial price relationships are determined largely by transfer cost between regions and considering the transfer cost of moving rice from one market to the other within the North central zone, transportation cost had about 74.6% share, followed by handling cost of 16.4% and lastly, assembler charges of about 8.98%. The reason for the high percentage accruing to transportation is because most of the feeder roads leading to the rural areas/villages where the bulk of the rice is produced are in a deplorable state due to several years of neglect. And as such, the few transporters who could take the risk of plying such

roads always charge high fares as a premium for any mechanical fault inherent from the use of their vechicles on such roads. According to Olukosi and Isitor (1990), inaccessibility of producing rural areas to fast means of transportation results in location surpluses at the rural areas and shortages in the urban areas. In general, the farther the distance of the rural markets from the urban markets, the less the profit and the more the negative spread. This is because transfer costs are often high in relation to the prices of agricultural commodities as confirmed by Nuhu *et al*. (2009). The predominance of negative price spreads suggests that marketers are making less gain except in Owode market. Thus, it can be concluded that consumers were void of exploitative behavior of middlemen in most of the markets. But in Owode market, there was minimal competition which led to the exploitation of consumers by the middlemen. Generally, the findings show that the markets were operating at inefficient level.

4.2 Rice Price Trend Analysis

4.2.1 Variability in Retail Prices of Rice in the Study Area: Most price data vary due to seasonality and other exogenous effects. In order to determine the relative dispersion or the degree of variability of retail prices in the study area, the Coefficient of Variation (CV) was computed. It was discovered that retail prices were more volatile in Kwara State (6.61%) than in Niger State (Table 2). The result implies that retail prices were relatively more stable in Niger than Kwara State. The study by Akande and Akpokodje (2003) on rice prices and market integration in selected areas in Nigeria revealed that retail prices of local rice were more volatile than that of imported rice. However, the reasons for the volatility and relative stability of the imported rice also followed the same line of thought.

4.2.2. Correlation Analysis of Rice Prices in the Study Area: To further determine the extent to which rice prices move together in the States, Pearson correlation analysis was applied to monthly retail price series as shown in Table 3. The result revealed that *r* was 0.753.This implies that there was a strong co-movement of rice prices in the two States. In other words, there was a fast flow of information between the two States and so, a deficit/surplus in one State may have been promptly transmitted to the other State. This finding was corroborated by Bassey et al (2013) who found out that correlation coefficient between the urban market pair was higher (0.81) than those between the urban and the rural market pairs which ranged from 0.21 to 0.46 in Akwa Ibom State rice traders.

4.2.3. t-Test Analysis: The result of summary statistics of rice prices (Table 4) in the study area revealed mean values of ₦12,720 and ₦14,165 in Niger and Kwara States, respectively. The maximum and minimum prices in Kwara State were ₦7, 800 and 27, 500, respectively while in Niger State, ₦1, 300 and ₦25, 000, respectively. A wide margin was also noticed between the minimum and maximum prices in the study area. Table 5 also shows that there was a significant difference in the mean of wholesale prices of rice between Kwara and Niger States. Lower rice prices in Niger State than Kwara State as stressed by Bassey *et al*. (2013) may be because few quantity of rice was supplied from Niger to Kwara State due to transportation cost, since the former is located several kilometers away from the latter. This result was however at variance with Oladapo *et al.* (2007) who reported that prices in the urban markets were higher than rural markets in their study on marketing margin and spatial pricing efficiency of pineapple in Nigeria. The wide margin observed between the minimum and maximum prices in the study revealed a high degree of instability of rice prices in the area. This was confirmed by the study conducted by Nuhu (2009) and Okuneye (2010). Also, Taru (2012) reported that such price variations among markets in Nigeria is necessary for the existence of market, as it create incentives that attract market actors to engage in trade.

Table 5 shows that there was a significant difference in the mean of wholesale prices of rice between Kwara and Niger States. This shows that there was a high degree of market integration and probably a free flow of marketing information among the markets in the area. This is in conformity with the findings of Oladapo *et al.* (2007).

4.3. Factors affecting Rice Price in the Study Area

Table 6 shows the results of the regression analysis of the factors affecting rice price in Kwara and Niger States. Based on *a priori* economic and statistical criteria for selecting the 'lead' equation, semi-log and linear functions were chosen for Kwara and Niger States, respectively. The estimated R^2 for Kwara State shows that 98.3% of the variability observed in price was explained by the included explanatory variables while the F- ratio of 763.78 showed that the joint determination of the explanatory variables was significant at 1% level. All the included cost components were positive and significant. In kwara State, the positive regression coefficients of all the cost components of the explanatory variables show that an increase in these variables will lead to increase in the price of rice in the State. Storage cost (X_1), packaging cost (X_4) and Communication cost (X_6) were significant at 1%, 1%, and 10%

probability levels, respectively. The estimated R^2 for Niger State shows that 42% of the variability observed in price was explained by the included explanatory variables (Table 2) while the F- ratio of 3.628 showed that the whole model was significant at 1% level. The transportation, packaging and capital costs were significant at 1%, 1% and 5% probability level respectively. The positive regression coefficients of the cost components showed that an increase in these variables led to an increase in the price of rice in the State.

4.4 Problems of Rice Marketing in the Study Area

It was revealed in Table 7 that rice marketing in the area was faced with constraints such as high cost of transportation, price instability, bad road, inadequate credit facilities and distance from the farm to markets. Of all these problems, high cost of transportation ranked first (28.2%). This is followed closely by deplorable road network of 24.6%. This is not surprising as bad road will cost result in hike in fare paid in moving rice commodity from farm to the various selling points. Inadequate credit facilities ranked 3rd at 19.4% because commercial lending institutions do not encourage marketers to obtain credit facilities due to high risk and uncertainties embedded in rain-fed agriculture, price instability 15.9% while Long distance from farm to market was the least identified constraint at 11.9%. This is corroborated by the study conducted by Bassey *et al* (2013) on intermarket performance and pricing efficiency of imported rice marketing in south-south Nigeria that cost of transportation ranked first of all the problems of marketing identified in the area. Of all the problems identified, high cost of transportation ranked first (28.2%). This is followed closely by deplorable road network of 24.6%. This is not surprising as bad road will cost result in hike in fare paid in moving rice commodity from farm to the various selling points. Inadequate credit facilities ranked 3rd at 19.4% because commercial lending institutions do not encourage marketers to obtain credit facilities due to high risk and uncertainties embedded in rain-fed agriculture, price instability 15.9% while Long distance from farm to market was the least identified constraint at 11.9%. This is corroborated by the study conducted by Bassey *et al.* (2013) on intermarket performance and pricing efficiency of imported rice marketing in south-south Nigeria that cost of transportation ranked first of all the problems of marketing identified in the area.

5. Conclusion and Recommendations

5.1 Conclusion

The study examined the pricing efficiency of rice marketing in North central zone of Nigeria. The result on spatial pricing efficiency revealed that consumers were void of exploitative behavior of middlemen in most of the markets except in Owode market were there was minimal competition which led to the exploitation of consumers by the middlemen. Price correlation analysis result revealed a strong co-movement of rice prices within the two States. The result of summary statistics implied that rice prices were lower in Niger State than Kwara State. In addition, the wide margin between the minimum and maximum prices revealed a high degree of instability of rice prices in the area. The t-test result showed that there was a high degree of market integration and free flow of marketing information among the markets in the area. All the included cost components affected rice prices in the study area with an estimated R^2 of 98.3% and 42% for Kwara and Niger States, respectively. The F- ratios of 763.78 and 3.628 showed that the joint determination of the explanatory variables was significant at 1% level. The positive regression coefficients of most of the cost components of the explanatory variables show that an increase in these variables will lead to increase in the price of rice in the area. The constraints facing rice marketing in the area were cost of transportation, price instability, bad road, inadequate credit facilities and distance from the farm to markets. In conclusion, spatial pricing efficiency of rice marketing in the study area can be described as inefficient, most of the included explanatory variables affected rice prices in the study area though in Niger State only 42% of the observed variations were explained by the included explanatory variables and finally, high cost of transportation fare posed the greatest challenge to rice marketing in the study area.

5.2 Recommendations

Based on these results, it is recommended that local government authorities should assist in the provision of more market outlets especially in Owode market so as to increase competition while eliminating the exploitative behavior of the marketers. Government should ensure improvement of the operational environment of the marketers through the rehabilitation of feeder roads as well as construction of new roads to aid easy access to rural markets thereby drastically reducing transfer costs involved in the movement of rice across spatially separated markets.

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Table 1: Annual Price Spread of Rice (₦/Ton) between Niger State and Kwara State

Name of market	Parity price (Ppij)	price /tonne (Pj)	Actual price spread (PPij-Pj)

Owode	1124	468	656
odo-owa	-8155	2690	-10845
Malete	914	1826	-912
Yagba	-7500	3765	-11264
Okeoyi	-9165	2471	-11637

Source: Authors'Computation

Table 2: Coefficient of Variation of Retail Prices of Milled Rice in Kwara and Niger States

State	Mean	Standard Deviation	Coefficient of Variation (%)
Kwara	155.28	10.26	6.61
Niger	144.46	6.07	4.20

Source: Authors'Computation

Table 3: Correlation Matrix of Rice Prices between Kwara and Niger States

	Kwara	Niger
Kwara	1.000	0.753***
Niger		1.000

Source: Authors'Computation *** Significant at 0.01 level

Table 4: Summary statistics of rice prices in the study area

Variables	Niger Prices	Kwara Prices
Mean	12720	14165
Median	12000	14000
Minimum	1300	7800
Maximum	25000	27500
Observation	200	200

Source: Authors'Computation *** Significant at 0.01 level

Table 5: Comparative Mean Wholesale Prices of local (milled) Rice between Niger and Kwara States

Variables	Mean	t Stat	P values	t Cal	Decision
Wholesale rice price in Niger State	12720.45	-3.010	0.003	1.966	Rejected
Wholesale rice price in Kwara State	14164.65				

Source: Authors'Computation *** Significant at 0.01 level

Table 6: Factors affecting rice price in the study area

	Kwara		Niger	
Variables	Coefficient	T-values	Coefficient	T-values
Constant	130749.000	24.102***	14165.204	19.397***
Storage cost (X_1)	15221.910	62.844***	0.031	0.532
Transportation cost (X_2)	119.057	1.158	0.011	2.702**
Labour cost (X_3)	34.952	0.314	0.002	0.218
Packaging cost (X_4)	443.711	3.760 ***	0.055	3.186***
Capital cost (X_5)	19.634	0.470	0.013	2.346**
Cost of communication (X_8)	323.535	1.917*	0.22	1.030
	R^2=0.983		R^2=0.420	
	F-Ratio=763.78***		F-Ratio=3.628***	

Source: Authors'Computation***Significant at 1%; **Significant at 5%; *Significant at 10%

Table 7: Constraints to rice marketing in the study area

Problems	***Frequency**	**Percentage (%)**	**Rank**
High transportation fare	71	28.17	1st
Bad road	62	24.60	2nd
Inadequate credit facilities	49	19.44	2nd
Price instability	40	15.87	4th
Long distance from farm to market	30	11.90	5th
Total	252	100.00	

Source: Authors'Computation *Multiple response