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A MARKOV CHAIN ANALYSIS OF PADDY RICE MARKETING IN ADAMAWA STATE, NIGERIA

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Abstract

Many factors such as poor transportation, inadequate capital and credit facilities, problem of supply, the magnitudes and multiplicity of fees arising from market operations and change in climate amounts to price instability which is quite threatening, as participant in rice marketing stand the danger of crashing in their investment if price fall. The study was conducted to predict the future price of paddy rice and described the problems militating against rice marketing. Data were collected from 204 rice marketers using multi stage sampling approach. Markov chain Techniques and simple statistical measures such as tables, means, frequencies and percentages were employed as tools for data analysis. The Markov chain result predicted 2% of the retailers to sell at a price of ≤ ₦4500, 4% to sell at prices between ₦4501 to ₦6500 and 94% to sell at prices above ₦6500 per 100kg bag in distant future. While, in the wholesale category 20% would sell at ≤ ₦4500, 60% would sell at prices between ₦4501 to ₦6500 and 20% would sell a 100kg bag of paddy rice at prices above ₦6500. The study recommends the state and non-governmental organizations to establish a broad common base of information for all economic agents involved in rice marketing chain. This will help policy makers to monitor marketing issues which are paramount in evaluating the outcome of agricultural price policies. The state should reconstruct rural roads for easy transfer of agricultural inputs and good. Financial support and formation of unions would enable the marketers benefit from large scale operation. These will stabilize prices and guarantee adequate returns hence, improved standard of living.

Key words**:** *Markov chain, Paddy rice, marketing*

INTRODUCTION

Rice is an edible grain of the origin *Gramineae* and genus *Oryza*. It is rated as one of the main food for more than 50% of human race globally [3] and the third most cultivated crop worldwide. It is a main calorie generic food for many people [12]. Estimate shows that about 500 million metric tonnes is produced annually from land area of 150 million hectares [20]. The crop is a substantial grain to the extent that most people use it as part of their daily diet particularly in Asian countries and part Africa [11]. The global demand for rice has being on the increase and to meet up with the future challenges production has to increase from annual production of 586 million metric tonnes in 2001 to 756 metric tonnes in 2030 [16].

High rate of increase in urban population is one of the factors responsible for the escalation of demand for rice in black African countries. Urban population in African is projected to increase by 10%, demand for the commodity is expected to grow tremendously [2]. Research has shown that importation of the commodity into African countries has been on the increase. In 2006 alone, Africa imported 32% leaving 68% to the rest of the world [6]. Similarly, 9.68 million metric tonnes, worth more than $5 billion was brought into black African countries in year 2009. Rice has become a necessity now in Africa than in other parts of the globe because of high population growth and rice is

cherished more than it was before [22]. Rice has become one of the Nigeria's leading foods to the extent that its consumption has outpaced production, making Nigeria the world leading importer of rice. In 2010, the total demand for milled rice in Nigeria was estimated to be around 5,000 kg million of which 3,200 kg million kg was produced locally and the deficit was bridged by importation [15].

Studies related to agricultural products prices helps in the upkeep of food availability status. Adequate agricultural marketing set up and its position in ensuring food availability in Nigeria is vital in minimizing post-harvest losses; guarantee sufficient reward to farmers investment and invigorating a boost in agricultural production thereby adding to the level of food availability in Nigeria as a result of appropriate information on prices of agricultural products [18]. Thus, producers will decide on the number of hectares to cultivate bearing in mind the preceding market value. This shows that price dictates the demand and supply of food commodities. If the market value of farm produce increases, the more resolute the eagerness of farmers and agricultural production will expand [23]. Price of farm products in Nigeria is not exempted from seasonal price variation as a result of unpreventable gab between planting period and harvest. Price is lowest at harvest and escalates as season progresses and reaches its peak at planting time [21]. Price instability is a broad obstacle that is caused by many elements, these conjointly, put the marketers at high risk. Although increase market value of goods is heart balm to farmers, volatile price is quite a terrible thing, as farmers and participants in rice marketing stand the danger of crashing in their investment if price fall. The nature of agricultural commodity market is one of the reasons why prices keep fluctuating. Supply is far less than people's need thus, escalated prices. Negative effects of climatic change and problems caused by population increased translates into price volatility in agricultural product market. [13]. Therefore, this study was conducted to analyze paddy rice marketing in the area under study. The objectives studied were:

(i) predict the future price of paddy rice and (ii) identify major constraints militating against rice marketing.

MATERIALS AND METHODS

Study Area

The study area is situated in Northern part of Nigeria on latitude 7^0 to 11^0N and longitude 11^0 to 14^0E. Adamawa state boarders Taraba, Gombe and Borno states [1]. It has boundary with Cameroon republic to the east. The State occupies an area of 38,741 km^2 with about 3,860,023 people inhabiting it [17] using 2.5% growth rate).

Questionnaires were used as instrument for data collection which was distributed to the sampled respondents in the study area. The respondents were selected from each market randomly proportionate to its size. The data for study covered year 2014 and 2015.

Multi stage sampling method was used in choosing the respondents from all the four Agricultural zones of Adamawa State,

Zone 1: Madagali, Michika, Mubi North, Mubi South and Maiha Local Government Areas (LGAs)

Zone 2: Hong, Gombi, Song and Girei LGAs

Zone 3: Fufore, Ganye, Jada, Mayo-Belwa, Toungo, Yola North and Yola South LGAs

Zone 4: Demsa, Guyuk, Lamurde, Numan, and Shelleng LGAs.

Stage two involved purposive sampling technique was employed to select ten famous rice markets in the State. The respondents were categorized into wholesalers and retailers in stage three. The statistic of traders in each category were obtained from market association chairman (Sarkin Kasuwa) and they classified the rice marketers as those that sale in bags (wholesalers) and those that sale in different units of small measures (mudus) as retailers. The final stage was the random selection of 60 wholesalers and 144 retailers proportionate to the number (40%) of respondents in each market.

The Markov chain model was used to predict the distant future monetary value of rice and simple statistics was employed to describe the problems militating against rice marketing.

This study adopted the markov chain model as demonstrated by [5, 8].
The model is expressed as:

$$P = \begin{bmatrix} P_{11} & P_{12} & P_{13} \\ P_{21} & P_{22} & P_{23} \\ P_{31} & P_{32} & P_{33} \end{bmatrix}$$

where: p = transition matrix, P_{11}, P_{12}, P_{13}, P_{21}, P_{22}, P_{23}, P_{31}, P_{32} and P_{33} are prices of rice at different states.

RESULTS AND DISCUSSIONS

Transition Probability Matrix for Price of Rice in Adamawa State

The monetary value of rice in Adamawa State in distant future was forecasted with the aid of Markov chain technique, which uncovers the future monetary value of rice (paddy) per 100 kg. The transition matrix and probability vector was obtained for projected price of rice from two years price: 2014 (t_o**)** and 2015 (t_{o+1}**).** Price was classified into three categories $S_{(i)}$ obtained from the total price of marketers for year 2014 and 2015. The three price categories were designated in the price states $S_{(i)}$ the price states created on the basis of price per 100 kg bag as:
S_1 = Less than or equal to N4,500
S_2 = Between ₦ 4,501 and ₦ 6,500
S_3= Above ₦ 6,500
Table 1 presents t_0 (2014) and t_o+_1 (2015). The first category, ($S_1 = \leq$ ₦4,500), the second category (S_2=N4.501- ₦6,500) and the third category (S_3= >₦6,500).
Q_{11} were the number of marketers who sold less than or equal ₦4,500 in year 2014 and still sold at the same price in 2015.
Q_{12} were the number of marketers that sold less than or equal to ₦4,500 in 2014, but transited to sell at price between ₦ 4,501- ₦ 6,500 in 2015.
Q_{13} were the number of marketers that sold at a value below or commensurate to ₦ 4,500 in 2014 but, advanced to sell above ₦6,500 in 2015.
Q21 were the number of marketers that sold at a price between ₦ 4, 501- ₦ 6,500 in 2014, but fall back to sell at price of ≤ ₦ 4,500 in year 2015.
Q22 were marketers that sold at a price between ₦ 4,501- ₦ 6,500 in 2014 and still maintained the same price in year 2015.
Q23 were marketers that sold between ₦4, 501- ₦ 6,500 in 2014, but proceeded to sell at price above N6,500 in 2015.
Q31 are number of those that sold above ₦ 6,500 in year 2015 but sold at a price of ≤ ₦ 4,500 in 2015.
Q32 were those that sold above ₦ 6,500 in 2014 but fall back to sell at price between ₦ 4,501- ₦ 6,500 in 2015.
Q33 were the number of marketers that sold at price above ₦6,500 in 2014 and maintained the same status quo in 2015.

Projected Price of Rice in Adamawa State

The result obtained from initial probability for year t_0 and t_{0+1} (2014 and 2015) in Table 1 revealed that in the long, 2% of the population of retail rice marketers in Adamawa State would sell their product at ≤ ₦4,500 per 100 kg bag, 4% at range of ₦4,501- ₦ 6,500 per 100 kg and a larger proportion (94%) of the retailers would sell at prices above ₦ 6,500 per 100 kg bag of paddy rice. The results from initial probability for year t_0 and t_{o+1} (2014 and 2015) also unveiled that in distant future 20% of wholesale traders to sell a 100 kg bag of paddy rice at a price range of ≤ ₦4,500, 60% of the would sell at a price range of ₦ 4,501- ₦6,500 and 20% would sell a 100 kg bag of paddy at prices above ₦6,500. The outcome of the long run prices analysis indicates that greater proportion (94%) of retailers would sell 100 kg bag of paddy at prices above ₦6,500 while greater part (60%) of wholesalers would sell at a price range of between ₦ 4,501- ₦6,500 meaning that most retail rice marketers in Adamawa State source their paddy rice from wholesalers at price range of ₦4,501 – ₦ 6,500 and sell at prices above ₦ 6,500. The implication of this result is that: rice traders and producers are likely to obtain favorable price for their products in distant future.
Also there is that likelihood that rice business would be a more profitable venture. So also, in distant future consumers taste is expected to change in favor of rice and rice products. This result is in agreement with [2] which revealed

the consumption of rice to rise considerably in African countries particularly Nigeria.

Table 1. Flow chart for rice price 2014 and 2015 marketing years

Year 2015(t_{0+1})		**Retailer**				**Wholesaler**			
Year 2014(t_0)		S_1	S_2	S_3	Total	S_1	S_2	S_3	Total
	S_1	32	49	63	144	14	20	26	60
	S_2	27	52	65	144	10	22	28	60
	S_3	21	54	69	144	7	24	29	60
	Total	80	155	197	432	31	66	83	180

Source: Field survey, 2015

S_1= ≤ ₦ 4,500, S_2 =₦4,501-₦6,500, S_3= > ₦6,500

Result for retailer: S_1=0.02, S_2=0.04, S_3=0.94

This can be interpreted as 2%, 4% and 94% respectively.

Conformation: 0.02+0.04+0.94=1

Result for wholesaler: S_1 =0.20, S_2= 0.60, S_3=0.20

This can be interpreted as 20%, 60% and 20% respectively.

Conformation: 0.20+0.60+0.20=1

Problems of Rice Marketing

Results in Table 2 indicate problems militating against rice marketing efficiency. These constraints hinder effective marketing system. The main problem confronting marketers in Adamawa state is inadequate transportation system. Transportation problems have much dispersion: in some cases there were insufficient vehicles to carry goods from the farm to rural market and from the rural market to towns. In some other, there were no roads or where they exist they are not motorable throughout the year or they are in deplorable conditions and this in turn affect the evacuation of farm produce from rural areas to urban markets thereby making market transportation cost to account for a very significant part of the overall costs. It can be deduced from the result that poor transportation is the behind poor in marketing performance. This is in accord with [7] that most transportation facilities in Nigeria are dilapidated. He pointed out that in almost all rural farm settlements, motorable roads are lacking and where they available, they are either not motorable or are laced with potholes which makes it difficult to get to farm site to evacuate the farm produce. The state of the roads further increases post-harvest losses through damages of farm produce. Similarly [14] mentioned high cost of transportation as one of the major factors rice value in Kano State, Nigeria.

Inadequate capital and credit facilities available to the marketers were grossly inadequate to cater for their marketing needs. This means that lack of or inadequate capital and credit facilities limit the capacity of marketers to take advantage of economies of scale to embark on large scale purchase, transportation, processing and sales of rice which cut down cost and increase income. This result compliments the finding of [19] who attested that low capital is one of the factors militating against rice marketing. Also the result is in consonance with [14, 9] that inadequate credit facilities is a major challenge to agricultural marketing in Nigeria.

Poor market communication system was identified as a major evil hindering effective marketing. Adamawa state rice traders were desirous to be informed about the credit facilities and product prices. Absence of facts about market situation to sellers and buyers could greatly reduce market efficiency. Another implication of this result is that without information on product prices, farmers are likely to be cheated and some middlemen will capitalize on this short coming by offering less attractive prices, a disincentive towards boosting rice production and marketing. The result is in agreement with [10] who stated that poor market information renders marketing system inefficient.

Source of supply serious problem affecting rice traders. Evidence from the study showed that rice is produced on small farms scattered throughout the study area. It is not an easy task to organize and assemble paddy for efficient marketing. Moreover, there may be varieties of rice which could pose problems

for easy pricing. Also the magnitudes and multiplicity of fees arising from market operations affect rice marketers. Fees are charged from whole range of functionaries (warehousing agents, loading agents etc.). In addition, commission agents are charged commission fees on transaction between farmers and buyers. This confirms the work of [4] that high taxes/fees are charged severally along the marketing chain which significantly increases the cost of marketing and causes problem to marketing.

Table 2. Constraint of Rice Marketing

Problems	Frequency	Percentage
Poor transportation system	179	87.70
High cost of transportation	98	48.04
Inadequate capital	83	40.68
Inadequate credit facilities	74	36.27
Poor market communication system	66	32.35
Inadequate storage facilities	48	23.53
Instability of prices	46	22.56
Source of supply	42	20.59
High taxes/levies	31	15.20
Lack of standardization/grading	21	10.29
Poor processing facilities	13	6.37
Total	701*	

Source: Field Survey, 2015 *Multiple responses

CONCLUSIONS

The research predicted that in the long run majority of the wholesalers would purchase rice at the farm gate and dispose to the retailers; then retailers would sell directly to the consumers. Farmers and marketers would also receive relatively good price for their produce and rice trading.

In order to stabilize prices, guarantee adequate returns and improve the standard of living of the market participants the following recommendations:

(i)Government and non-governmental organizations to establish a broad common information base for all economic agents involved in rich marketing chain. This will help policy makers monitor marketing issues which is paramount in evaluating the outcome of agricultural price policies.

(ii)Government and other agencies should construct the rural roads in the State for easy transfer of farm inputs and agricultural goods.

(iii)Financial support and formation of unions would enable marketers benefit from large scale operation.

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