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ANALYSIS OF FOOD-GRAIN STORAGE COST AS A FACTOR FOR SEASONAL PRICE VARIATION IN TWO STATES OF NORTH-WEST NIGERIA

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Abstract

The study analyzed grain storage cost as a factor in explaining seasonal price variation in two states (Kaduna and Katsina) of North-West Nigeria. The food grain markets considered were maize, rice, cowpea and soybeans. The study used both primary and secondary data. The primary data were collected by means of structured questionnaire and focus group discussion to elicit information on grain storage cost, cost of the grains, transportation and other handling costs. The secondary data covered monthly prices of food grains for 96 months (2007-2014). Six markets known for food grains (Giwa, Ikara, Pambeguwa, Funtua, Dandume and Danja) were purposively selected from the two states. Data were analyzed using temporal price model. The study revealed that seasonal price increase exceeded cost of storage for rice (54 out of 56 instances), cowpea (54 out of 56 instances) and soybean (47 out of 56 instances) which provided the opportunity for marketers to make above normal profit. The study recommended that agencies involved in policy formulation should formulate and implement price policy that will curtain unnecessary fluctuations in the price of food grains in Nigeria. There is the need for adoption of value chain system in food grain production so that a platform will be created for all the actors/stakeholders to discuss their problems and reduce price fluctuations in food grain marketing.

Keywords: Food-grain, Storage cost, Seasonal price variation, North-West Nigeria

INTRODUCTION

The volatility in price of agricultural commodities in Nigeria has been attributed to various factors including variances in bargaining power among consumers, cyclical income fluctuation among sellers and consumers, seasonality of production, natural shocks such as flood, pests, diseases, and inappropriate response by farmers to price signals (Gilberts, 1999; Adebusuyi, 2004; Udoh and Sunday, 2007). Short- run fluctuations in agricultural commodity prices occur between production seasons (Cashin and Pattillo, 2000). During harvesting periods, prices of farm product are generally low due to surpluses; in the off season, prices rose due to reduce production and seasonal changes (Akpan, 2002). Hence, agricultural commodity price is one of the major determinants of quantity of

commodities supplied by farmers and demanded by consumers.Product price instability among agricultural commodities is a regular phenomenon in markets across Nigeria (Akpan, 2007).

Storage is the holding of goods from the time of production until when they are needed. Seasonality is a marked characteristic of agricultural production. More than 60% of the agricultural production in Nigeria is done under rain fed condition (Olukosi *et al.,* 2005). Thus products need to be effectively stored overtime to ensure supply during off season because the demand for farm products is relatively constant all year round. Consumers want the same kind of food all the year round and industries must get continuous supply of raw materials. In order to satisfy these needs, commodities must be stored and preserved until when needed, since storage confers on the commodity the utility of time (Olukosi and Isitor, 1990).

Prices observed through time are as a result of a complex mixture of changes associated with seasonal, cyclical, trend and irregular factors. The most common regularity observed in agricultural prices is a seasonal pattern of change. Normally, prices of food grains are lowest at harvest time, rise as the season progresses, and reach a peak prior to the next harvest. The purpose of selling directly to consumers is to reduce the charges for possession utility. Anytime an intermediary is forced to own and hold inventory, it must be financed. These finance charges for possession utility are included in the purchase price of the food grains (Downey and Erickson, 1987).

Maize (*Zea mays*), Rice (*Oryza Sativa*), Cowpea (*Vigna unguiculata*), and Soybean (*Glycinemax*) are among food grains (Ayinde and Adejobi, 2002), whose prices are highly unstable between seasons in Kaduna and Katsina State.

The problem necessitating this study is that food prices have continued to fluctuate with season and other factors thereby making future predictions, production and planning uncertain over the years. Several economic factors have rendered the allocative efficiency of personal disposable incomes of households inefficient due to erratic nature of most of the basic food items in the market. This has also left the farmers with uncertainties about future production. It has also affected government budgets and future plans especially in the long run. It also has effects on forces of demand and supply, factors of production, population, taste, fashion and other multiplier effects on food prices. According to Shelton (2007), the grain crop is a major food crop investment that needed to be protected. Grain quality does not improve in storage, but the initial quality must be maintained. According to Ladele and Ayoola (1997), efficient food marketing system would reduce post-harvest losses, ensure adequate returns to farmers' investment and stimulate expansion in food production thereby enhancing the level of food security in Nigeria. Food marketing is a very important but rather neglected aspect of agricultural development. Traders therefore had to critically embrace effective storage procedures so as to make their grains acceptable to consumers. In Nigeria, food marketing by farmers and their families mostly in the immediate post-harvest period

usually involves a lot of costs. These costs are so high that lowering the costs through efficient marketing system may be as important as increasing agricultural production. Proper storage begins with the condition of the harvested grain, including moisture level and how it leaves the harvester and then is transported and handled. Grain bins should receive a thorough check up and cleaning, including removal of old grains. Ideally it is better to store grains in several small bins rather than a few large ones (Shelton, 2007).

Long term grain storage is profitable (Beranek, 2010) and one of the major factors in determination of grain sales is storage structures. Addition of storage facilities is anticipated to increase marketing flexibility thereby strengthening marketing position. Importance of storage structure in grain marketing is highlighted by Oelke *et al*., (2008) who stated that much grain is damaged during storage and can result in reduced profits. Good storage management is essential to prevent spoilage which is caused by mould growth and insect activity. A properly managed aeration system greatly improves the storability of grains by maintaining a cool, uniform temperature throughout the storage to reduce mould growth, insect activity and prevent moisture migration.

The focus of this study is to analyse food grain storage cost for effective marketing in explaining seasonal price variation of selected markets in kaduna and katsina states

METHODOLOGY

Study Area

Kaduna State is located in the Northern Guinea Savanna ecological zone. The global location of the State is between Longitude 06º00 and 09º00 East of the Greenwich Meridian and also between Latitude 09º00 and 11º30, north of the equator. The state occupies an area of about 48,473.2 square kilometer. The major crops grown in the state includes; maize, sorghum, millet, rice, groundnut, cowpea, soya beans etc. Food grain marketing is one of the major activities engaged in by farmers, middlemen and mainly retailers in almost all markets in the state.

Katsina State covering an area of 23,938 square km is located between latitude $110^{0}08^{0}$N and 130 22^{0}N and longitude 60 52'E and 90 20'E. Agriculture is the backbone of the state's economy as 75 per cent of its people are farmers. Katsina state is blessed with abundant agricultural land and a wide range of crops are grown. These include: guinea corn, soybeans, rice, millet, maize, cowpea, cotton, and groundnut, etc. Food grain marketing is one of the major activities engaged in by farmers, middlemen and mainly retailers in almost all markets in the state.

Sampling Procedure and Sample Size

Multi-stage procedure was adopted for the study. The first stage involved purposive selection of two (2) states; Kaduna and Katsina for the predominance production and marketing of the selected food grains. The second stage involved purposive selection of six (6) markets which are Giwa, Ikara, Pambegua, Funtua, Dan-dume and

Danja markets from Kaduna and Katsina States respectively based on their interactive participation in marketing and storage of the selected food grains across the region (Dahiru, 2013). The third stage involved random selection of 10% of the sampling Frame (1346) of the food grains marketers obtained from the list of Marketers' (wholesalers), through Associations/Union of the marketers in the six markets. A total of one hundred and thirty five (135) wholesalers constituted the sample size for the study. Both primary and secondary data were used for the study. Primary data were obtained through structured questionnaires and focus group discussion to generate the information required for the study.

Analytical Techniques

The following tool was used in the analysis of the data as shown below:

Temporal price model

In economic theory, there should be parity between post-harvest price rise and cost of storing the grains for a perfectly competitive market. However, if a price rise is greater than cost of storing grains; it implies an imperfect and inefficient market which gives room for traders making more than normal profit.

For a perfect market, the expected seasonal price increase is calculated as:

$$E(P_{ti}) = P_{to} + t(R + I + S + D) \quad ------ \quad 1$$

Where:

$E(P_{ti})$ = Expected price per ton of stored grain in i^{th} month.

t = time in months; i = 0, 1, 2,…….i^{th} months.

P_{to} = Price of one tonne of grain stored at harvest; i.e. t = 0.

R = Rent per ton of grain stored.

I = Interest on capital needed for one ton of grain, estimated at one percent per month (Hays, 1977).

S = Cost of storage chemicals used for storing one ton of grain.

D = Depreciation on sacks used in storing one ton of grain estimated to be <5 per month (Hays, 1977).

In a perfectly competitive market, it is expected that seasonal rise in the price of stored grains should be equal to storage cost. The net seasonal rise in price (NSRP) for any period is:

$$NSRP_{ti} = P_{ti} - E(P_{ti}) \quad ---------- \quad 2$$

Where

$NSRP_{ti}$= Net seasonal rise in price in month i.

P_{ti}= price of one ton of grain stored in month i.

$E(P_{ti})$ = Expected price per tonne of stored grain in i^{th} month.

The rule of thumb is that:

i. If the net seasonal rise in price (NSRP) is significantly greater than storage cost, the market is an imperfectly competitive market with an inefficient pricing system.
ii. If the net seasonal price rise is zero, there is existence of perfectly competitive market and an efficient pricing system.

RESULTS AND DISCUSSION

Analysis of storage cost as a factor in explaining seasonal price variation for maize

Table 1 shows the net seasonal rise in maize prices expressed as a percentage greater than (or less than) expected prices across the seven selected markets studied over a period of eight years (from 2007-2014). Maize is usually harvested in September to October and the seasonal price movement showed that high and low points are consisted with the harvest period. In Table 14 the average net increase in maize price at Danja market was about 60% and 58% at Dandume market respectively in 2010.The highest per-unit profits from buying at harvest would have been obtained by selling in January (₦84) and August (₦92) in 2010. However, in this study only in fourteen (14) of the fifty six (₦56) instances for the seven markets studied had the yearly average seasonal increase in maize prices exceed the calculated expected increase (Tables 1). This is an indication that traders might not have been making per unit profit in maize for almost all part of the eight years studied.

Therefore, it is not a rational decision for traders to stored maize all throughout the years speculating for an increase in price because the gross returned to storage is less than the costs of storage. This seems to suggest that in these markets, traders monthly purchases are about equal to monthly sales for maize. This is in line with the researched of Nuhu *et al.,* (2009) who studiedfood grain marketing in Northeast Nigeria, found that traders did not make excess profit in maize particularly those that rented their shops for storage of their grains.

Analysis of storage cost as a factor in explaining seasonal price variationfor milled rice

Table 2 showed that the average net increase in price of rice at Ikara market was (48%) 2007 and (41%) at Danja market 2011. Milled rice is usually harvested in the months of August and September. The harvest per-unit profit from buying at harvest would have been obtained by selling in January (₦54) 2011 at Danja market and April (₦57) 2007 at Ikara market. This seasonal price increases vary considerably among markets and between months within a givenyear. Comparison of the expected and actual price of storage across the seven selected markets in the below Table, shows that in 54 cases out of 56 the computed net seasonal storage returned exceed the costs of storage throughout the study. This implies that the expected price rises is greater than the cost of storing rice and this is an indication that traders made more than normal gain and hence generate more profit. This is also an indication of inefficiency in the marketing systems. Adekanya (1982) supported this in his researched on marketing margins for food, who found that food grains are stored and resale when the price rises to generate excess profit.

Analysis of storage cost as a factor in explaining seasonal price variationfor cowpea

Relationship between the storage cost and the seasonal price variationfor cowpea is presented in Table 3. It was observed in Table 3 that there are significant seasonal variations in the prices of cowpea across the selected markets investigated over a period

of eight years. The gross returns to storage are highest (about 83%) in 2009, followed by 74% in 2008, both at Ikara market. Comparing these figures to the current cost of borrowing capital, 9% per annum, it seems that the returns to storage are high.The harvest per-unit profit from buying at harvest would have been obtained by selling in June (₦142) 2008 and July (₦121) 2008 both at Ikara market.Comparison of the expected and actual price of storage across the seven selected markets in Table 3 shows that 54 out of 56 computed cases, net seasonal storage returned exceed the costs of storage throughout the study. This implies that the marketers are making abnormal profit in the storage of cowpea over the years and hence brings an imperfection and inefficiency in the marketing system. This is in line with the work of Nuhu *et al.,*(2009), in their work on food grain marketing in Northeast Nigeria, observed that there is abnormal profit made in the storage of cowpea.

Analysis of storage cost as a factor in explaining seasonal price variation for soya beans

Table 4shows that the net seasonal rise in price expresses as a percentage greater (or less) than expected price for soybeans from 2007-2011. Soybean is usually harvested in September to October. The average net increase in price of soybeans at Dawanau market was (72%) in 2008 and (45%) at Funtua market in 2011. The harvest per-unit profit from buying at harvest would have been obtained by selling in August (₦115) 2011 at Dawanau market and February (₦45) 2007 at Ikara market. Comparison of the expected and actual price of storage across the seven selected markets as shown in Table 4 shows that there are 47 out of 56 of the computed cases had net seasonal storage returns exceeded the costs of storage in the study. This implies that the traders made abnormal profit and hence encourage them to store the grain in large quantity. This is an indication of inefficiencies in the marketing system across the study area. This is also supported by Hays and McCoy (1977), in their researched on food grain marketing in Northern Nigeria, found that traders made abnormal profit by keeping their grains in shops until when prices rise.

CONCLUSION

The study concludes that seasonal price increases in many parts of the study exceeded the costs of storage, providing the opportunity for those who stored grains to make more profit, even though there is an exception in the storage of maize where the cost of storage exceed the seasonal price increase.

RECOMMENDATIONS

The study recommended that agencies involved in policy formulation should formulate and implement price policy that will curtain unnecessary fluctuations in the price of food grains in Nigeria. Also, there is the need for adoption of value chain system in food grain production so that a platform will be created for all the actors/stakeholders to discuss their problems and reduce price fluctuations in food grain marketing.

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Table 1: Average net seasonal rise in price express as a percentage greater (or less)than expected price from 2007-2014 for maize

MARKETS	YEARS							
	2007	2008	2009	2010	2011	2012	2013	2014
Giwa	8.08	-8.83	-1.33	5.75	-6.08	-5.67	-10.08	-4.25
Ikara	3.58	8.08	-1.92	-4.83	-3.42	-2.58	9.83	-10.33
Pambegua	9.08	-12.08	-4.08	39.75	-4.25	-9.83	-2	-12.25
Funtua	-8.58	-0.17	-2.17	21.92	-4.83	23.33	-7.17	-6.83
Dandume	-1.25	-2	-14.58	57.75	-9.58	-16.67	-17.42	-14.25
Danja	-8.92	-9.25	-8.5	59.92	53.83	-16.25	-20.67	-9

Source: Field survey, 2015

Table 2: Average net seasonal rise in price express as a percentage greater (or less)than expected price from 2007-2014 for milled rice

MARKETS	YEARS							
	2007	2008	2009	2010	2011	2012	2013	2014
Giwa	27.42	27.33	23.67	25.42	16.33	24.25	24.33	5.58
Ikara	48.08	36.08	12.67	35.083	20	20.58	17.67	12.25
Pambegua	25.33	17.58	18.67	12	7.58	11.83	1.083	15.08
Funtua	21.83	20.25	18.92	30.75	23.5	31.08	17.083	24.08
Dandume	21.67	19.92	18.67	26.58	28.17	11.92	12.42	16.08
Danja	22	21.25	18.58	32.33	40.67	34.42	30.67	13.83

Source: Field survey, 2015

Table 3: Average net seasonal rise in price express as a percentage greater (or less)than expected price from 2007-2014 for cowpea

MARKETS	YEARS							
	2007	2008	2009	2010	2011	2012	2013	2014
Giwa	17.42	35.25	56.17	39.25	49.25	69.58	58.42	51.75
Ikara	7.83	74.83	83.92	61.75	75.75	62.42	68.08	16.42
Pambegua	4.08	70.58	49	31.5	41.92	62.83	52	44.83
Funtua	40.33	42.42	48.08	39.17	59.92	53.33	-78.83	-79
Dandume	14.33	12.42	6.25	6.25	7.33	5.92	0.92	4.42
Danja	20.42	63.67	39.5	29	41	36.33	29.58	25.75

Source: Field survey, 2015

Table 4: Average net seasonal rise in price express as a percentage greater (or less)than expected price from 2007-2014 for soybean

MARKETS	YEARS							
	2007	2008	2009	2010	2011	2012	2013	2014
Giwa	-17.08	14.75	-5.75	-21.92	13.33	30	-6.17	37.92
Ikara	-10.5	21.5	-6.08	-13.92	12.17	17.25	-4.67	16.83
Pambegua	12.75	42	0.42	-17.08	39	37.75	-5.25	39.25
Funtua	-21.08	12.67	10.75	-4.58	11.92	38.08	44.25	45.33
Dandume	-29.5	4.58	0.67	-19.5	1.83	23.25	23.17	38.25
Danja	12.08	2	-7.67	4.83	28.5	16.92	10.33	26

Source: Field survey, 2015