ANALYSIS OF INTER-TEMPORAL PRICING EFFICIENCY OF SORGHUM IN GUYUK LOCAL GOVERNMENT OF ADAMAWA STATE, NIGERIA

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ABSTRACT

The study examined inter-temporal pricing efficiency of sorghum in Guyuk Local Government of Adamawa State, Nigeria. Data were collected from both primary and secondary sources. The seasonal price pattern of sorghum from1996-2006 was investigated using index number approach through the use of simple regression analysis. Average monthly storage cost of sorghum was estimated from the primary data collected. The findings revealed that female marketers dominated sorghum marketing in the study area and had one form of formal education or the other. Their marketing capital was mainly from personal savings with an initial investment capital of less that N10,000. There was the existence of seasonal variation in the price pattern of sorghum with an average monthly price rise of 8.97%, with September being the peak period and March being the lowest. Also, marketers were found to be efficient in sorghum marketing as revealed by the average monthly storage cost exceeding average monthly price rise of the commodity, thus establishing the existence of inter-temporal pricing efficiency.

Keywords: Inter-temporal pricing efficiency, guinea corn, Guyuk, Adamawa State, Nigeria.

INTRODUCTION

Sorghum is grown mainly in the semi-arid areas of the tropics, and is the fifth in importance among world's cereals (Doggett, 1996). Its production cycle allows for seasonal price behavior or variation. The crop is planted and harvested at particular times with the implication that the harvest must suffice for the entire year, as substantial part is usually stored for later use in the year. The price of the commodity like other agricultural commodities is usually low at harvest but rises gradually with storage cost until the next harvest brings down the price. Variation across years in the seasonal price spread of sorghum arises mainly from market forces of demand and supply, speculative activities of middlemen and dichotomous nature of the areas of production and consumption. This variation is a central factor in determining household food security, as sorghum is a staple food of many households.

Efforts to satisfy the wishes of consumers with respect to space, form and time are among the marketing functions performed by middlemen. Pricing efficiency studies attempt to appraise the system by comparing actual prices with the ones that are generated by perfectly competitive markets (Bressler and King, 1970). Price differentials among markets do not result from planned manipulation as is the case with monopolistic and

monopsonistic conditions, but rather from imperfections inherent in the marketing system which make effective arbitrage difficult. In highly competitive markets, temporal arbitrage should reduce price differential between markets to the level of storage cost (Lutz *et al.*, 1995; Afolami, 2002). If the difference in price over time is greater that the storage cost, it is an indication of pricing inefficiency.

Researchers have criticized the performance of food markets in developing countries over the years. In the light of Anthonio (1984), Harrison (1985) and Ejiga (1988), some of these criticisms include: speculative activities of middlemen to the detriment of consumers and farmers, high cost of marketing, products passing through too many middlemen in the marketing channel, insufficient market information, high physical losses incursion during marketing and high transportation cost among others. These factors tend to bring inter-year and inter-location instability in prices, where both food producers and consuming households have to adjust their net sales and storage strategies to achieve profit maximization and food consumption objectives respectively.

This paper examines whether or not there is temporal pricing efficiency in the marketing of guinea corn in Guyuk area of Adamawa State since marketing is an integral part of the peoples' lives, and sorghum is their staple food. The benefit of this work lies in providing information on whether middlemen exploit consumers and producers in the course of performing the marketing function of storage.

METHODOLOGY AND DATA

Guyuk Local Government is situated in the south-west of Adamawa State and lies between latitude 9⁰30′ to 10⁰00′ east and longitude 11⁰30′ to 12⁰00′ north. The area has seven districts where the major markets are located. These are Banjiram, Bobini, Chikila, Dumna, Guyuk, Kola and Kurnyi. The local markets exhibit periodicity in their operations where the times spacing allows for sufficient demand-build up for the products traded.

Seasonal price pattern of sorghum was investigated using index number from 1996-2006. The data used were average monthly retail commodity price in naira/kg obtained from the Monitoring and Evaluation unit of the Adamawa Agricultural Development Programme. Twenty markers of the commodity were randomly selected in each of the five district markets purposively sampled for this study. These are Chikila, Banjiram, Bobini, Kurnyi and Guyuk. This formed the basis for primary data collection.

In calculating the seasonal price pattern, monthly price index numbers (Im), defined as the ratio of average monthly price (Pm) to average annual price (Py) multiplied by 100 i.e. (Pm/Py x 100) for each year was calculated. From these values, the seasonal price indices defined as $\sum Im/n$, where n is the number of years of data used, were investigated. Average monthly seasonal price rise was obtained from the seasonal monthly price indices.

Simple regression analysis (as used by Afolami, 2002) was used to investigate seasonal price rise of sorghum. The model is expressed as;

$$P_t = \alpha + \beta T + U_t \text{-----------------------------} (1)$$

where:

P_t = Price per kg of commodity in time t

T = Trend variable for months, serially numbered as 1,2,3,----n starting from the month with the lowest index number is January, 1996.

α and β = Intercept and slope parameters, respectively. The *apriori* expectation is that β is greater than zero.

U_t = Random error term which is assumed to be normally distributed with zero mean and a constant variance

Next, the storage cost per ton/month for sorghum was estimated from the primary data collected from 25 wholesalers of the commodity in 2007. These estimates were compared with commodity price rise per month, estimated from the regression equation (1), after adjusting monthly price rise in N/kg to N/ton.

The elements of storage cost in N/ton/ month considered are:
  i. Rent on storage facilities
  ii. Cost of empty sacks used for storing commodities
  iii. Cost of chemicals used in preservation
  iv. Handling cost
  v. Losses in storage due to weight loss resulting from damages caused by pest and diseases. Storage losses were based on assumption of weight loss of 5% of product value (Afolami, 2001).

The average storage cost for the commodity for each marketer is reported and compared with average monthly commodity price rise to reach decision on inter-temporal pricing efficiency.

RESULTS AND DISCUSSION
a. Socioeconomic characteristics of sorghum marketers:

The socioeconomic characteristics of sorghum marketers in the study area reveals that majority (61%) of them are relatively young, with mean age of 37.5 years. Marketers' age determines the type of marketing function to be performed, where younger marketers are more likely to be efficient in labour tasking jobs such as assembling and loading/offloading of produce. The marketers are mostly if the female gender which is attributed mainly to the culture of the area. Men are mostly involved in production while women are into marketing.

Majority (87%) of the respondents acquired one form of formal education or the other, which is an incentive to effective communication and also useful in devising strategies to enhancing efficient marketing system. The marketers have average household size of seven persons and with a mean marketing experience of eight and half years. This marketing experience would to a large extent affect their marketing decisions, customer- relationship, marketing exposure and making information. Okereke and Anthonio (1988) obtained a positive relationship between experience in trade and volume of sales. Main source of marketing capital is from personal savings (76%), although interest-free loans from relations and friends accounted for 20% of the capital. Initial marketing capital outlay by most marketers (62%) was less than N10,000 hence sorghum marketing in the study area is mostly undertaken in the form or retail.

Table 1: Socio-economic characteristics of sorghum marketers

Category	Frequency	Percentage	Mean
Age (years)			
10-19	01	01	
20-29	10	10	
30-39	50	50	37.5
40-49	32	32	
≥ 50	07	07	
Total	100	100	
Sex			
Male	37	37	
Female	63	63	
Total	100	100	
Educational level			
Non-formal	13	13	
Primary school	43	43	
Secondary school	34	34	
Tertiary level	10	10	
Total	100	100	
Household size			
1-5	46	46	
6-10	49	49	7.2
>10	05	05	
Total	100	100	
Marketing experience (years)			
<10	68	68	
10-19	23	23	8.5
>19	09	09	
Total	100	100	
Source of marketing capital			
Personal savings	76	76	
Loans from relations/friends	20	20	
Loan from bank	02	02	
Cooperative associations	02	02	
Total	100	100	
Initial capital (N)			
<10,000	62	62	
10,001-20,000	25	25	9,254.36
>20,000	13	13	
Total	100	100	

Sources: Field survey, 2007

b. Seasonal Price Pattern

The result of the seasonal price pattern of sorghum using index number approach is presented in Table 2.

Table 2: Seasonal Price indices for sorghum in Guyuk from 1996-2006

Months	Price Indices
January	84.15 (4.28)
February	87.21 (3.11)
March	84.03 (6.32)
April	92.47 (3.02)
May	95.13 (6.54)
June	96.89 (3.22)
July	106.04 (5.28)
August	112.65 (4.46)
September	118.06 (4.22)
October	114.32 (3.21)
November	117.88 (4.02)
December	113.17 (6.14)

The measure of seasonal movement in price of sorghum from 1996-2006 (derived from Table 2) is presented in Table 3. The result of the regression model is presented thus:

$P_t = 3.323 + 0.299T$

   (3.985)* (10.801)*

F – statistics = 116.643*

*- Denotes significant at 1%

R^2 (Coefficient of determinant) = 0.477

Figures in parenthesis are corresponding t-statistics

This result shows that the intercept and the slope coefficients are significant at 1 percent level. The explanatory power of the model as revealed by R^2 value of 0.477, indicates that only 47.7 percent if the variation in the seasonal price rise of sorghum in the study area is explained by trend variable. The statistical significance of the slope parameter at one percent confirms its reliability in estimating commodity price rise. The over all model is significant 1 percent level as revealed by the F-statistics. Since the unit of measurement of price is in N/kg, the slope coefficient of 0.299 translates to a price rise of N0.299 per kilogramme per month, and which further translates to an average price rise of N299/tone/month.

The intercept value on the other hand represents the average price of the commodity after adjustment has been made for trend. The ratio of slope coefficient (price rise per month) to intercept value multiplied by 100, give the percentage commodity price rise, over and above average price. From the regression analysis the percentage price rise per month over and above average price rise was computed to be 9 percent which is comparable with that obtained using index number approach i.e. 8.97 percent.

Table 3: Measures of seasonal movement in price of sorghum from 1996 -2006

Seasonal Index High month Low month	Months between seasonal low and high prices	Total Rise in Seasonal Price (%)	Average monthly rise in seasonal price (%)
September March	Six	53.82	8.97

Source: Computed from Table 2 and regression analysis

c). Pricing Efficiency

the average monthly storage cost is estimated to be N4,125 per ton, and is higher than average monthly price rise of N299/tone. This indicates efficiency in the pricing system of sorghum in the study area. Marketers may not recoup investments made in order to engage in inter-temporal arbitrage, and the issue of making profit (or excessive profit) does not arise, but sustaining the system. This supports the findings of Afolami (2002). The location of the study area coupled with the attached to sorghum might have been responsible for this. Table 4 presents the average monthly storage cost of sorghum in Guyuk local government.

Table 4: Average monthly storage cost associated with sorghum marketing

Cost items	Cost (N)
Rent per month	1,000
Empty sack at N70/bag for 30 bags	2,100
Storage chemicals (phostoxin tablets)	400
Handling cost	500
5% weight loss valued at wholesale price of N3,500/tone	175
Total	**4,125**

Source: Field survey, 2007

SUMMARY AND CONCLUSION

The study revealed the existence of inter-temporal pricing efficiency in the marketing of sorghum in Guyuk Local Government Area of Adamawa State. Most of the Marketers were female, and used their personal savings in sorghum marketing. There is a seasonal variation in the price pattern of sorghum with an average monthly price rise of 9% during the 11-year period studies. On the pricing efficiency, marketers were found to be efficient as indicated by the average monthly storage cost (N4,125) exceeding average monthly price rise of the commodity (N299/tonne). Traders cannot even recoup investments made and the issue of making profit does not even arise.

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