



INTER-TEMPORAL PRICING EFFICIENCY OF AFRICAN LOCUST BEAN (*Parkia biglobosa* Benth.) IN SEMI-ARID REGION OF NIGERIA

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ABSTRACT: The study examined Inter-temporal pricing efficiency of African locust bean in Semi-arid Region of Nigeria. Data were collected from both primary and secondary sources. Purposive and random sampling techniques were employed in the study, where five markets were purposively selected and forty marketers were randomly selected in each market. The seasonal price pattern of African locust bean from 2016-2020 was collected and analyzed using index number approach using simple regression analysis. Average monthly storage cost of African locust bean was estimated from the primary data collected. The findings revealed that female marketers dominated African locust bean 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 than ₦ 25, 000. There was the existence of seasonal variation in the price pattern of African locust bean with an average monthly price rise of 9.09%, with September being the peak period and March being the lowest. The result further indicated efficiency in the pricing system of African locust bean as average monthly storage cost exceed average monthly price rise of the commodity, thus establishing the existence of inter-temporal pricing efficiency.

Keywords: Inter-temporal pricing efficiency, African locust bean, Semi-arid region, Nigeria

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1. INTRODUCTION

Parkia biglobosa commonly known as African locust bean is a perennial deciduous tree belonging to the family fabaceae, grown in both temperate and tropical areas (Elima, 2018). *Parkia biglobosa* is an essential spice in most African dishes as result of its abundant nutritional value of vitamin A, protein (Amino acid) and its pleasant aroma (Audu, 2017). The high cost of animal protein has directed interest towards several leguminous seed proteins as potential sources of vegetable protein for human food and livestock feed. Among the plant species, grain legumes are considered as the major source of dietary proteins. They are consumed worldwide, especially in developing and under developed countries where consumption of animal protein may be limited

because of economic, social, cultural or religious factors (Elima, 2018)).

Parkia biglobosa production cycle allows for seasonal price behaviour or variation. It is 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 Non-Timber Forest Products (NTFPs) 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 *Parkia biglobosa* arises mainly from market forces of demand and supply, speculative activities of intermediaries and dichotomous nature of the areas of production and consumption. This variation is a central factor in determining household

food security as *Parkia biglobosa* is a potential sources of Vegetable protein of many households.

Efforts to satisfy the wishes of consumers with respect to space, form and time are among the marketing functions performed by intermediaries. 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; Adu, 2017).

If the difference in price over time is greater than 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 Annie (2014), Harrison (2005) and Elima (2018), some of these criticisms include: speculative activities of middlemen to the detriment of consumers and producer, 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 African locust bean in Semi-arid region since marketing is an integral part of the peoples' lives, and African locust bean is one of the condiment use in cooking their 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.

2. METHODOLOGY

2.1 Study Area

The study was conducted in Maiduguri, Borno State of Nigeria. It has a total landscape of about 50,778 square meters, that lies roughly within latitude 11° 30' to 12°00' North and longitude 13°00' to 13°30' East. It is located within the semi-arid zone of West Africa and Sudan savanna zone of northern Nigeria at an elevation of about 35metres above sea levels. It shares common boundaries

with Konduga Local Government to the North and the Northwest, Jere Local Government to the south. The population was estimated at 521,492 (NPC, 2006). Maiduguri has an annual rainfall of about 300 – 700mm which commences from June to September with an annual temperature of between 28–40° (BOSADP, 2010). The rainy season lasts for about 3 – 4 months in a year and it normally starts in June and ends in September with very few or rare case of rain starting in May. The dry season is usually long and very hot. The driest months are March and April while the coldest months are December and January. The mean relative humidity at noon fluctuates between 5% in December to January and 45% in July to August (BOSADP, 2010). Maiduguri is inhabited by people from diverse ethnic group dominant by Kanuri, Babur-bura, Marghi, Shuwa-arab and others such as Fulani, Yoruba, Igbo etc. the major occupation in Maiduguri is trading in which African lust bean production is not an exception.

The local markets exhibit periodicity in their operation, where the time spacing allows for sufficient demand-build up for the products traded. Seasonal price pattern of African locust bean was investigated using index number from 2016-2020. The data used were average monthly retail commodity price in naira/kg obtained from the Monitoring and Evaluation unit of the Borno Agricultural Development Programme.

2.2 Sampling Techniques

Purposive and random sampling techniques were employed in this study. Forty marketers of the commodity comprising of ten wholesalers and thirty retailers were randomly selected in each of the five district markets that were purposively sampled for this study. These are Tasha Bama, Monday Market, Bulukutu, Tasha Baga and Bolori. This formed the basis for primary data collection. Thus, fifty wholesalers, one hundred, and fifty retailers formed the sample size.

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 ie $(Pm/Py \times 100)$ for each year was calculated. From these values, the seasonal price indices defined as elm/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 Zira *et. al.*, 2020) was used to investigate seasonal price rise of *Parkia biglobosa*. The model is expressed as;

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

Where:

Pt = 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 i.e. January, 2016.

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

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

The storage cost per ton/month for *African locust bean* was estimated from the primary data collected from the wholesalers of the commodity in 2020. These estimates were compared with commodity price rise per month, estimated from the regression equation (1), after adjusting monthly price rise in ₦/kg to N/ton.

The components 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 (Audu, 2017). The average storage cost for the commodity for each marketer is computed and compared with average monthly commodity price rise to reach decision on inter-temporal pricing efficiency.

3. RESULTS AND DISCUSSION

3.1 Socioeconomic characteristics of African locust bean Marketers

The socioeconomic characteristics of African locust bean marketers in the study area reveals that majority (62%) of them are relatively young, with mean age of 37years. 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 were mostly of the female gender, which is attributed mainly to the culture of the area. Men were 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 largely affect their marketing decisions, customer relationship, marketing exposure and marketing information. Obe and Annie (2018) obtained a positive relationship between experience in trade and volume of sales. Main source of marketing capital is from personal savings (75%), although interest-free loans from relations and friends accounted for 21% of the capital base. Initial marketing capital outlay by most marketers (63%) was less than ₦25, 000 hence African locust bean marketing in the study area is mostly undertaken in the form of retail.

This result shows that the intercept and the slope coefficients are significant at 1% level. The explanatory power of the model as revealed by R² value of 0.498 indicates that only 49.8 % of the variation in the seasonal price rise of African locust bean in the study area is explained by trend variable. The statistical significance of the slope parameter at 1% confirms its reliability in estimating commodity price rise. The overall model is significant at 1% level as revealed by the F statistics. Since the unit of measurement of price is in N/kg, the slope coefficient of 0.389 translates to a price rise of N 0.389 per kilograms per month, and which further translates to an average price rise of N389/ton/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, gives 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 % which is comparable with that obtained using index number approach i.e. 9.09 %.

Table 1: Socioeconomic characteristics of African locust bean marketers

Category	Frequency	Percentage	Mean
Age (years)			
10-19	04	02	
20-29	18	09	
30-39	102	51	37.0
40-49	62	31	
≤ 50	14	07	
Total	200	100	
Sex			
Male	76	38	
Female	124	62	
Total	200	100	
Educational Level			
Non-formal	28	14	
Primary school	84	42	
Secondary school	70	35	
Tertiary level	18	09	
Total	200	100	
Household size			
1-5	90	45	
6-10	100	50	7.5
>10	10	05	
Total	200	>100	
Marketing experience (years)			
<10	138	69	
10-19	44	22	8.0
>19	18	09	
Total	200	100	
Source of marketing capital			
Personal savings	150	75	
Loans from relations/friends	42	21	
Loan from Bank	04	02	
Cooperative associations	04	02	
Total	200	100	
Initial capital (₦)			
<25,000	126	63	
25,001-50,000	50	25	8,751.23
>50,000	24	12	
Total	200	100	

Source: Field survey, 2020

3.2 Seasonal price pattern

The result of the seasonal price pattern of African locust bean using index number approach is presented in Table 2. The measure of seasonal movement in price of African locust bean from 2016-2020 (derived from Table 2) is presented in Table 3. Figures in parenthesis are corresponding t- statistics

The result of the regression model is presented thus:

$$P_t = 4.211 + 0.389T$$

$$(4.874)^* (11.699)^*$$

$$F\text{- statistics} = 116.643^*$$

* - Denotes significant at 1%

$$R^2 \text{ (Coefficient of determination)} = 0.498$$

Table 2: Seasonal price indices for *Parkia biglobosa* in Semi-arid region from 2016-2020

Months	Price	Indices
January	89.65	(5.17)
February	92.72	(4.09)
March	89.54	(7.21)
April	97.98	(4.91)
May	100.64	(7.43)
June	102.15	(4.11)
July	111.55	(6.17)
August	118.06	(5.35)
September	123.57	(5.11)
October	119.83	(4.19)
November	122.39	(5.91)
December	118.72	(7.03)

Table 3. Measures of seasonal movement in price of *Parkia biglobosa* from 2016-2020

Seasonal High Month - Low Month	Months Between low and High Price	Seasonal Total rise in price (%)	Average monthly rise in seasonal price (%)
September - March	Six	64.71	9.09

Source: Computed from Table 2 and regression analysis

3.3 Pricing Efficiency

The average monthly storage cost is estimated to be ₦8,150 per ton, and is higher than average monthly price rise of ₦389/tonne. This indicates efficiency in the pricing system of African locust bean 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 of sustaining the system. This supports the findings of Audu (2017). The location of the study area coupled with the value attached to African locust bean might have been responsible for this. Table 4 presents the average monthly storage cost of African locust bean in Semi-arid region of Nigeria.

Table 4: Average monthly storage cost associated with *Parkia biglobosa* marketing

Cost items	Cost (₦)
i). Rent per month	2,000
ii). Empty sacks at ₦140/bag for 30 bags	4,200
iii). Storage chemicals (phostoxin tablets)	800
iv). Handling cost	900
v). 5% weight loss valued at wholesale price of ₦5,000/tonne	250
Total	8,150

Source: Field survey, 2020

4. SUMMARY AND CONCLUSION

The study revealed the existence of inter-temporal pricing efficiency in the marketing of African locust bean in Semi-arid region of Nigeria. Most of the marketers were female, and obtained their capital from informal source of financing. There is a seasonal variation in the price pattern of African locust bean with an average

monthly price rise of 9% during the five year period studied. The result further indicated efficiency in the pricing system of African locust bean as average monthly storage cost exceed average monthly price rise of the commodity, thus establishing the existence of inter-temporal pricing efficiency. Traders cannot even recoup investments made and the issue of making profit does not even arise.

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