NIGERIAN AGRICULTURAL JOURNAL
ISSN: 0300-368X
Volume 53 Number 3, December 2022 Pg. 243-248
Available online at: http://www.ajol.info/index.php/naj
https://www.naj.asn.org.ng

Spatial Pricing Efficiency of Palm Kernel Markets in Southeast, Nigeria

Nse-Nelson, F. A., Obinna, L. O., Mmerife, R.P. and Oke, U. R.

Department of Agricultural Economics, Michael Okpara University of Agriculture, Umudike, Nigeria
Corresponding Author's email: floxynse@gmail.com

Abstract
The study examined spatial pricing efficiency of palm kernel markets in Southeast, Nigeria. A multi-stage sampling technique was adopted in sampling 120 palm kernel marketers for the study. Data were collected using structured questionnaire and analyzed using descriptive statistics, spatial price model and Pearson correlation matrix. Socioeconomic characteristics of the marketers showed a mean age of 48 years, majority (59.2%) were females, with many (69.2%) married. Mean household size of 7 persons was recorded and they all had formal education. Mean marketing experience of 12 years was recorded from the study and half (50%) do not belong to any market unions. Quite a number (75%) of the marketers use personal savings as source of finance for the palm kernel business. There was positive price spreads in all the market pairs which suggest inefficiency in palm kernel marketing in the study area. There were also significant differences in the average price of palm kernel between the urban and rural market pairs. Positive correlation coefficient values were recorded between the market pairs which suggest symmetry and co-movement of prices between the urban and rural markets. The study recommends that credit facilities should be advanced to the marketers and that there should be provision of more market outlets in the area to increase competition within the markets.

Keywords: Spatial, efficiency, palm kernel, markets

Introduction

Palm kernel is a by-product of the oil palm industry which has great potential as a source of oil and dietary protein, high in demand as its extracts serve a lot of purposes. Palm kernel oil is refined into edible vegetable oil. The market for palm kernel is very large because 70% of the edible vegetable oil consumed in Nigeria is made from refined palm kernel oil (Mahmood and Azuaga, 2021). The oil is also used in the confectionery, cosmetics and pharmaceutical industries. After the palm kernel oil has been extracted, the dried kernels are crushed into palm kernel cake which is used for production of livestock feed (Onoja and Ogali, 2014; Nze *et al*., 2021). Palm kernel provides one of the leading vegetable oils produced globally, accounting for one-quarter of global consumption and approximately 60 percent of international trade in vegetable oils (World Bank, 2015).

Pricing efficiency studies attempt to evaluate the system by comparing actual prices with the ones that are generated by the perfectly competitive market. Under this theoretical construct, we expect that an efficient market will establish prices that are interwoven through space by transportation costs, form by costs of processing, time by costs of storage, and competition of middlemen by the size of their net returns. Pricing efficiency is the ability to choose the level of inputs that maximizes returns given factor prices. Pricing efficiency helps us to determine the mark up earnings accruing to marketing intermediaries as well as determining the extent of marketing efficiency (Oladapo *et al*., 2007). Spatial price analysis examines how prices in different markets over space (in different locations) are related especially through transportation and handling costs of transfer. Spatial price analysis gives indication of potential profit margin and it is a means of assessing the level and direction of market integration (Ani *et al*., 2017). In other words, spatial price analysis aims at achieving same prices for homogenous commodities at different locations after accounting for transportation and other marketing costs (Ojo *et al*., 2016). Palm kernel wholesale marketers purchase palm kernel from small holder producers and marketers. They assemble and store the produce over time to ensure supply during off-season.

Njoku and Obasi (2009) and Nwibo and Odoh (2014) worked on spatial price analysis of palm oil by using only pricing efficiency. These studies barely analyzed

the effect of prices across different locations and in different markets separated by few kilometers. Having realized the fact that prices vary considerably between different market locations, it is therefore important to examine and measure the price differences between palm kernel markets in Southeast, Nigeria. The objectives of the study is to describe the socioeconomic characteristics of the marketers; estimate spatial price efficiency of palm kernel markets and lastly determine the correlation between the rural and urban palm kernel market prices in Southeast, Nigeria.

Methodology

Study Area

The study was conducted in Southeast Nigeria, which is located between latitudes 4°10' and 7°8' North of the equator and longitudes 5°30' and 9°27' East of the Greenwich meridian. Southeast comprises five (5) states namely Abia, Anambra, Ebonyi, Enugu and Imo. The population of the zone is 32,952,778 or 22.46% of the total population of Nigeria (NPC, 2016; NBS, 2016). The choice of Southeast Nigeria as the study area is based on the fact that oil palm is the most important economic tree crop grown by the people. A multi-stage sampling technique was adopted for the study. The first stage was the random selection of three states which were Abia, Enugu and Imo. The second stage involved a random selection of two (2) agricultural zones from each of the three states. The third stage was a purposive selection of two (2) markets known for large supply of palm kernel from each of agricultural zones. Purposive selection of the markets was based on major markets in the urban and rural areas with high activities of palm kernel wholesalers. This gave a total of 12 (twelve) markets for the study. The markets were Ahia ohuru, Itungwa market, Ubani market and Ndoru market for Abia State; Relief market, Nkwo Orodo market, Orlu international market and Afo Umuaka market for Imo State and Ogbete market, Orie Ugwogo, Eke Agbani and Ugbawka for Enugu State. Ten (10) palm kernel wholesalers were randomly selected from the twelve (12) markets giving a total of one hundred and twenty (120) respondents. Palm kernel wholesale marketers sell in 50 kg bags. They buy in bulk and keep in stock to sell during price increase. Panel data was used for the study which was collected from palm kernel marketers with the aid of structured questionnaire. Data were collected on socio-economic characteristics of the respondents and also on selling price, handling cost, assembling cost and finally transportation cost for a period of 5 months from June to October, 2019. Data collected were analzyed using descriptive statistics, spatial price model and Pearson correlation matrix.

Spatial price model is specified as:

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

Where:

PP_{ij}= Calculated parity price of palm kernel from the i^{th} market (urban market) in relation to the j^{th} markets (rural market) (N)

P_i= Actual wholesale price for palm kernel at the i^{th} (urban) market (N)

TC_{ij}= Transport cost for moving palm kernel from the j^{th} to the i^{th} market (N).

HC_{ij} = Handling cost involved in moving palm kernel from the j^{th} to the i^{th} market (N)

HC_{ij} = Charge for the assemblers' service in moving the palm kernel from the j^{th} to the i^{th} market (N)

The actual price spread between the two markets would be:

$$PS_{ij} = PP_{ij} - P_j \ldots . (2)$$

Where:

PS_{ij}= Price spread of oil palm kernel between the i^{th} and the j^{th} market (N)

Pp_{ij} = Calculated price of oil palm kernel from the i^{th} market (urban market) in relation to the j^{th} markets (rural market) (N)

P_j= Actual wholesale price of oil palm kernel in the j^{th}(rural) market

In a perfectly competitive market, when palm kernel is moving from j^{th} (rural) to i^{th} (urban) market, the calculated price (PP_{ij}) would always be equal to the rural price (P_j) and the price spread (PS_{ij}) will be equal to zero. The decision rule is that, positive price spread means the wholesalers are making more than normal profit. If the price spread is zero, they are making just normal profit, which can only exist for perfect and efficient market. If the price spread is negative, the wholesalers are making a loss. Positive price spread indicates value greater than transfer cost while negative price spread indicates value less than transfer cost. To test for the linear and symmetric association between market pair prices of palm kernel in Southeast, the Pearson correlation coefficients were estimated. Price correlation coefficients were used to examine the strength of price linkages across markets. The formula is as described by Akpan *et al*. (2014) thus;

$$P_r = \frac{n\sum P_{1t}P_{2t} - (\sum P_{1t})(\sum P_{2t})}{\sqrt{\{n\sum P_{1t}^2 - (\sum P_{1t})^2\}\{\sum P_{2t}^2 - (\sum P_{2t})^2\}}} \quad \ldots..(3)$$

Where;

P_r = the correlation coefficient between market selling prices of palm kernel

n = number of observations

P_{1t} and P_{2t} are the prices of palm kernel in the market pairs measured over time t

A significant relationship between the market pair prices will suggest a perfect or symmetric price transmission between the two markets while insignificant association indicates otherwise.

Results and Discussion

The socio-economic characteristics of the marketers are presented in Table 1. From the pooled result, the mean age of the marketers was 48 years. This implies that palm kernel marketers consists mostly middle-aged people who are energetic and active. This is in consonance with (Okere *et al*., 2016) who noted that palm kernel is bulky and requires people who are energetic and strong to handle the produce. More of the

marketers (59.2%) were males and this could be because palm kernel marketing business is strenuous and could only be withstood by men. This is in line with Nze *et al*. (2021) who opined that most times, females are not considered competent like their male counterparts. The result also shows that 69.2% of the marketers were married. This finding agrees with Okere *et al*. (2016) who stated married people engage in economic activities such as palm kernel marketing in order to earn income for their family upkeep. For educational level, average number of years spent in school was 11 years. This implies that they had formal education for about 11 years, which is good because education is vital for the expansion and management of any business. Nwibo and Odoh (2014) noted that as an individual increases his educational level, his managerial ability for business sustainability also increases. The mean household size was 7 persons. This implies a large household size. This finding is in agreement with Agwu *et al*. (2017) who reported that the higher the family size the higher the tendency to get additional helping hands from other members (especially the children) of the household and hence, the possibility of business proliferation. Mean marketing experience of 12 years was obtained and this implies that the wholesalers have some years of experience that could help them to overcome marketing challenges like price and seasonal variations. This is in consonance with Njoku and Obasi (2009) who observed that marketers gain more expertise with the length of time they spend in their business activities. Furthermore, the result shows that 50 percent of the wholesalers were members of market union while 50% were not members. This means that half of the wholesalers enjoy the benefits accruable from market union membership while the remaining 50 percent do not partake from such benefits. This agrees with Onoja and Ogali (2014) who stated that marketers belong to market unions in order to fend off low pricing and collectively tackle other problems facing the palm kernel business. For source of finance, 75 percent of the respondents in the study area use personal savings to start up the business while 25% borrow money from market association. This result is in conformity with Nwankwo (2016) who noted that most marketers finance their business through personal savings.

Spatial price analysis for palm kernel in selected markets in Southeast is presented in Table 2. Result shows positive price spreads in all the market pairs. This positive price spread presents the feature of market imperfections and inefficiency. The average positive spread stood from the lowest value of (₦486.40) in Relief-Nkwo Orodo markets to the highest value of (₦938.59) in Ubani-Ndoro markets. This finding agrees with that of Abubakar (2015) who observed that imperfections in the marketing system results in price differentials greater than zero. The results strongly suggest that the excess price differences between the urban and rural markets did not result from planned manipulation under monopolistic conditions. It is rather a result of imperfection inherent in the market system which is due to certain characteristics of ineffective information which leads to lack of concentration in supply. The correlation matrix result for palm kernel prices in selected markets in Southeast is presented in Table 3. The positive correlation coefficient values showed that increase in the wholesale price in one market led to the price increase in the other market. This result corroborates the findings of Joshua (2015) who noted high correlation coefficients of cowpea prices in rural and urban markets of Kaduna State. Similarly, Orewa and Egware (2012) noted that positive correlation exist between urban and rural garri prices in their study on comparative analysis of rural and urban markets for garri in Edo State, Nigeria. This could be possible due to the transmission of market information by marketers through various means, particularly via the use of mobile phones, aided with the short distance between markets.

Conclusion

Palm kernel markets in Southeast were not spatially efficient since the urban and rural market pairs recorded positive price spreads. Credits should be given to marketers at less stringent conditions. Advancing credits to small-scale marketers could improve distribution of sales and income thereby enhancing the structural efficiency for development of competitive marketing system. Furthermore, there should be substantial benefits in developing better infrastructural facilities to effectively link production centres to market centres. Government should embark on massive construction and rehabilitation of roads for easy evacuation of produce from interior villages to rural and urban markets which can lead to market efficiency on movement of produce between markets.

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Table 1: Socio-Economic Characteristics of Palm Kernel Wholesale Marketers In Southeast

Variables	Abia		Enugu		Imo		Pooled	
	Freq.	%	Freq.	%	Freq.	%	Freq.	%
Age of respondents (years)								
28 – 36	10	25.0	1	2.5	2	5.0	13	10.8
37 – 45	8	20.0	15	37.5	12	30.0	35	29.2
46 – 54	12	30.0	20	50.0	14	35.0	46	38.3
55– 63	9	22.5	4	10.0	8	20.0	21	17.5
64 – 72	1	2.5	0	.0	4	10.0	5	4.2
Total	40	100.0	40	100.0	40	100.0	120	100.0
Mean	45.65		46.90		49.98		47.51	
Sex								
Female	7	17.5	21	52.5	21	52.5	49	40.8
Male	33	82.5	19	47.5	19	47.5	71	59.2
Total	40	100.0	40	100.0	40	100.0	120	100.0
Marital status								
Married	31	77.5	27	67.5	25	62.5	83	69.2
Single	5	12.5	5	12.5	8	20.0	18	15.0
Divorced/Separated	2	5.0	3	32.5	1	37.5	6	5.0
Widow/widower	2	5.0	5	67.5	6	62.5	13	10.8
Total	40	100.0	40	100.0	40	100.0	120	100.0
Educational level (years)								
No formal education	0	0	2	5.0	0	0	2	1.7
Primary school education	8	20.0	14	35.0	10	25.0	32	26.7
Secondary school education	28	70.0	23	57.5	21	52.5	72	60.0
Tertiary education	4	10.0	1	2.5	9	22.5	14	11.7
Total	40	100.0	40	100.0	40	100.0	120	100.0
Average	11.30		9.43		11.63		10.78	
Household size (numbers)								
1 – 3	3	7.5	5	12.5	8	20.0	16	13.4
4 – 6	8	20.0	9	22.5	12	30.0	29	24.2
7 – 9	19	47.5	19	47.5	15	37.5	53	44.2
10 – 12	10	25.0	7	17.5	5	12.5	22	18.3
Total	40	100.0	40	100.0	40	100.0	120	100.0
Mean	7.70		7.10		6.28		7.03	
Marketing experience (years)								
1 – 5	9	22.5	1	2.5	7	17.5	17	14.2
6 – 10	13	32.5	15	37.5	25	62.5	52	43.4
11 – 15	7	17.5	16	40.0	5	12.5	28	23.3
16 – 20	7	17.5	6	15.0	3	7.5	16	13.3
21 – 25	5	12.5	2	5.0	0	0	7	5.8
Total	40	100.0	40	100.0	40	100.0	120	100.0
Mean	13.87		14.27		8.50		12.22	
Market union membership								
No	25	62.5	22	55.0	13	32.5	60	50.0
Yes	15	37.5	18	45.0	27	67.5	60	50.0
Total	40	100.0	40	100.0	40	100.0	120	100.0
Source of finance								
Personal savings	30	75.0	38	95.0	22	55.0	90	75.0
Market association	10	25.0	2	5.0	18	45.0	30	25.0
Bank	0	0	0	0	0	0	0	0
Total	40	100.0	40	100.0	40	100.0	120	100.0

Source: Field survey, 2019

Table 2: Spatial price efficiency of palm kernel in selected markets in Southeast, Nigeria

States and markets	Parity price (Pp_{ij}) (₦)	Price/50kg bag (P_j) (₦)	Actual price spread (PS_{ij}) (₦)	Remark
Abia				
Ubani-Ndoru	15441.63	14503.04	938.59	Inefficient
Ahia Ohuru-Itungwa	14678.54	14089.38	589.16	Inefficient
Imo				
Relief-Nkwo Orodo	13486.59	13000.19	486.40	Inefficient
Orlu int'l-Afo Umuaka	13493.16	13004.14	489.02	Inefficient
Enugu				
Ogbete-Orie Ugwogo	12716.61	12106.14	610.47	Inefficient
Eke Agbani-Ugbawka	12673.49	12001.36	672.13	Inefficient
Combined	**13748.34**	**13117.38**	**630.96**	**Inefficient**

Source: Field survey, 2019

Table 3: Correlation matrix between palm kernel prices in the selected markets in Southeast, Nigeria

Abia State Markets	**Ndoro**	**Ubani**	**Itungwa**	**Ahia Ohuu**
Ndoru	1	0.806**	0.493	0.308
Ubani		1	0.627**	0.893**
Itungwa			1	0.926***
Ahia Ohuru				1
Imo State Markets	**Nkwo Orodo**	**Relief**	**Afor Umuaka**	**Orlu international**
Nkwo Orodo	1	0.977***	0.259	0.845**
Relief		1	0.783**	0.891**
Afo Umuaka			1	0.732**
Orlu international				1
Enugu State Markets	**Orie Ugwogo**	**Ogbete**	**Ugboawka**	**Eke Agbani**
Orie Ugwogo	1	0.998**	0.430	0.336
Ogbete		1	0.276	0.844**
Ugbawka			1	0.969***
Eke Agbani				1
Southeast Nigeria		**Abia State**	**Imo State**	**Enugu State**
Abia State		1	0.808**	0.739**
Imo State			1	0.642**
Enugu State				1

Source: Field survey, 2019

Note: *** represents 1% significant level and ** represents 5% significant level.