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SPATIAL PRICING EFFICIENCY IN ONION MARKETING IN NORTHWESTERN NIGERIA

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ABSTRACT
Spatial pricing efficiency in the marketing of onion in northwestern Nigeria was investigated. Data on onion retail price variations were collected fortnightly for a period of 12 months (June 2002 to May 2003) from 16 market locations, eight each in Sokoto and Kebbi States. Wholesale price variations in two supply markets and four receiving markets in southern Nigeria were collected. Retail price difference between Sokoto and Aliero onion markets and 14 other markets in the two states, wholesale price difference between the two markets and four receiving markets in southern Nigeria were regressed on distance between the market pairs, to arrive at a decision on spatial pricing efficiency. Data for the study were anlaysed suing simple linear regression analysis. The magnitude of the R^2 values, indicated that distance between markets was not an important determinant of price difference between the two onion markets and 14 other markets within the two states. It was however, important between the two markets and the southern markets. Analyses of retail and wholesale price difference between the markets studied based on distance suggested some level of spatial integration for both retail and wholesale markets.

INTRODUCTION

Onion is produced in large quantities in many countries and is traded within and between countries on a significant scale (Currah and Proctor, 1990). Commercial production of onion in Nigeria is limited to the Savannah region of the north, where it is grown mainly as a dry season vegetable under irrigation in the *fadama* areas (Inyang, 1966; Ayodele, 1993).

Agricultural marketing involves the movement of livestock and crops from thousands of scattered small sized farms where they are produced, to the thousands of consumers located in both rural and urban areas (Adegeye and Dittoh,1982). Njoku (1994) observed that the quantity of onion available for consumption and the price paid by consumers depend on how efficiently the marketing system for the commodity functions. A striking feature of onion marketing, according to Azucena (1993) is the price fluctuation due primarily to variation in supply and the non-availability of a system for the delivery of market information. Ejiga (1981) argued that efforts to satisfy the wishes of consumers with respect to space, form and time are among the vital functions of marketing performed by middlemen. Tomek and Robinson (1981) opined that for price integration,

(a) price difference between any two regions or markets that trade with each other will just equal transfer cost.

(b) Price difference between any two regions or markets that do not engage in trade with each other will be less than transfer cost.

Durojaiye and Aihonsu (1988) reported integrated markets as markets between which a stable price differential exists for a commodity and for which relative price for the commodity remain constant. For such markets, prices of commodities do behave independently and differ by no more than the cost of commodity arbitrage. Afolami (2001) was of the view that the key issue for empirical spatial market integration analysis is formed on the degree to which prices of the same commodity between markets can be considered proportional or said to exhibit a stable differential and high correction between market prices. When these conditions are upheld, Afolmi (2001) further noted that market integration, additionally requires the condition of standardization of measures and common

trade habits among the markets. Pricing efficiency analyses how the wishes of the consumers are transmitted as manifested in resultant prices.

This paper examined the spatial pricing efficiency in the marketing of onion in northwestern Nigeria. Onion is in focus because of its position as an important vegetable that is widely utilized and the nature of its marketing which requires the commodity to be moved from production to consumption areas.

METHODOLOGY

The study covered Sokoto and Kebbi State in northwestern (10°40ठ - 13° 55ठ N 3° 30ठ -7°06ठ e) Nigeria (Singh,2000). The two states have a combined population of 4,421,579 (FGN, 1991). The area falls within semi-arid sub-Saharan region, where the mean annual rainfall (400-700mm) is frequently erratic and poorly distributed (Singh,1995). Farming is the major occupation of the inhabitants of the two states. Shaib et al. (1997) reported that northwestern zone contributes 79% of the onion produce in the nation.

Onion retail price collected fortnightly, two onion collection centres one each from Sokoto and Kebbi States and 14 other markets seven each from Sokoto and Kebbi States were used for the study. The onion collection centers considered were Sokoto and Aliero, in Sokoto and Kebbi State, respectively .The 14 other markers used for the study were Gada,Goronyo,Bodinga,Kware, Wurno,Sabon Birini and Tambuwal markets in Sokoto State, while Jega, Birini Kebbi, Argungu, Dodoru, Ambursa; Bayawa and Danko markets were selected in Kebbi State.

Inter-state trading in onion is a major trading activity performed by onion traders in the study area. The process involves buying onion from markets in Sokoto and Kebbi States, and transporting the commodity for sale to different cities across the country. In this study, the supply markets considered were Sokoto and Aliero onion markets in Sokoto and Kebbi State, respectively. The receiving markets were Lagos, Ibadan, Enugu and Aba in southern Nigeria. To reach decision on spatial pricing efficiency, data on onion wholesale price in naira per bag were collected on fortnightly basis from selected supply markets in Sokoto and Kebbi States and selected receiving markets in southern Nigeria

from June 2002 - May 2003. The data collected in naira per bag were transformed to naira per kilogram and used for the analysis. The southern market locations considered were Lagos, Ibadan, Enugu and Aba. Data on distance between the supply and receiving markets were obtained from SOSG (2003).

Based on the assumption that the price difference between any two markets for a given weight of onion transported should be determined by the distance. The regression model estimated is of the form:

$$PD = a + \beta K + u$$

Where PD = Price difference between market pairs (N)

K = Distance between market pairs (Km)

β = Slope parameter estimated

a = Intercept

u = Error term.

The value β represents what is charged per kilogram per kilometer by traders arbitrating over space. It comprises of their profit, cost of loading, unloading, transportation cost and loss in transit. The information is used to arrive at a conclusion as to whether or not, there is spatial pricing efficiency in onion marketing in north western Nigeria. Spatial pricing efficiency is reported when the price difference between spatial markets differ by no more than the cost of commodity arbitrage.

RESULTS AND DISCUSSION

For onion retail price difference between Aliero and other markets, the R^2 values ranged between 0.002 for October 2002 to 0.348 for June 2002 (Table 1). This implies that only between 0.2% and 34.8% of the variation in onion retail prices between Aliero and other markets were explained by the distance between the markets. Similarly, the R^2 values for onion retail price difference between Sokoto and other markets were between 0.010 in November 2002, to 0.193 for April 2003. This implies that only between 1% and 19.3% of the variation in onion retail prices between Sokoto and other markets were explained by distance between them. The results further imply that the explanatory power of the independent variable was weak.

Table 1 further shows that the regression coefficients for of December 2002, January, February and March 2003 were positive but

insignificant, indicating that onion retail prices increased insignificantly with increase in distance between Aliero and other markets for the four months. The coefficients for the remaining eight months were negatively signed indicating a decrease in onion retail price with increase in distance between Aliero and other markets. The decrease was however, insignificant except for June 2002 which was significant ($p<0.05$).The positive coefficients for December 2002, January, February and March 2003 were 0.03451, 0.02366, 0.01357 and 0.003695 respectively with an average value of 0.0189. This implies an average retail price increase of N0.019 per kilogram of onion for every kilometer increase in distance between Aliero and other markets for the months. The value reflects the returns to the traders engaged in onion arbitrage between Aliero and other markets and it covers transportation cost of N0.00062 per kilogram per kilometer, traders' profit per kilogram per kilometer and cost of loading and unloading of N0.00052/kg/km and loss in transit.

Table1   Regression results for retail price difference between two onion collection centres and 14 other markets in Sokoto and Kebbi States (N/kg) on distance between the markets.

Month	Aliero Market			Sokoto Market		
	Intercept(a)	Slope (β)	R^2	Intercept(a)	Slope (β)	R^2
June, 02	7.040 (6.036)	-0.02735 (-2.735)**	0.348	1.425 (0.978)	-0.01890 (-1.513)	0.140
July, 02	21.992 (5.432)	-0.05765 (-1.661)	0.165	-0.313 (-0.061)	-0.03832 (-0.873)	0.052
Aug. 02	0.902 (0.257)	-0.02273 (-0.755)	0.039	7.955 (2.816)**	-0.01876 (0.775)	0.041
Sept. 02	-6.230 (-2.025)	-0.02859 (-1.084)	0.077	4.171 (1.374)	-0.02583 (-0.992)	0.066
Oct. 02	20.779 (3.300)	-0.008264 (-0.153)	0.002	-1.854 (-0.288	0.01243 (0.225)	0.004
Nov. 02	-9.551 (-1.495)	-0.02454 (-0.450)	0.014	0.603 (0.094)	-0.02048 (-0.382)	0.010
Dec. 02	-7.544 (-2.220)	0.03451 (1.184)	0.091	-1.050 (-0.311)	0.03429 (1.183)	0.091.
Jan. 03	-9.736 (-4.488)	0.02366 (1.272)	0.104	1.344 (0.620)	0.02366 (1.272)	0.104
Feb. 03	-2.903 (-1.932)	0.01357 (1.053)	0.073	2.383 (1.587)	0.01357) (1.054)	0.074
March 03	-1.011 (-0.895)	0.003695 (0.382)	0.010	-0.111 (-0.100)	0.005480 (0.580)	0.023
April, 03	-0.844 (-0.346)	-0.04256 (-2.032)	0.228	0.986 (0.459)	-0.03370 (-1.831)	0.193
May, 03	-3.940 (-1.783)	-0.01623 (-0.856)	0.050	7.290 (3.341)***	-0.01596 (-0.853)	0.049

Values in parenthesis are t - values
*** Coefficient is significant ($p<0.01$).
** Coefficient is significant ($p<0.05$).

The regression results for price difference between Sokoto and other markets shows that the coefficients are positively signed though insignificant for October 2002, December 2002, January, February and March, 2003, with 0.01243, 0.3429, 0.02366, 0.01357 and 0.005480, respectively (Table 1). The average value was 0.017886 implying an average increase of N0.018 for every kilometer increase in distance from Sokoto to other markets for the months. The value also represents the returns to the traders engaged in onion arbitrage between Sokoto and other markets and it covers the cost of transportation of N0.00063/kg/km, traders' profit and the cost of loading, unloading of N0.0005/kg/km and loss in transit.

The eight and seven months with negative coefficients for Aliero and Sokoto markets, respectively, implies a decrease in onion retail price with increase in distance between each of the collection centres and other markets. This might be explained by the fact that the commodity is produced in nearly all parts of the study area. Therefore, retailers may not necessarily have to travel to the collection centres to obtain their supplies. Since the supply is mostly obtained locally, retailers sell at the prevailing local price without regard to the prevailing retail price at the collection centres or the cost of transporting the commodity to the retailer's locality. The retail price in most markets was therefore, more or less uniform.

Results on the effect of distance on onion retail price between the two collection centres, Sokoto in Sokoto State and Aliero in Kebbi State, each with selected markets in their respective States are presented in Table 2.

The R^2 values for onion retail price difference Aliero onion collection centre and seven other sampled markets in Kebbi State were between 0.003 for October 2002 and 0.205 for April 2003 (Table 2). This implies that between 0.3% and 20.5% of the variation in onion retail price between Aliero market and other selected markets in Kebbi State were explained by the distance between them. The R^2 values for Sokoto and other selected markets in Sokoto State were between 0.004 for March 2003 and 0.270 for April 2003 (Table 2). This implies that between 0.4% and 27% of the variation in onion retail price between Sokoto market and other selected markets in Sokoto State were explained by the distance between them. The results also imply that the explanatory power of the independent variable was weak. The low R^2 value and low regression coefficients further imply that other factors apart from distance are explaining the variation in price. This means that there is weak market integration.

Table 2 shows that the regression coefficients for the months of October, December 2002 and January, February and March 2003 were positive but insignificant, indicating that onion retail prices increased insignificantly with increase in distance between Aliero and other markets within Kebbi State for the five months. The coefficients for the remaining seven months were negative; indicating a decrease in onion retail price with increase in distance, they were however, insignificant.

Table 2: Regression results on retail price difference between Aliero (Kebbi State) and Sokoto (Sokoto State) onion markets with other markets in the respective States (N/kg) on distance between the market

Month	Aliero market Intercept	Slope	R^2	Sokoto market Intercept	Slope	R^2
June 02	1.134 (0.896)	-0.0167 (-1.497)	0.130	5.602 (4.504)***	-0.0166 (-1.513)	0.132
July 02	-0.249 (-0.059)	-0.0388 (-0.995)	0.062	17.500 (4.194)***	-0.0242 (-0.655)	0.028
Aug.02	6.330 (-2.469)**	-0.0665 (-0292)	0.006	0.717 (237)	-0.0214 (-0.798)	0.041
Sept .02	3.319 (1.252)	-0.0195 (-0.831)	0.044	-4.958 (-1.816)	-0.381 (-0.578)	0.142
Oct .02	-1.478 (-0.266)	0.096 (0.195)	0.003	16.535 (2.830)**	0.02339 (0.453)	0,013
Nov. 02	0.480 (0.087)	-0.0196 (-0.400)	0.011	-7.568 (-1.358)	-0.390 (-0.792)	0.040
Dec. 02	-0.836 (-0.287)	0.03269 (1.269)	0.097	-6.003 (-1.980)	0.0231 (0.859)	0.047
Jan. 03	1.069 (0.570)	1.0257 (1.552)	0.138	-7.797 (-.643)***	0.08834 (0.470)	0.015
Feb. 03	1.896 (1.439)	0.01720 (1.477)	0.127	-2.310 (-1.737)	0.09149 (0.778)	0.039
March 03	-0.0880 (-0.093)	0.05312 (0.633)	0.026	-0.804 (-0.822)	0.02156 (0.246)	0.004
April 03	0.785 (0.424)	-0.0322 (-1.966)	0.205	-0.672 (-0.319)	-0.0438 (-.355)**	0.270
May 03	5.801 (2.861)	-0.0486 (-0.271)	0.005	-3.135 (-1.609)	-0.0222 (-1.291)	0.100

Values in parenthesis are t-values
*** Coefficient is significant (p<0.01).
** Coefficient is significant. (p<0.05).

The positive coefficients for October and December 2002 and January, February and March 2003 were 0.009597, 0.03269, 0.02571, 0.01720 and 0.005312, respectively, with an average value of 0.0181. This implies an average retail price increase of N0.018 per kilogram of onion for every kilometer increase in distance between Aliero and other markets for the months. The value reflects the returns to the traders engaged in onion arbitrage between Aliero and other markets and it covers transportation cost of N0.008 per kilogram per kilometer, traders' profit and cost of loading, unloading of N0.0005/kg/km and loss in transit.

Results for price difference between Sokoto and other markets within Sokoto State shows that coefficients were positively signed though insignificant for October, December 2002 and January, February and March 2003 with o.02339, 0.02301, 0.008834, 0.009149 and o.002156, respectively. The average value for the coefficients was 0.013, this implies an average retail price increase of N0.013/kg/km between Sokoto and other markets for the months. The value reflects the returns to the traders engaged in onion arbitrage between Sokoto and other markets and it covers transportation cost of N0.0079 per kilogram per kilometer, traders profit and cost of loading, unloading of N0.0005/kg/km and loss in transit.

The seven months with negative coefficients for Aliero and Sokoto markets respectively, implies a decrease in onion retail price with increase in distance between each of the collection centres and markets in the respective States. Analysis of the result (Table1) revealed that there was not much market integration, probably because the Markets do not trade with each other as they are located in

different states. Markets located within the same state (Table2) are likely to trade with each other. Surprisingly, there was no market integration as revealed by the low R^2 value and low regression coefficients.   Spatial pricing efficiency for onion marketing between Sokoto and Aliero onion supply markets in Sokoto and Kebbi States and the receiving markets of Lagos, Ibadan, Enugu and Aba, in the South was investigated. Wholesale price difference between the supply and receiving markets was regressed on distance between the respective supply markets and each of the receiving markets for the period covered by the study and the result is presented in Table 3.

Table 3 shows that R^2 values for distance between Aliero and the four southern markets were between 0.313 for October 2002, and 0.901 for November 2002. This implies that between 31.3% and 90.1% of the variation in onion wholesale prices between Aliero and four southern markets were explained by the distance between the markets. Similarly, the R^2 values for Sokoto and four receiving markets were between 0.808 in October 2002 and 0.988 for the month of March 2003. This implies that between 80.8% and 98.8% of the variation in onion wholesale prices between Sokoto and the four receiving markets were explained by the distance between them. The high R^2 values demonstrate the strength of the independent variable in explaining the dependent variable.

The regression coefficients for price difference between Aliero and the four Southern markets for the 12 months covered by the study were all positively signed with the coefficients for nine months being significant ($p<0.05$). The coefficients for Sokoto and the southern markets were also positively signed, with the coefficients for nine months being significant ($p<0.01$) and for three months significant ($p<0.05$) (Table 3). The average regression coefficients for distance between the two supply markets and the four receiving markets were 0.0147 and 0.0175 for Aliero and Sokoto, respectively. The implication is that on the average, there was a wholesale price increase of N0.015/kg/km and N0.018/kg/km between Aliero and Sokoto, respectively and the four receiving markets. It implies that the onion traders arbitrating over space between the two supply markets and the four receiving markets had an average return of N0.015/kg/km and N0.018/kg/km from Aliero and Sokoto markets, respectively. This goes to cover N0.0045/kg/km, cost of loading / unloading N0.00042/kg/km, profit N0.0045/kg/km and lost in transit.

Table 3:   Regression results for wholesale price difference between two northern supply markets and four southern markets (N/kg) on distance between the markets.

Month	Aliero Market			Sokoto Market		
	Intercept(a)		R^2	Intercept(a)		R^2
June, 02	1.796	0.01229	-756	-0.301	0.01098	0.895
	(4.478)	(3.052)		(-0.142)	(5.048)**	
July, 02	0.975	0.01351	0.796	-0.329	0.01591	0.943
	(0.265)	(3.425)**		(-0.150)	(7.074)***	
Aug. 02	1.420	0.01276	0.84	0.256	0.01503	0.945
	(0.474)	(3.976)**		(0.126)	(7.201)***	
Sept. 02	1.918	0.007180	0.595	0.437	0.009611	0.877
	(0.600)	(2.097)		(0.216)	(4.634)**	
Oct. 02	1.840	0.003696	0.313	1.070	0.01153	0.808
	(0.624)	(1.169)		(0.337)	(3.548)**	
Nov. 02	1.115	0.009877	0.901	0.462	0.009075	0.954
	(0.633)	(5.237)**		(0.411)	(7.890)***	
Dec. 02	0.660	0.02621	0.875	-1.051	0.02514	0.968
	(0.124)	(4.583)**		(-0.405)	(9.467)***	
Jan. 03	2.181	0.01950	0.842	0.146	0.02334	0.978
	(0.480)	(4.006)**		(0.074)	(11.579)***	
Feb. 03	1.774	0.02194	0.879	0.101	0.02799	0.985
	(0.404)	(4.663)**		(0.051)	(13.861)***	
March 03	2.333	0.01910	0.816	0.320	0.02541	0.988
	(0.477)	(3.647)**		(0.201)	(15.608)***	
April, 03	2.194	0.02013	0.834	-0.02821	0.02272	0.986
	(0.454)	(3.885)**		(-0.019)	(14.635)***	
May, 03	0.309	0.009670	0.842	-0.129	0.01312	0.946
	(0.137)	(3.994)**		(0.947)	(7.221)***	

Values in parenthesis are t - values
***   Coefficient is significant at 1% level
**   Coefficient is significant at 5% level

Analyses of retail and wholesale price difference between the market's studied based on distance and for the period covered by the study, suggested that there was no integration for the retail market, but some wholesale markets were integrated . This supports the findings of Southworth *et al.*, (1979) and Afolami (2000) who reported spatial integration between market pairs for yam, rice and maize in Atebubu District, Ghana and between market pairs for maize in Nigeria, respectively.

CONCLUSION

Results of the study revealed that the retail price difference between the two onion collection centers and other markets, and the wholesale price difference between the two centers and four southern markets based on distance was not excessive. It was thus concluded that no spatial integration existed between the retail markets studied. For the wholesale onion trade, however, there was spatial integration between the supply and receiving markets.

High transportation cost as result of frequent increases in pump price of petroleum products has been identified as a problem in the marketing of onion and other agricultural commodities. To minimized the problem, government should ensure stable supply and uniform pricing of petroleum products throughout the country. Government should also encourage the establishment of a privately owned company for the distribution and marketing of onion. This may go a long way in reducing the number of middlemen through which the commodity pass before getting to the final consumer. This may in turn help in reducing the price paid per kilogramme by the final consumer.

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