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Analysis of Price and Market Integration for Onion in Rural-Urban Markets of Oyo State, Nigeria

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ABSTRACT

Accessibility to information on commodities prices is important for optimization of returns to the farmers and prices paid by the consumers. This study examined the trend in price movements and market integration for onion in rural-urban markets in Oyo state. Monthly retail prices in ₦/kg covering a period of eight years (2003 to 2010) were obtained from Oyo State Agricultural Development Programme (OYSADEP). Data were analysed using discriptive statistics, Augmented Dicker Fuller (ADF) test, Cointegration test, Granger causality test and index of market connection (IMC). Price trend analysis result revealed that price onion peaked in November and December. Lowest price was obtained in March (₦82.40/kg) and April (₦84.14/kg) for rural and urban markets respectively. ADF test revealed that prices were all integrated of order one I (1). Co-integration and Granger causality analysis showed that prices of onions in urban and rural market were integrated in the long run, and that the urban market price granger caused rural market price of onions. The index of market connection (IMC) was 0.610, indicating high short market integration. The study, therefore recommends that the policy which will enhance greater market efficiency through improvement of transportation infrastructure and market price information in the state should be encouraged.

Keywords: *Onions, price movements, market integration, rural and urban*

1. INTRODUCTION

Onion (*Allium cepa*) is one of the most important vegetables in Nigeria. It is an important ingredient for cooking stew and it adds flavor to food. It provides essential nutrients and health promoting phytochemicals. Onion is highly rich in vitamin C and is a good source of dietary fibres and folic acid (NOA, 2001). Onion is ranked second most important vegetable after tomato in Nigeria (Hussaini *et al*, 2000). In 2011, 4,277,647 tonnes of onion was produced worldwide, out which 236,000 tonnes was produced in Nigeria, making the country a fifth onion producing country in the world (FAO, 2011). Onion is one of the vegetable of focus under Agricultural Transformation Agenda (ATA) of the Federal Government of Nigeria. Thus analyzing price movement and integration in urban and rural market is crucial in order to assess the efficiency of the distribution of the commodity.

Prices are an important feature of a market; it plays an important role in efficiently distributing resources and signaling shortages and surpluses which help farmers to respond to changing market conditions (Haji and Gelaw, 2011). Prices are the signals that direct and coordinate not only the production and consumption decisions but also the marketing decisions over time, form, and space (Kohls and Uhl 2001). Market integration on the other hand refers to a situation in which the prices in different markets move together (Barrett, 2001).

Market integration exists when price changes in one market are reflected in price changes in other markets. Markets that are not integrated may convey inaccurate price signal that might distort producers marketing decisions and contribute to inefficient product movement (Goodwin and Schroeder (1991), and traders may exploit the market and benefit at the cost of producers and consumers. In more integrated markets, farmers specialize in production activities in which they are comparatively proficient, consumers pay lower prices for purchased goods, and society is better able to reap increasing returns from technological innovations and economies of scale (Vollrath, 2003).

Previous studies on Price Analysis and Market integration in Nigeria were on pepper (Afolami, 1998), pineapple (Oladapo, 2003), plantain and banana (Adeoye *et al*, 2011), staple food stuff (Akintunde *et al*, 2012). There is little empirical evidence on Price movement and Market integration of Onion in rural and urban market of Oyo State. This study therefore intend to analyze the price movement and market integration of onion in rural and urban market of Oyo State in order to analyze the price movement of the commodity and examine the extent of market integration of the commodity.

2. METHODOLOGY

2.1 Study area

Oyo state is one of the thirty-six states in Nigeria and has its capital city at Ibadan. It covers an area of about 28,454 square kilometers (10,986 sq mi) and has $8^{o}00^{1}$ N and longitude 2.5^{o} E - $4^{o}00^{1}$ E in south-western Nigeria. The mean annual rainfall ranges from 100mm to 1500mm and average daily temperature ranges between 25^{o} C and 35^{o} C. The state is bounded in the north by Kwara, in the south by Ogun, in the east by Osun state and in the west partly by Ogun and partly by Republic of Benin.

2.2.Data source and scope

The data for this study were obtained from secondary sources. Average monthly retail onion price in Naira per Kilogramme from January, 2003 to December, 2010 for both urban and rural markets were obtained from the Oyo State Agricultural Development Programme (OYSADEP).

2.3.Method of analysis

This analysis started with an investigation of the stationarity properties of each time-series. This was done to avoid spurious regression outcomes in time series data. The hypothesis is tested at the level form i.e I(0). If the null hypothesis cannot be rejected at I(0), the next is to test whether the first difference, I(1), is stationary. If the null hypothesis cannot still be rejected, the price series is not stationary. Therefore, differencing continues until series become stationary and order noted (Emokaro and Ayantoyinbo, 2014). The process is considered stationary if $/\partial/ < 1$, thus testing for stationarity is equivalent with testing for unit roots ($\partial < 1$). This study applied Augmented Dickey-Fuller (ADF) test of the following hypothesis.

H_0: $\partial = 0$ (rural price series of onions is non-stationary)

H_a: $\partial \neq 0$ (rural price series of onions is stationary)

H_0: $\partial = 0$ (urban price series of onions is non-stationary)

H_a: $\partial \neq 0$ (urban price series of onions is stationary)

The second stage of the analysis is the Co-integration analysis which involved establishing statistically sound long-run relationships between time series data. The Engle and Granger (1987) test and the Johansen test are the two most common approaches to testing for cointegration of data that are not stationary.

$$\Delta X_t = \mu_t + \sum_{i-1}^{k} \Gamma X_{t-1} + \Pi X_{t-k} + \varepsilon_t \text{ .....(1)}$$

where X_t is an (N x 1) vector containing the series of interest (onion spatial prices series), Γ and Π = matrices of parameters, K = number of lags, and should be adequately large enough both to capture the short-run dynamics of the underlying Vector Auto-Regressive (VAR) and to produce normally distributed white noise residuals, ε_t = vector of white noise errors.

The third step is the Granger causality test which was carried out to determine the direction of causality. When Granger causality run one way (uni-directional), the market which Granger-causes the other is tagged the exogenous market. It could also be bi-directional which indicates that both series influence each other (e.g. A causes B and B also causes A). The Granger model used in this study can be represented by:

$$\Delta P_{it} = \sum_{i=1}^{m} a_i \Delta P_{j(t-1)} + \sum_{j=1}^{n} a_j \Delta P_{j(t-1)} + \varepsilon_t \text{ ..... (2)}$$

Where m and n are the numbers of lags determined by a suitable information criterion. Rejection of the null hypothesis indicates that prices in market j Granger-cause prices in market i (Baulch, 1996). The hypotheses under the Granger causality can be stated as follow:

H_o: price of onion in one market does not determine (granger cause) the price in the other market

H_1: price of onion in one market does determine the price in the other market (not granger cause).

2.4.Index of market connection (IMC)

$$P_t = \alpha_0 + \beta_1 P_{L(t-1)} + \beta_2 \left(P_{C(t)} - P_{C(t-1)}\right) + \beta_3 P_{C(t-1)} + \varepsilon_t$$
……(3)

Where:

$P_{C(t)}$= urban price (₦)

$P_{L(t)}$ = rural price (₦)

$P_{C\,(t-1)}$ = lagged price for urban market (₦)

$P_{C\,(t)}$- $P_{C\,(t-1)}$= difference between urban price and its lag (₦)

ε_t = error term

α = constant term

β_1 = coefficient of rural lagged price

β_2 = coefficient of $P_{C\,(t)}$- $P_{C\,(t-1)}$

β_3 = coefficient of urban lagged price

ε_t =error term

Timmer suggested an index of market connection (IMC) defined as the ratio of the local (rural) market coefficient (β_1) to the central (urban) market coefficient (β_3). It was used to measure the degree of price relationship between integrated markets. This approach was used by Oladapo and Momoh, (2007) and adopted by Adeoye *et al* (2011) and Akintunde *et al* (2012).

Therefore, from the regression equation above, IMC is given as:

$$IMC = \frac{\beta_1}{\beta_3} \text{ ;where } 0 \leq \text{IMC} \leq \infty \text{ .....(4)}$$

If:
IMC < 1 implies high short run market integration
IMC > 1 implies low short run market integration
IMC = 1 high or low short run market integration
IMC = ∞ implies no market integration
The closer the IMC is to zero, the higher the degree of short run market integration. The farther away the value of IMC is to unity, the lower the degree of market integration.

3. RESULTS AND DISCUSSION

3.1. Average Monthly Retail Price for Onion

In rural market, the peak price for onion was obtained in December (₦114.05/kg) while the trough price occurred in March (₦82.40/kg). Trough price rose from ₦82.40/kg in March to ₦97.58/kg in June and it declined below average value in July (₦90.75/kg), August (₦86.50/kg) and September (₦90.35/kg), the value rose again to ₦102.96/kg in October and the highest price was obtained in December (₦114.05/kg). The prices for urban market were below average (₦96.87/kg) between January and August but rose steadily from ₦97.31/kg in September to ₦112.47/kg November, decline slightly to ₦112.01/kg in December. The lowest price was obtained in April (₦84.14/kg) while the highest price was obtained in November ₦112.47/kg. Lastly, higher prices were observed in both rural and urban markets from October to December while the lower prices were recorded between March and April (Figure1).

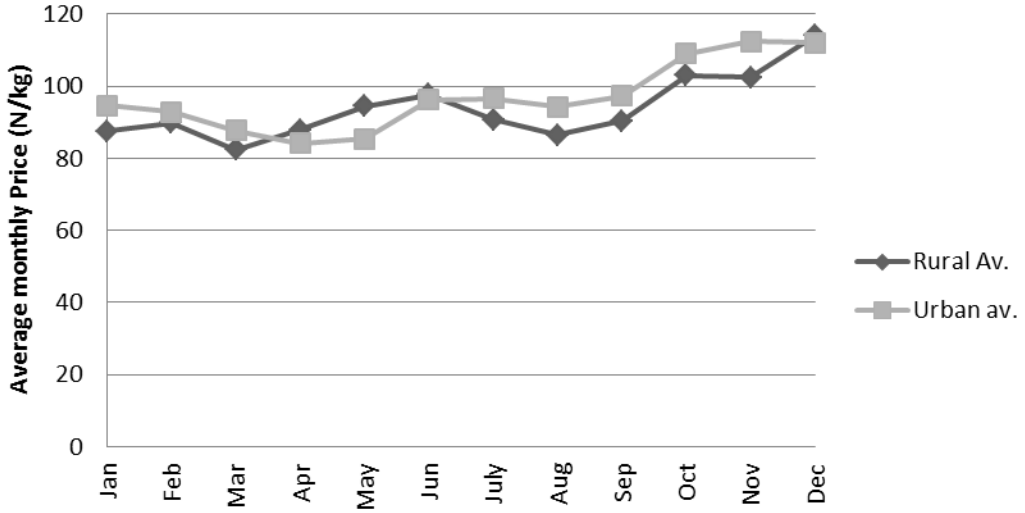

Figure 1: Eight years Average Monthly Price for Onion in Oyo State (2003-2010)

3.2. Stationarity test of onion price series

The result of the stationarity test by the ADF method is shown in Table1. A variable is said to be non-stationary when the ADF t-statistics is smaller in absolute terms than the critical values. The non-stationary variable is said to be integrated of order 1, if it has to be differenced once to make it stationary and it is written as I(1). A variable that is stationary is integrated of order zero and it is written as I(0). The price series in both markets accepted the null

hypothesis of non-stationarity at their levels at 1% and 5% significance level. The values of the ADF t-statistics were smaller in absolute term than the critical value. However when first-differenced, the null hypothesis of non-stationarity was rejected. The result confirms the earlier findings that food commodity price series are mostly integrated of order 1 i.e I(1) (Oladapo and Momoh, 2007, Mafimisebi, 2008, Adeoye *et al*, 2011 and Akintunde *et al*, 2012, Emokaro and Ayantoyinbo, 2014). This may be as a result of trends observe in most of food prices due to inflation and therefore exhibit mean non-stationarity. They need to be first-differenced to become stationary (Mafimisebi, 2008).

Table 1: Result of the stationarity test for onions price series

Market price series	Level form I(0)		First difference I(1)	
	ADF statistics	Remarks	ADF statistics	Remarks
Rural market	-2.6265	Non-stationary	-7.0268***	Stationary
Urban market	-2.5957	Non-stationary	-14.6242***	Stationary

Source: Compiled from computer printout of result of stationarity test.
Notes: 1. *** significant at 1 percent level.
2. Critical values of ADF Statistics are -3.5007 and -3.5047 at 1% significance level for level form and first difference series, respectively.

3.3. Co-integration test for onions

Table 2: Results of Johansen maximum likelihood test for rural-urban markets of onions

Market pairs	Hypothesized No of CE (s)	Eigenvalue	Trace statistic	5% CV	1% CV
Rural-Urban onion markets	None**	0.2117	22.9285	15.41	20.04
	At most 1	0.0086	0.8061	3.76	6.65

***(**) denotes rejection of hypothesis at 5% (1%), CV- critical value.**

In table 2, the result of Johansen co-integration test indicated that the null hypothesis of no co-integration was rejected at both 5% and 1% significance level thus the null hypothesis of co-integration between rural and urban onion market was accepted. This implies rural-urban onion markets in Oyo state, Nigeria are integrated and there is significant existence of long run market relationship. It also implies that a perfect transmission of price information exist in the markets. This is also an indication that the rural and urban onion markets have their price tied together in the long run.

3.4. Granger causality test for onions

Table 3: Granger causality test for onions

Null hypothesis	Obs.	F-Statistic	Prob.	Decision
URMPON does not Granger cause RUMPON	93	3.0078	0.0346**	Reject H_0
RUMPON does not Granger cause URMPON		1.3198	0.2732	Accept H_0

Source: Compiled from computer printout of result of granger-causality test.
Note: 1. URMPON represents urban market price of Onions while RUMPON represents rural market price of Onions.
2. ** Significant at 5%.

Granger causality tests were performed to test the causality of prices (Granger, 1969). The result in table 3 showed that the market link exhibits uni-directional granger causality. The null hypothesis that urban price does not cause rural price of onions is rejected at 5% (test 1). However, the null hypothesis of no causality from rural to urban prices of onions is accepted (test 2). This implies that it is the urban market price determines the rural price of onions in Oyo state. Price transmission occurs from urban to rural market and not vice versa. This may lead inadequate flow of information between rural areas and urban areas.

3.5. The Index of Market Connection between Rural and Urban

The result of index of market connection (IMC) is presented in table 4. The index is used to show short run relationship between integrated markets. The IMC obtained was 0.61 for onion market pair. This is less than one, indicating that the market pair exhibits high short run market integration. This result further revealed that price changes in the urban markets cause immediate and accurate change in the prices in rural markets.

Table 4: Result of Index of Market Connection (IMC) for Rural-Urban Onion Market integration in Oyo state

Market pair	β_0	β_1	β_2	β_3	R^2	DW	IMC Classification
Rural-Urban	10.471	0.341	0.699	0.559	0.54	1.88	0.61, High S/R market integration
	(1.10)	(3.51)	(7.66)	(4.21)			

***-Coefficients significant at 1%, Figures in parentheses are t-value, S/R-short run**

4. CONCLUSION AND RECOMMENDATION

The study examined the price analysis and market integration for onion in rural and urban markets in Oyo state. Price trend analysis showed that price of onion rose from August to December and peaked in November and December for both markets. Lower price was obtained in March and April for rural and urban markets respectively. Prices were higher in both markets from October to December. Co-integration and Granger causality analysis showed that prices in urban and rural market of onions were integrated in the long run, and that the urban market price determined rural market price of onions in the state. Also the result of the index of market connection indicated high short run market integration in the markets. The price changes were accurately and immediately transmitted between the markets. It is therefore recommended that the policy which will enhance greater onion market efficiency in the state should be encouraged. This could be done through improvement of transportation infrastructure and market price information

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