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Price Analysis of Tomato in Rural and Urban Retail Markets of Oyo State

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Abstract: Prices are the most readily available and often the most reliable information on developing country marketing systems. The study examined the level of market integration in tomato markets in rural and urban markets of Oyo State, Nigeria. Secondary data on tomato price spanning *2003 –2010* were sourced from Oyo State Agricultural Development Programme (OYSADEP). The data were analyzed using Augmented Dicker Fuller (ADF) test. Indices of market concentration were also used to measure the degree of market integration. Results indicated that the maximum rural price of tomato was ₦131.74/kg in May, 2009 while the minimum price was ₦43.23/kg in August, 2004. In the urban areas, the maximum price was ₦132.13/kg in May, 2009 while the minimum price was ₦40.98/kg in September, 2004. The results also revealed that prices of tomato were stationary at their level. Urban tomato market does not granger cause rural tomato market ($P > 0.05$), while rural tomato market granger cause urban tomato market ($P< 0.05$). None of the markets links exhibited bi -directional granger causality or simultaneous feedback relationship. The Index of market connection (IMC) indicates that the markets exhibit low short run market integration. It is recommended that there should be efficient flow of information, good access road and infrastructural development to improve market performance.

Keywords: Tomatoes, Urban and Rural Market, Price Analysis, Oyo State

INTRODUCTION

Tomato is one of the most important vegetables. It supplies vitamins, minerals, fibres and is of high nutritional values. It also contains health benefit anti-oxidants such as lycopene for cancer prevention especially those of the prostate gland, lung and stomach (Ihekeonye et al, 1985). Cultivation on a large area can generate employment both at the urban and rural levels. Tomato is cultivated almost throughout Nigeria and the most important areas lie between 7.5^0N and 13^0N mostly around urban areas in the Northern and Southern-western parts of the country. The principal areas of tomato production include Zaria, Kaduna in Kaduna state, Jos in Plateau state, Gombe in Bauchi state, Ilorin in Kwara state, Sokoto in Sokoto state, Maiduguri in Borno state, Ogbomosho and Ibadan in Oyo state.

Tomato marketing is characterized mainly by the problem of seasonality and perishability amongst others. Efficient harvesting, handling, transportation and marketing techniques are extremely important in tomato production because it is seasonal and highly perishable in nature. A familiar problem in a metropolitan state such as Oyo State is the inter- and intra-pricing variations among her urban and rural retail markets due to the forces of demand and supply. There are price differences

between these markets which are significant in gaining marked intelligence with respect to tomato. Many consumers do not have price information on tomato in various retail markets in Oyo state which might be responsible for exploitation due to insufficient price statistics.

Spatial Market Integration refers to co-movements of prices, and more generally, to the smooth transmission of price signals and information across spatially separated markets (Okoh and Egbon, 2005). Market Integration provides the basic data for understanding how specific markets work. Market integration refers to the co-movement of prices and more generally to the smooth transmission of price signals and information across spatially separated markets. Link among spatially separated market will lead to efficient price formation. Dittoh, (1994) indicated that the federal, state and local governments of Nigeria paid little attention to the marketing of vegetables such as pepper, tomatoes, onions, okra and leafy vegetables despite the fact that they need spatial marketing facilities. Amusa, (1997) in her study of the trend analysis of agricultural food prices in Nigeria reported that food items such as vegetable oil, garri, brown beans, ripe plantains, fresh tomatoes, green vegetables, onion bulbs, shelled melon seeds, experienced increases and fluctuation in their prices.

Oyo state is among the tomato producing states in Nigeria and it becomes very important to improve upon its marketing and the various marketing channels of the commodity. There are arrays of competitive prices on tomato produce within and across the two categories of market.

Therefore, it becomes imperative to conduct a study to determine variations in price series over the years so as to gain useful information as a prerequisite for maximizing returns. The general objective is to analyze price differences of tomato in the rural and urban retail markets of the study area. However, the specific objectives are to:

- Examine the trends of the monthly prices of tomato in the rural and the urban retail markets of the study area.
- Examine the extent of integration in the rural and the urban retail markets of the study area.
- Determine the leading markets between urban and rural markets

Hypotheses

Ho: Price of tomato in the rural market does not determine price in the urban market.

H_1: Price of tomato in the rural market determine price in the urban market.

METHODOLOGY

Study Area - The study area is Oyo State. It is located in the South-Western part of Nigeria and lies between 7^0 and 9.3^0N and longitude 2^0 and 4^0E. The state is made up of 33 local government areas with a total population of 5,591,585 (NPC, 2006). The Oyo state rural retail markets are representing different communities and villages in the rural areas while the urban retail markets are representing different towns and cities in the urban areas.

Source of Data - Secondary time series price data (2003 -2010) was obtained from Oyo State Agricultural Development Programme. This contains monthly retail price per kilogram of fresh tomato from the selected rural and urban

retail markets of the state. These markets are classified into four different zones. The urban markets in Ibadan zone are Bodija, Oje, Oritamerin, Olomi, Olorunsogo while the rural markets are Omi adio, Ijaye-orile, Egbeda, Towobowo and Anko-eruwa for Ibadan zone. For Ogbomoso zone, the urban markets is odo oba while the rural markets are gambari, arowomole, iluju, oko-oba. For Oyo zone the urban markets are ilora, akesan, sabo, oluwole while the rural are irepodun and obada ipaapo. In zaki zone, the urban markets are sango, gbonje, yante while the rural markets are oja-oba, ago are.

Methods of Data Analysis - The analytical methods used are descriptive statistics, unit root test, co integration and granger causality test.

Test of Stationarity - This was carried out to check for stationarity of the variables or price series using Augmented Dickey fuller test. A price series is stationary if its mean and variance are constant over time. Long time will take up to 30 years. Non stationary stochastic series have varying mean or time varying variance. The price series in this study were first tested for stationarity. The purpose was to overcome the problems of spurious regression. The augmented Dickey Fuller (ADF) was adopted to test for stationarity. This involves running a regression of the form:

$$\Delta P_{it} = \partial P_{t-1} + \sum_{i=1}^{P} \beta_1 \Delta P_{t-1} + \ell_{it} \quad \text{.....(1)}$$

Where Δ = first difference operator, ∂ = 0, implies the existence of a unit root in $P_{i\,t}$ or that the price series is non-stationary, i = commodity price series, i.e. tomatoes, t = time indicator, e_{it} is the error term . The process is considered stationary if $/\partial$ / < 1, thus testing for stationarity is equivalent with testing for unit roots (∂ <1). Therefore:

H_o: ∂ = 0 the price series is non stationary or existence of unit root

H_1: ∂ < 0 the price series is stationary

Test of Cointegration - Johansen Tests were carried out using a linear deterministic trend in order to know the number of co-integrating vectors. The Johansen testing procedures have the advantage that they allows for the existence of more than one co integrating relationship (vector) and the speed of adjustment towards the long-term equilibrium is easily determined (Bakucs and Ferto, 2005).

The model is presented thus:

$$\Delta X_t = \mu_t + \sum_{i-1}^{k} \Gamma X_{t-1} + \Pi X_{t-k} + \varepsilon_t \quad \text{..... (2)}$$

Where X_t = an n x 1 vector containing the series of interest (tomatoes spatial price 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 VAR and to produce normally distributed white noise residuals, ε_t = vector of white noise errors. The Johansen test will give an insight into the number of estimation equations to be fitted. The presence of one cointegration relationship is necessary for the analysis of long run relationship of the prices to be plausible.

Granger Causality Tests - The Granger causality test was carried out to determine the direction of causality. When two price series are co-integrated and stationary, one may proceed to carry out the granger causality

test. This is because one granger causal relationship must exist in a group of co integrated series (Chirwa, 2000). When Granger causality run one way (uni-directional), the market, which Granger-causes the other is tagged the exogenous market. Exogeneity can be weak or strong. Hendry (1986) observed that weak exogeneity occurs when the marginal distribution of $P_{i\ (t-1)}$ and $P_{j(t-1)}$ was significant, while strong exogeneity occurs when there is no significant Granger-causality from the other variable. It could also be bi-directional which indicates that both series influence each other (X causes Y, and Y also causes X). The Granger model used in this study can be represented by:

$$\Delta P_{it} = \sum_{i=1}^{m} a_i \Delta P_{j(t-1)} + \sum_{j=1}^{n} a_j \Delta P_{j(t-1)} + \ell_t \quad \ldots\ldots (3)$$

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.

Index of Market Concentration Analysis - Index of Market concentration (IMC) is used to measure price relationship between integrated markets and following formula was used to calculate IMC:

$P_t = \beta_o\beta_1 P_{t-1} + \beta_2 (R_t - R_{t-1}) + \beta_3 R_{t-1} + e_t$

Where:

R_t = Urban or reference price

P_t = Rural price

R_{t-1}= Lagged price for urban markets.

$R_t - R_{t-1}$ = Difference between urban price and its lag

e_t = error term or unexplained term.

β_o = constant price

β_1 = coefficient of rural lagged price

β_2=coefficient of $R_t - R_{t-1}$

β_3 = coefficient or urban lagged price

$IMC = \beta_1/\beta_3$ where $0 \leq IMC \leq \infty$

where

IMC < 1 implies high short run market integration

IMC > 1 implies low short run market integration

IMC = ∞ implies no market integration

IMC = 1 high or short run market integration.

RESULTS AND DISCUSSION

Trend Analysis of Tomato Prices

The trend analysis of the tomato price in the rural and urban retail markets shows that there are fluctuations and changes in the produce price over the period of seven years (2003-2010). The maximum price of tomato per kilogram was ₦164.29/kg in rural market in May, 2010 while the minimum price in the rural market was ₦43.23/kg in August, 2004. Similarly in the urban areas, the maximum price was ₦132.13/kg in May, 2009 while the minimum price was ₦40.98/kg in September, 2004. The prices were not stable across seasons and this could be attributable to the fact that tomato yield is very low during the rainy season (Figure 1). The peak of the price was always in the second and third quarters of the year while the least price was observed in the first quarter of the year. The reason for the variation in price can be attributed to the economic principle of supply and demand. Also, the second and third quarters coincide with the period of high rainfall and tomato doesn't do well during this period and therefore the supply will be greatly reduced in the markets. Thus, these quarters of the year are regarded as off season and the resultant effect is the high prices

of tomato fruits. The first and fourth quarters are the harvesting season of tomatoes which justifies the reason for the low price.

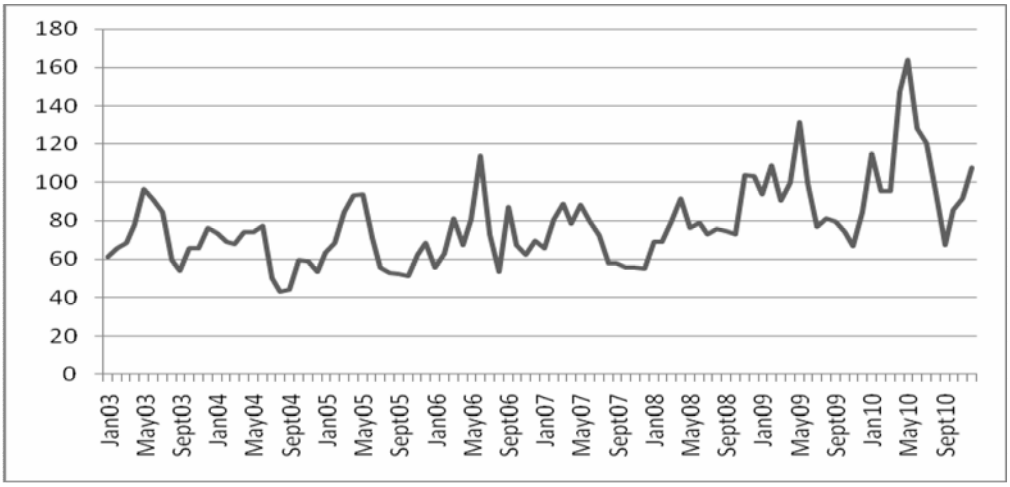

Fig 1: Prices of tomatoes in rural market (2003-2009)

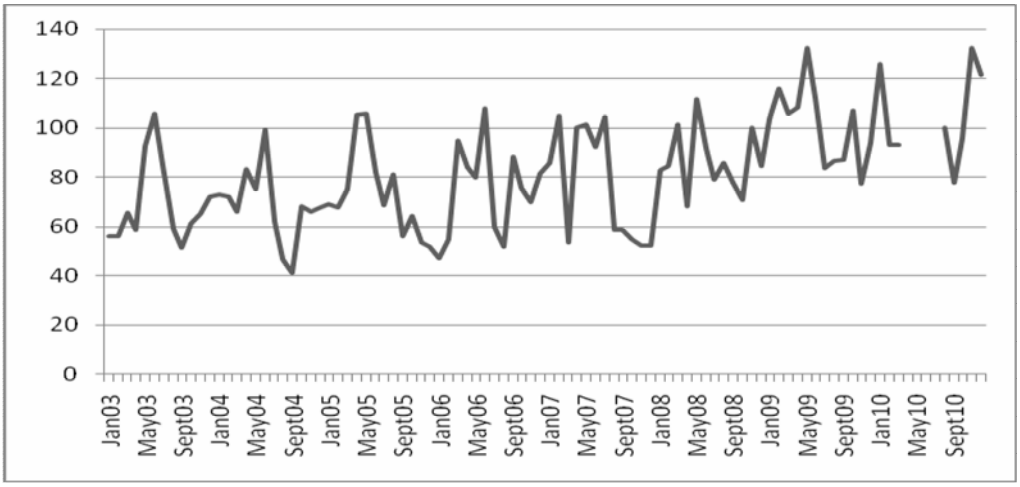

Fig 1: Prices of tomatoes in urban market (2003 – 2009)

Stationarity test of tomato prices in Nigeria - The result (Table 1) shows the stationarity test for tomato using ADF procedure. The results indicate that all the variables are stationary at their level. Therefore, the null hypotheses of non stationary were rejected for all the variables at their level. This did not conform with the findings of Alexander and Wyeth (1994), Chirwa (2000), Yusuff *et al* (2006) that commodity prices are stationary at the order of first difference. Thus, the test of co integration could be applied as all the tomato price data series were integrated of the same order, i.e. I(1) and did not have unit root.

Table 1: ADF test results for rural and urban prices of tomatoes

Variable	ADF at levels	ADF at first difference	Remarks
Rural Price	-3.85**	-9.29***	Stationary at level
Urban Price	-5.26***	-12.59***	Stationary at level

** Sig at 5% *** Significant at 1%.

Co integration and Granger Casualty Test for Tomato

In Table 2, The maximum Eigen value test shows that the two tomato market pairs investigated are cointegrated at 1% level of significance. The trace test shows that the tomato market pairs are cointegrated at 1% level of significance. Therefore using the trace statistics, it could be inferred that the tomato markets investigated are cointegrated of the order (1, 1). This is the proportion of tomato market pairs which prices are tied together in the long run.

Table 2: Johansen tests for co integration for rural prices and urban prices of tomatoes

Rural and urban prices	Trace test	Max test
r = 0	47.36***	15.49***
r=≤1	16.36***	3.84***

***Sig at 1%

Granger causality test for Tomato in Nigeria

Two tomato market links were investigated for evidence of granger causality (table 3). From the result of the analysis, urban tomato market price does not determine the rural market price. Although, rural market price determine the urban market price, none of the market links exhibited bi directional granger causality or simultaneous feedback relationship.

Table 3: Granger causality test results for Rural and urban prices of tomatoes

Variable	F-statistic	Probability
Urban does not granger cause rural	0.38473	0.68193
Rural does not granger cause urban	6.46427	0.00254***

***Sig at 1%

Index of Market Concentration

The indices of market concentration (IMC)

For tomato prices in the rural and urban markets, the IMC obtained were 0.69. The IMC for these market pairs was less than one thus indicating high short run market integration. The result shows that price changes in the rural market does cause immediate change in the prices in the urban market.

CONCLUSION

The study examined price behavior in tomato rural and urban markets in Oyo State, Nigeria. The trend analysis showed that the prices of tomato in the markets studied moved in an upward trend from April to August of each year. This is due to the fact that prices were higher in those months compared to other months of the year. The stationary test indicated that the prices were stationary at level form. The result of the granger causality test confirmed that rural prices of tomato determine the urban prices in Oyo State.

Policy Recommendations

Based on the results of the study, the following are recommended

- Market information centers should be established to facilitate adequate communication and flow of information between markets.
- improvement in the transportation system, this will prevent product spoilage during transportation from the food surplus market to the food deficit/shortage market.

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