Journal of Agripreneurship and Sustainable Development (JASD)
Volume 4, Number 1, March, 2021
ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

PRICE DYNAMICS OF LOCAL AND IMPORTED RICE IN RURAL AND URBAN MARKETS OF LAGOS STATE, NIGERIA

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ABSTRACT
The study aimed at analyzing price dynamics of local and imported rice in Lagos State Nigeria. Analytical tools employed in the study include unit root test, Granger causality test and index of market concentration (IMC). The result revealed that all the price series became stationary after 1st differencing with an order of integration of I(1), implying that the prices of both local and imported rice in rural and urban markets were trending upwards in an irregular pattern. The Granger causality test result revealed a bi-directional causality relationship between all the price pairs as the null hypothesis was rejected at P≤0.01 level of probability. The IMC result shows a value of 2.795 and 2.581 for local and imported rice, respectively, indicating low short run relationship among. The study concluded that there is a feedback relationship between rural and urban market and existence of short run relationship between the markets in the study area. It was recommended that the flow of information should be enhanced between spatially separated markets and also firm policies should be implemented on prices to minimized irregularities in rice prices across board.

Keywords: Granger causality, Index of market concentration, Price, Rice, Trend.

INTRODUCTION
Global demand for agricultural products is expanding rapidly and the demand for food products is foreseen to continue to grow for several decades as a result of a combination of population growth, rising per capita incomes and urbanization (Nasirin *et al.*, 2015). In developing countries, approximately 60 % of total calories consumed are derived directly from cereals, among which rice is the most important source of calories for humans. Rice is the most important staple food for about half of the human race (Imolehin and Wada, 2000). In Nigeria, rice was primarily an urban middleclass product, but has now become a more widely consumed staple food. Nigeria currently is leading in terms of per capita consumption of rice in sub-Sahara Africa with about 10% of the 2000 average daily calorie intake (Mohanty, 2013). According to Federal Ministry of Agriculture and Rural Development (FMARD, 2011), there is an increasing demand for rice in Nigeria, as rice consumption was 5 million metric tons in 2010 and is expected to reach 36 million metric tons by 2050. Nigerian economy relies heavily on the importation of food to supplement domestic food production and rice is one of the most important food commodities in the country's food import basket (Onu *et al.*, 2015). The alarming increase in prices over time is an issue of great importance as it causes food insecurity as most people go hungry because they cannot get food at affordable prices (Oyinbo *et al.*, 2013). The objectives of the study were to:

i. describe the trend in the prices of local and imported in rural and urban markets;
ii. ascertain the market that causes movement in the prices of local and imported rice; and
iii. estimate the extend of price relationship between integrated markets in the short run.

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Price instability affects both producers and consumers and has macroeconomic implications as well, a steep rise in the prices of primary commodities spills over to other sectors of the economy and leads to an increase in the overall rate of inflation (Golam, 2010). Hence, it is hoped that the findings from this study will provide information to consumers and marketers as well as support decision making of policy makers.

MATERIALS AND METHODS

The Study Area

According to National Bureau of Statistics (NBS, 2015), Lagos State located in the South western geopolitical zone of Nigeria. It has the smallest area in terms of land mass in Nigeria. It is arguably the most economically important State of the country. It is located on Latitudes 6^0 35 and 6.583^0 north and Longitudes 3^0 45 and 3.750^0 east. It is bounded by Ogun State on the North and East, and in the West, it shares boundaries with the Republic of Benin. Behind its southern borders lies the Atlantic Ocean. About 22% of its 3,577 km^2 are lagoons and creeks. The 2006 population census shows that Lagos State has a population of 9,013,534 people, by 2012 the estimated population stood at 17,552,940 (National Population Commission [NPC], 2006) and the projected population for 2016 using the Lagos State annual population growth rate of 13.6% stood at 27,101,739 people.

Sampling Procedure and Sampling Size

Lagos State being one of the major rice consuming State of Nigeria and also an area through which rice importation comes into Nigeria due to proximity to sea ports was selected for the study. Average monthly retailed prices of both local and imported rice for rural and urban markets were collected from year 2000 to 2016 periods (17 years), thus the sample size is 204 observations.

Method of Data Collection

The study mainly used secondary source of data which was average monthly retailed prices of local and imported rice for rural and urban markets in Lagos State. The prices were collected for a period of 17 years that is from 2000-2016. Data was collected from National Bureau of Statistics (NBS) and Central Bank of Nigeria (CBN) statistical bulletins.

Method of Data Analysis

The study applied series of statistical and econometric tools to achieve the stated objectives. The tools used include Vector Autoregressive Model (VAR), Granger Causality test, Trend Analysis, Index of Market Concentration (IMC). Eveiw software was used for the analysis.

Augmented Dicky Fuller (ADF) test for stationarity (ADF) test is the most common method of testing unit root. The idea behind the ADF test is to simply regress a time series variable Y_t on its one period lagged value Y_{t-1} and find out if the estimated β is statistically equal to 1 or not. The autoregressive process of order one AR (1) is given as:

$$Y_t = \phi Y_{t-1} + e_t \qquad -1 \leq \beta \leq 1 \qquad \ldots(1)$$

where;

Y_t = price in time t, e_t = a serially uncorrelated white noise error term.

if $\phi = 1$, the series Y_t is nonstationary, if $\phi < 1$ then the series Y_t is stationary. To test for β, Y_{t-1} is subtracted from both side of the equation to obtain the following equation:

$$Y_t - Y_{t-1} = Y_{t-1}(\phi - 1) + e_t \qquad \ldots(2)$$

This can to rewritten as:

$$\Delta Y_t = \beta Y_{t-1} + e_t \qquad \ldots(3)$$

where;

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$\beta = (\phi - 1)$, and Δ is the first difference operator; thus in practice, equation 3 is estimated and the null hypothesis of $\beta = 0$ is tested against the alternative hypothesis of $\beta \neq 0$. If, $\beta = 0$, then $\phi = 1$, it implies that there is unit root problem and Y_t is nonstationary; but when $\beta \neq 0$, then $\phi < 1$ and the series Y_t is stationary. But according to Erdogdu (2007), the t- value of the estimated coefficient of Y_{t-1} does not follow the t-distribution even in large samples, therefore the decision to reject or accept the null hypothesis of $\beta = 0$ is based on the critical values of the tau statistic in the Dickey Fuller (DF) test.

The DF test is based on the assumption that the error terms are not serially corrected, however in practical sense they show evidence of serial correlation, therefore the ADF test was developed to resolve this problem. In the ADF test, the lags of the first difference are included in the regression equation in order to whiten the noise of the error term e_t, the equation is presented as:

$$\Delta Y_t = \beta Y_{t-1} + \phi_i \sum_{i=1}^{m} \Delta Y_{t-1} + e_t \quad \ldots(4)$$

When intercept and time trend are added, the model becomes

$$\Delta Y_t = \alpha_1 + \alpha_2 t + \beta Y_{t-1} + \phi_i \sum_{i=1}^{m} \Delta Y_{t-1} + e_t \quad \ldots(5)$$

where;

α_1 and α_2 are constant and coefficient of time trend, respectively.

The ADF test was carried out on equations 3, 4 and 5, where; Y_t represents a random walk without drift, a random walk with drift, and a random walk with drift around a deterministic trend.

With regards to causality of market prices, objective ii was achieved by the use of Granger causality test to determine the lead market between rural and urban markets that is the direction in which the price is moving. The Granger model for the study as adopted from Izekor *et al*. (2016) is represented as:

$$RP_t = \alpha_0 + \sum_{i=1}^{m} \alpha_i \, UP_{t-1} + \sum_{j=1}^{n} \beta_j \, RP_{t-j} + \varepsilon_t \quad \ldots(6)$$

where;

n = number of observations, M = number of lag, RP_t = rural market price, UP_t = urban market price, α and β = parameters to be estimated and ε_t = error term. The study tested hypothesis are:

H_0: price of rice in one market does not determine the price of rice in the other market

H_1: price of rice in one market determine the price of rice in the other market.

On extent of price relationship, objective iii was achieved by the use of Index of Market Concentration (IMC). This was used to measure the degree of short-run price relationship between integrated markets. The model is specified below for both local and imported rice as follows;

$$R_{1t=} \beta_0 + \beta_1 R_{1t-1} + \beta_2 (R_{2t} - R_{2t-1} + \beta_3 R_{2t-1} + \varepsilon_{1t}) \quad \ldots(7)$$

$$R_{3t=} \alpha_0 + \alpha_1 R_{3t-1} + \alpha_2 (R_{4t} - R_{4t-1} + \alpha_3 R_{4t-1} + \varepsilon_{2t}) \quad \ldots(8)$$

where;

R_{1t} = price of local rice in rural market (₦/kg), R_{2t} = price of local rice in urban market (₦/kg) R_{3t} = price of imported rice in rural market (₦/kg), R_{4t} = price of imported rice in urban market (₦/kg), R_{1t-1} = lag price of local rice in rural market (₦/kg), R_{3t-1} = lag price of imported rice in rural market (₦/kg). β_0 and α_0 = intercept, ε = stochastic term. IMC = $\frac{\beta_1}{\beta_3}$ is for local rice, IMC = $\frac{\alpha_1}{\alpha_3}$ is for imported rice; where; $0 \leq IMC \leq \infty$, if:

$IMC < 1$ implies high short-run market integration, $IMC > 1$ implies low short-run market integration, $IMC \infty 1$ implies no market integration, and $IMC = 1$ implies moderate short-run market integration

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RESULTS AND DISCUSSION

The summary statistics for the price series as revealed by Table 1 shows that the maximum price for local rice in the area for the period under study is ₦274.48 and ₦283.07 in rural and urban markets, respectively. The maximum prices for imported rice in Lagos were ₦400.52 and ₦ 485.89 in rural and urban markets, respectively. The skewness of both prices of local and imported rice shows that it is positively skewed with many small values, since the values were all greater than zero. The kurtosis value (Table 1) indicates that flat peaks for local rice prices and sharp peaks for imported rice prices, though the prices of local rice which is more closer to 3 seems to be normally distributed than that of imported rice.

Table 1: Summary Statistics for Local and Imported Rice Prices in Rural and Urban Markets

Variables	**RURLOCL (₦/kg)**	**URBLOCL(₦/kg)**	**RURIML(₦/kg)**	**URBIML(₦/kg)**
Mean	130.61	130.17	154.45	159.21
Median	125.62	126.12	153.33	154.07
Maximum	274.48	283.07	400.52	485.89
Minimum	32.90	35.50	54.10	48.56
Std. Dev.	64.41	62.18	71.39	85.52
Skewness	0.34	0.36	0.71	1.06
Kurtosis	2.15	2.30	3.51	4.06
Jarque-Bera	10.07	8.53	19.15	48.13
Probability	0.00	0.01	0.00	0.00
Observations	204	204	204	204

Note: RURLOCL-Price of Rural local Rice Lagos State; URBLOCL-Price of Urban Local Rice Lagos State; RURIML-Price of Rural Imported Rice Lagos State; and URBIML-Price of Urban Imported Rice
Source: Data analysis, 2018

The result (Table 2) of ADF test for the price series which include price of local rice at rural and urban markets as well as price of imported rice in rural and urban as indicated by t-statistics and t-critical value (5%) became significant after the first differencing for all the estimated equations (no intercept, with intercept and with intercept and trend). The result of ADF with intercept and trend as reported is in agreement with the findings of Ohen *et al.* (2007) and Mkpado *et al.* (2013) who observed that rural and urban market price of rice became stationary after the first differencing and also that of Ojo *et al.* (2015) in the study of rural and urban rice market in Niger state and find out that unit root was eliminated after the first difference, the result also conforms with those of Moses (2017) who observed that rural and urban market prices of maize in Gombe state were stationary at first differencing and also Chen and Saghaian (2016) who observed that the monthly series of rice in Thailand and United states are integrated of I(1).

To achieve objective i of the study which is trend in prices. The trend was achieved by a graphical presentation of the price series, where the prices were compared graphically for rural and urban markets to see their movement pattern.

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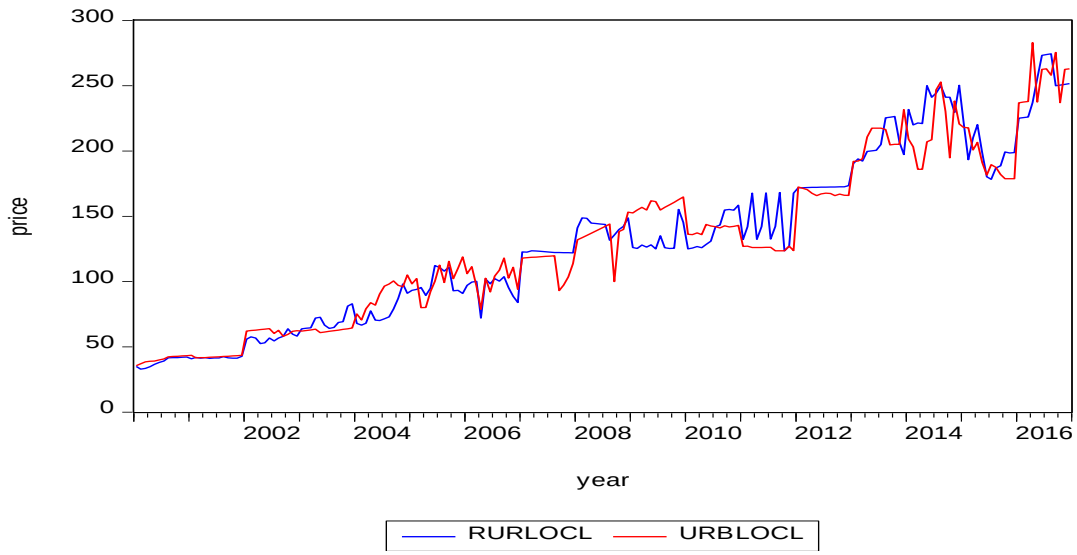
Table 2: ADF Test for Prices of Local and Imported Rice in Rural and Urban Markets

Variables	Stage	t-statistic	t-critical (5%)	Order of int.	Remarks
PRLL	Level	1.739	1.942	-	Non-stationary
	1st difference	-19.59***	-3.432	I(1)	Stationary
PULL	Level	1.847	-1.942	-	Non-stationary
	1st difference	-15.274***	-3.432	I(1)	Stationary
PRIL	Level	-2.285	-2.577	-	Non-stationary
	1st difference	-14.989***	-3.432	I(1)	Stationary
PUIL	Level	2.202	2.876	-	Non-stationary
	1st difference	-6.131***	-3.433	I(1)	Stationary

Note: PRLL is Price of Rural Local Rice in Lagos State; PULL is Price of Urban Local Rice in Lagos State; PRIL is Price of Rural imported rice in Lagos State and PUIL is Price of Urban Imported Rice in Lagos State;
***implies significance at 1% level of probability; and I(1) implies order of integration at level one.
Source: Data analysis, 2018

The graph of trend in the price of local rice in rural and urban markets of Lagos State as visualized in Figure 1, shows that the price of local rice in both rural and urban markets was increasing and moving up in an irregular pattern. This implies that there is information flow between the two markets, which enable marketers to know about price change in one market and it is easily reflected in the other market, this will make marketers apprised on prices and take decisions quickly.

The graph in Figure 2 shows that the price of imported rice was increasing in both rural and urban market of Lagos State between the period under study, Akande and Akpkodje (2003) finds out that average monthly retailed prices of imported rice was increasing. The prices got to it peak at the end of 2016 were price per kg of imported rice got close to ₦500.



Note: RURLOCL means price of local rice in rural market of Lagos State and URBLOCL means price of local rice in urban market of Lagos State.
Figure 1: *Trend in price of local rice in rural and urban markets of Lagos state*

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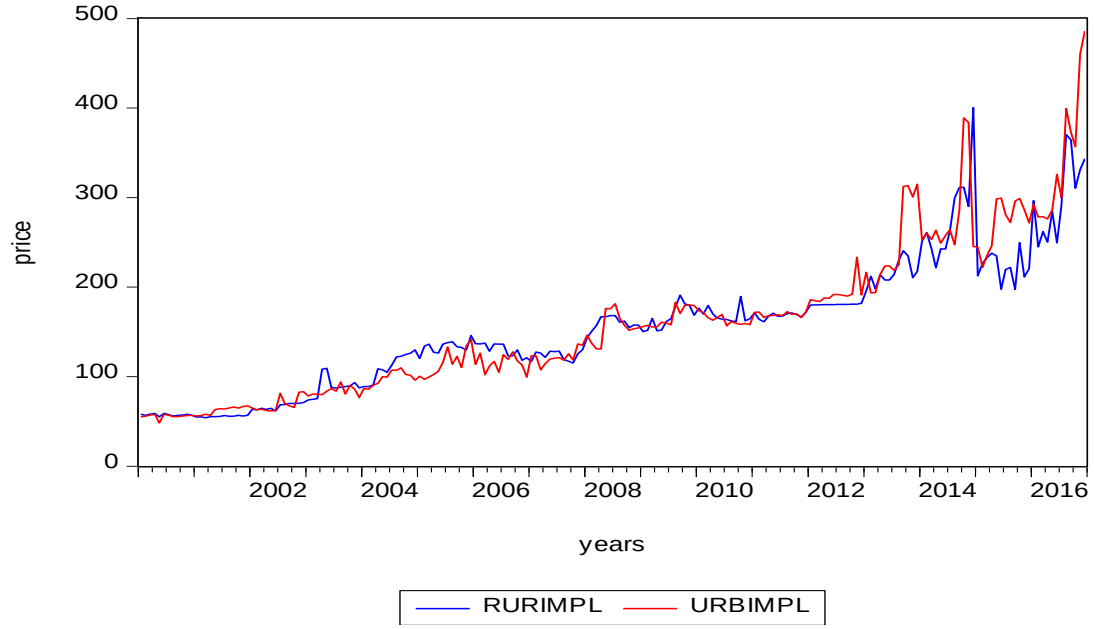

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Note: RURIMPL means price of imported rice in rural market of Lagos State and URBIMPL means price of local rice in urban market of Lagos State.

Figure 2: *Trend in price of imported rice in rural and urban markets of Lagos state*

The result (Table 3) of Granger causality test for Lagos State price shows that all the prices paired together granger causes each other as shown by the probability which rejected the null hypothesis at 1% (P≤0.01) for all the price pairs except for the pairs of PLUL to PLRL, PLRI to PLRL, PLRI to PLUL and PLUL to PLUI which were rejected at 5% (P≤0.05).

Table 3: Result of Granger Causality Test for Lagos State Price Series

Null hypothesis	**F-ratio**	**Prob >F**	**Decision**
PLUL does not granger cause PLRL	10.687	0.001	Reject
PLRL does not granger cause PLUL	17.293	0.000	Reject
PLRI does not granger cause PLRL	6.900	0.009	Reject
PLRL does not granger cause PLRI	21.963	0.000	Reject
PLUI does not granger cause PLRL	13.059	0.000	Reject
PLRL does not granger cause PLUI	21.440	0.000	Reject
PLUL does not granger cause PLRI	36.918	0.000	Reject
PLRI does not granger cause PLUL	10.239	0.002	Reject
PLUI does not granger cause PLRI	33.714	0.000	Reject
PLRI does not granger cause PLUI	18.613	0.000	Reject
PLUI does not granger cause PLUL	13.353	0.000	Reject
PLUL does not granger cause PLUI	9.251	0.003	Reject

Note: PLUL means price of local rice in urban market Lagos state, PLRL means price of local rice in rural market Lagos state, PLUI means price of imported rice in urban market Lagos State and PLRI means price of imported rice in rural market Lagos State.

Source: Data analysis, 2018

The result of Table 3 implies that there exist a bilateral or bi-directional relationship between all the price pairs and these further justify the existence of perfect price transmission or simultaneous feedback relationship in Lagos State markets, and that prices of rice both local and imported in rural markets can be used to predict the prices in urban markets and prices in urban markets can also be used to predict prices in rural market. These means that the prices

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ISSN (Print): 2651-6144; ISSN (Online): 2651-6365

move together and any change in one market is quickly transmitted to the other market and this conforms with the findings of Ohen *et al.* (2007), and Mohammed and Wim (2010) who studied the evaluation of rice market in Banglandesh and Adeoye *et al.* (2011) who observed a bi-directional causality or simultaneous feedback in Oyo State Nigeria.

The IMC for local rice prices in rural and urban markets of Lagos State as revealed in Table 4 shows a value of 2.795 which is greater than 1 means a low short-run market integration for local rice prices between rural and urban markets of Lagos State. This further means that price transmission mechanism in Lagos State markets is low which may be attributed to inadequacy in the flow of market information in the short run period. This was also observed by Akintunde *et al.* (2012) in the study of long run price integration of grains in Oyo State.

Table 4: Regression Estimates of Index of Market Concentration for Local Rice Lagos State

Variables	Coefficient	Standard Error	t-value
Constant	-0.004	0.049	0.078
R_{1t-1}	0.738	0.049	15.223***
$R_{2t-}R_{2t-1}$	0.129	0.0692	1.863*
R_{2t-1}	0.264	0.0507	5.205***
IMC	2.795		
R^2	0.981		
F. cal	3478.17***		
Durbin Watson			

Note: ***significant at 1%, * significant at 10%, IMC =2.795 >1, that is low short run market integration.
Source: Data analysis, 2018

The result of IMC in Table 5 shows a value of 2.581 which is greater than 1, this imply low short run market integration for imported rice prices in Lagos state markets. That is, there is low flow of market information from rural market to urban market and also from urban market to rural markets in the short run. This is in contrast with the findings of Akpan (2014), who observed a high short run market integration between prices in rural and urban market.

Table 5: Regression Estimates of Index of Market Concentration for Imported Rice Lagos State

Variables	Coefficient	Standard Error	t-value
Constant	0.128	0.057	2.244**
R_{1t-1}	0.7029	0.047	14.768***
$R_{2t-}R_{2t-1}$	-0.158	0.066	-2.386**
R_{2t-1}	0.272	0.045	6.111***
IMC	2.581		
R^2	0.974		
F. cal	2472.98***		
Durbin Watson	2.30		

Note: ***significant 1%;**significant 5%; *significant 10% and IMC = 2.581 >1, that is low short run market integration
Source: Data analysis, 2018

CONCLUSION AND RECOMMENDATIONS

The study concludes that prices of both local and imported rice in rural and urban markets were seen to be increasing at an irregular pattern, the maximum price for local rice in rural and urban markets in the study are ₦274.48 and ₦283.07, respectively, while that of imported rice was ₦400.52 and ₦485.89 for rural and urban markets, respectively. All prices

were integrated of I(1) and there is a bi-directional causality relationship between all the price pairs. The IMC shows a low short run relationship for both local and imported rice. It is recommended that the flow of information should be enhanced between spatially separated markets and also firm policies should be implemented on prices to minimized irregularities in rice prices across board.

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