Invited paper presented at the 6th African Conference of Agricultural Economists, September 23-26, 2019, Abuja, Nigeria

Analysis of growth rate in price of local and imported rice in rural and urban markets of Niger state, Nigeria

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Abstract
The study analyzed the growth rate in prices of local and imported rice in rural and urban markets of Niger state, secondary source of data, which was average monthly retailed prices per kg of local and imported rice in the study area from January 2000 to December 2016. Data was sourced mainly from Nigerian Bureau of Statistics (NBS), the data was analyzed using descriptive statistics, Augmented Dickey Fuller (ADF) unit root test and exponential growth equation model, the E-views software was used for the analysis. The result shows that the maximum price for rice per kg was ₦ 259.63, ₦ 261.43, ₦ 346.02, and ₦ 345.89 for local and imported rice in rural and urban markets of the state respectively. The ADF unit root test shows that all the price series became stationary after taking the first difference, thus having an order of integration of I(1). The graph of the trend in the prices shows that a close relationship between the prices as they tend to move together in an upward and irregular pattern. The result of the exponential trend equation for the growth rate using the ATA period, shows a decelerated growth rate for all the series during the pre ATA period and an accelerated growth rate during the ATA period.
Keywords: growth rate, price and rice

Background of study

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). 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 is been gotten from rice (Mohanty, 2013), and average growth in per capital rice consumption is likely to continue to increase in Nigeria for some times partly due to increase in population and the proliferation of different varieties of processed form (Erenstein *et al.*, 2004). 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.

The level of domestic rice production in Nigeria in 2012 was about 3.5 million metric tons per annum; while the domestic demand stood at about 6.1 million metric tons per annum (Central Bank of Nigeria CBN, 2013), in 2016 the estimated demand for rice is 6.3 million tons, while the

supply is 2.3 million tons (FMARD, 2016). And according to Daramola (2005) and Awe (2006) any shortfall in supply of rice creates incentive for rice importation in the country.
The agricultural transformation agenda (ATA) of the Federal Ministry of Agriculture and Rural Development sees Agriculture is an important sector of the economy with a high potentials for employment generation, food security and poverty reduction. According to ATA blue print, Low productivity in Nigeria over years compared to leading countries like Malaysia, Thailand, Indonesia, and Brazil has been largely due low fertilizer and improved seed utilization and inadequate government expenditure and the inability to compete with others, thus food imports are growing at an unsustainable rate of 11% per annum. (FMARD,2011).
The vision of the ATA strategy is to achieve a hunger-free Nigeria through an agricultural sector that drives income growth, accelerates achievement of food and nutritional security, generates employment and transforms Nigeria into a leading player in global food markets to grow wealth for millions of farmers. The main target is to grow the agricultural sector through the various commodities rice inclusive and also to generate employment opportunities. For instance, rice transformation plan would involve massive local production of milled rice which will be aimed at substituting parboiled (imported) rice. The expectation is that with the advent of high quality lower cost milled rice, a significant portion of demand in the domestic rice market will shift from parboiled rice to milled rice. A projected decline in demand for high quality parboiled rice from 1.9M metric tons to 1.3M metric tons between 2011-2015 and a shift in demand for milled rice from 0M metric ton in 2011 to 1.1M in 2015 is expected (FMARD,2011).

Aim and objectives of the study

The main aim of the study is to analyze the growth rate in price of local and imported rice in rural and urban markets of Niger State, Nigeria. The specific objectives however are;

1. describe the price series of local and imported rice in rural and urban markets in the study area,
2. examine the trend and growth rate in price of local and imported rice in rural and urban markets of the state, using the Agricultural Transformation Agenda (ATA) period.

Methodology

Study area

The study area is Niger State (North Central) the was carved out of the former North-Western State in 1976 and it is located in North Central Nigeria. The State lies between Latitudes $8^{o}20'$ and 11^{0} 30' North and Longitudes $3^{o}30'$ and7^{0} 20' East and share border with the Republic of Benin (West), Zamfara State (North), Kebbi (North-West), Kogi (South), Kwara (South-West), Kaduna (North-East) and South-East by FCT Abuja (Niger State Bureau of Statistics (NBS), 2012). The 2006 population census shows that the state has a population of 3,950,249 with an annual growth rate of 3.4% (National Planning Commission (NPC), 2006). The projected population at 3.4% annual growth rate gives a population of 5,293,333 by 2016, Niger State is among the largest States in Nigeria covering about 86,000km^2 (or about 8.6 million hectares) representing about 9.3% of the total land area of the country (Development Action Plan for Niger State, 2008) and about 95% of the land is arable and serve as source of employment for the predominantly rural population whose primary occupation is farming.
Niger State experiences two distinct climatic seasons in a year, these are rainy and dry seasons. Rainfall is steady and evenly distributed, usually between May and November, varying from 1,100mm to 1,600mm in the southern part of the state. Its maximum temperature is normally

37^0C which is recorded between March and June, while minimum temperature is around 21^0C recorded between December and January (Development Action Plan for Niger State, 2008). This climatic condition favours the production of many types of crops which include rice, maize, guinea corn, millet, melon, yam, cassava, cowpea, soya beans, potatoes, groundnut, cotton, sugarcane, and vegetables of various kinds, but the major staple food of the majority of the population are rice, maize, guinea corn, millet, yam, potatoes and cassava, therefore farmers all over the state lay more emphasis on their production and hence, the processing and marketing.
Niger State has 25 Local Government Areas (LGAs) which are grouped into three agricultural zones; I, II and III, with each zone having 8, 9 and 8 LGAs respectively. There are three major ethnic groups in the State, *Nupe, Gbagyi* and *Hausa.* Other minority tribes include *Kadara, Dibo, Kakanda, Koro, Kambari, Dukkawa, Dakarkari, Kamuku, Gana-Gana* etc.

Sampling Procedure and Sampling Size

A two-stage sampling procedure was used for this study. The first stage is the selection of Niger state being one of the major rice producing state in Nigeria. The second stage was the collection of average monthly retailed prices per kilogram (kg) of both local and imported rice for rural and urban markets in the state from 2000 to 2016 period (17years), thus the sample size will be 204 observations.

Method of Data Collection

This study mainly used secondary source of data which was the average monthly retailed prices per kg of local and imported rice for rural and urban markets in Lagos State. The prices was collected for a period of 17 years, that is from January,2000 to December, 2016. Data was collected from National Bureau of Statistics (NBS) and Food and Agriculture Organization (FAO) statistics

Method of Data Analysis

The study applied series of statistical and econometric tools to achieve the stated objectives. The tools used include exponential trend analysis, but before running any of the analysis, the data set was tested for stationarity using the Augmented Dickey Fuller Test and also a suitable lag length was selected for the analysis.

Test for stationarity

The test for stationarity precedes the use of any of the aforementioned tools, because in time series studies the data has to be stationary before any further analysis is run. A time series is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods strictly depend on the distance or lag between the two periods and not the actual time at which the covariance is computed (Gujarati, 2004).

Augmented Dicky Fuller (ADF) test for stationarity

The presence of unit root in a time series means the series is nonstationary and this generates unreliable results regarding the hypothesis testing According to Upender (2012), one method of testing for unit root and the order of integration of time series is the use of ADF. 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. Given the autoregressive process of order one AR (1),

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

Where;

Y_t = price in time t,

e_t = a serially uncorrelated white noise error term .

if $\phi = 1$, the serie 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

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

this can to rewritten as

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

Where; $\beta = (\phi - 1)$, and Δ is the first difference operator, thus in practice equation 3.3 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

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

When intercept and time trend are added, the model becomes

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

Where; α_1 and α_2 are constant and coefficient of time trend respectively.

The ADF test will be carried out on equations 3.3, 3.4 and 3.5), where Y_t represents a random walk without drift , a random walk with drift, and a random walk with drift around a deterministic trend.

Lag length Selection

A suitable lag was selected for each of the analysis using the various lag length selection criteria such as:

1. Akaike's information criterion: $AIC_\rho = n\ln(\sigma^2) + 2p$
2. Schwarz information criterion: $SIC_\rho = n\ln(\sigma^2) + n^{-1} p \ln(n)$
3. Hannan-Quinn criterion: $HQC_\rho = n\ln(\sigma^2) + 2 n^{-1} p \ln (\ln(n))$
4. Final prediction error: $FPE_\rho = \ln(\sigma^2)(n+ p)(n- p)^{-1}$
5. Corrected version of AIC: $AIC_\rho = \ln(\sigma^2) + n \frac{1+\frac{\rho}{n}}{1-\frac{p+2}{n}}$

Where n = sample size. $\sigma^2 = (n- p - 1)^{-1} \sum_{t-1}^{n} \varepsilon_t^2$ and ε_t are the model residuals.

Growth Rate in Prices

Objective 1 was achieved by the use of trend analysis. Here the average monthly retailed prices of both local and imported rice was used to investigate the nature of the growth rate in prices. The model is specified below

$P_t = b_o\, e^{bt}\, e^{ut}$ (6)

$\text{Log}_e\, p_t = \log_e b_o + b_1 t + u_t$ (7)

Where

Exponential growth rate (r) = $e^{b1} - 1 \times 100$

Thus the quadratic exponential trend equation is specified as

$\text{Log}_e\, p_t = b_o + b_1 t + b_2 t^2{}_2 + u_t$ (8)

Where

P_t = average monthly prices of rice, b_o = constant, b_1 and b_2 = are coefficients

t = time trend (1, 2, 3,------n) if;

$b > 0$: the price has accelerated growth,

$b < 0$: the price has decelerated growth and

$b = 0$: the price has stagnant growth.

RESULTS AND DISCUSSION

Table 1: Summary statistics of local and imported rice prices in rural and urban markets of Niger state.

variables	RURLOCN (₦/kg)	URBLOCN (₦/kg)	RURIMN (₦/kg)	URBIMN (₦/kg)
Mean	104.34	109.52	201.85	207.55
Median	103.77	101.18	203.27	205.89
Maximum	259.63	261.43	346.02	345.89
Minimum	30.00	28.97	135.59	159.04
Std. Dev.	47.99	52.81	36.79	34.41
Skewness	0.743	0.819	1.470	1.776
Kurtosis	3.83	3.63	7.23	7.72
Jarque-Bera	24.59	26.23	225.56	296.90
Probability	0.00	0.00	0.00	0.00
Observations	204	204	204	204

Source; data analysis 2018.

RURLOCN-Price of Rural local Rice Niger State, URBLOCN- Price of Urban Local Rice Niger State, RURIMN- Price of Rural Imported Rice Niger State and URBIMN- Price of Urban Imported Rice Niger State.

The result of the summary statistics in table 1 revealed the maximum price for rice in the study area over the period under study (2000-2016) to be ₦ 259.63, ₦ 261.43, ₦ 346.02 and ₦ 345.89 per kg of local rice in rural and urban market as well as imported rice in rural and urban markets respectively in the state. While the minimum price was ₦ 30.00, ₦ 28.97, ₦ 135.59 and ₦ 159.04 per kg for local and imported rice in rural and urban markets of the state respectively. The skewness showed that the data is positively skewed (value greater than zero), implying that the data has many small values. The kurtosis value which is greater than 3 shows the existence of sharp peaks in the data, but the prices of local rice in both rural and urban markets shows more normality than that of imported rice because it is closer to 3.

ADF test for unit root

Table 2: ADF test for prices of local and imported rice in rural and urban markets of Niger state (with intercept and trend)

Variables	Stage	t-statistic	t-critical (5%)	Order of int.	Remarks
PRLN	Level 1st difference	1.158 -8.711***	-2.876 -3.433	- I(1)	Non-stationary Stationary
PULN	Level 1st difference	2.162 -11.919***	-2.576 -3.432	- I(1)	Non-stationary Stationary
PRIN	Level 1st difference	0.741 15.212***	-1.942 -3.432	- I(1)	Non-stationary Stationary
PUIN	Level 1st difference	1.251 13.903***	-1.942 -3.432	- I(1)	Non-stationary Stationary

Source: data analysis, 2018

Where; PRLN is Price of Rural Local Rice in Niger state, PULN is Price of Urban Local Rice in Niger state, PRIN is Price of Rural imported rice in Niger state and PUIN is Price of Urban Imported Rice in Niger state.

In time series analysis one of the first things is to ascertain whether the series are stationary (do not have unit root), before any further analysis is ran. That is to ensure that the properties of the series are not affected by change in time only. According to Shrestha and Bhatta (2018), Augmented Dickey Fuller (ADF) test is the most common method of testing unit root. Thus, the ADF test for Niger state prices series which include price of local rice at local market, price of local rice at urban market, price of imported rice at local market and price of imported rice at urban market, as shown in table 2 reveals that all the price series were non-stationary at level as indicated by the absolute value of t-statistics which was less than absolute value of t-critical at 5% level of precision. But all the price series become stationary after taking the first difference (with no intercept, with intercept and with intercept and trend), as the absolute value of the t-statistics was greater than the absolute value of t-critical at 5%. This is in line with the results of the study of Acquah and Rebecca (2012) and that of Akpan et al (2014), who reported that prices of agricultural commodities are generally integrated at first order. A suitable lag was selected based on the Akaike Information Criterion (AIC) for all the series.

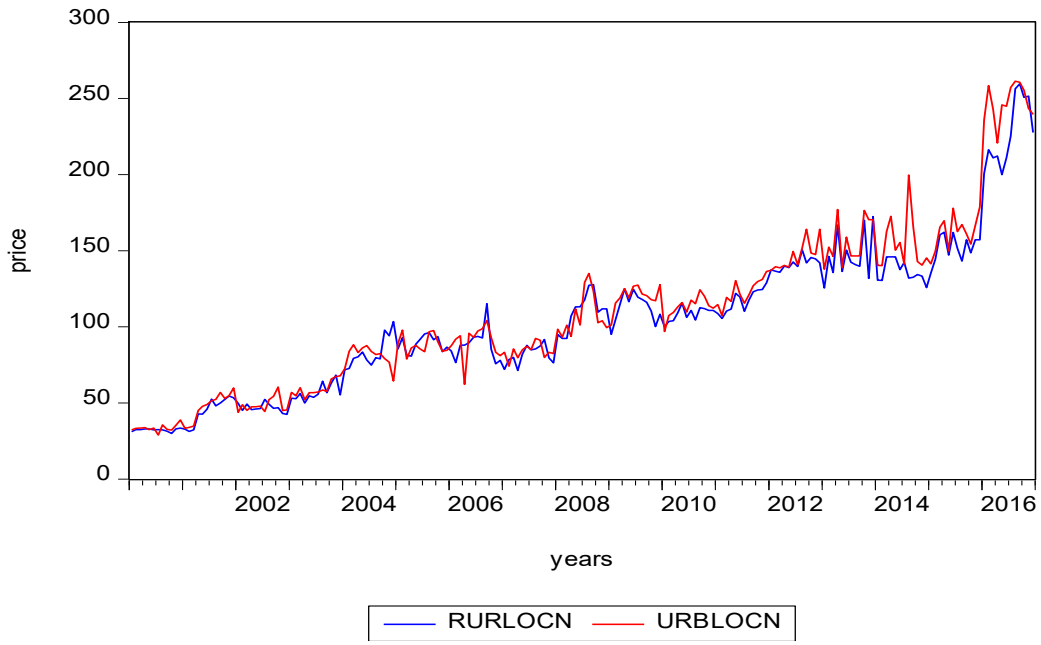

Figure 1: Trend in prices of local rice in rural and urban markets of Niger state

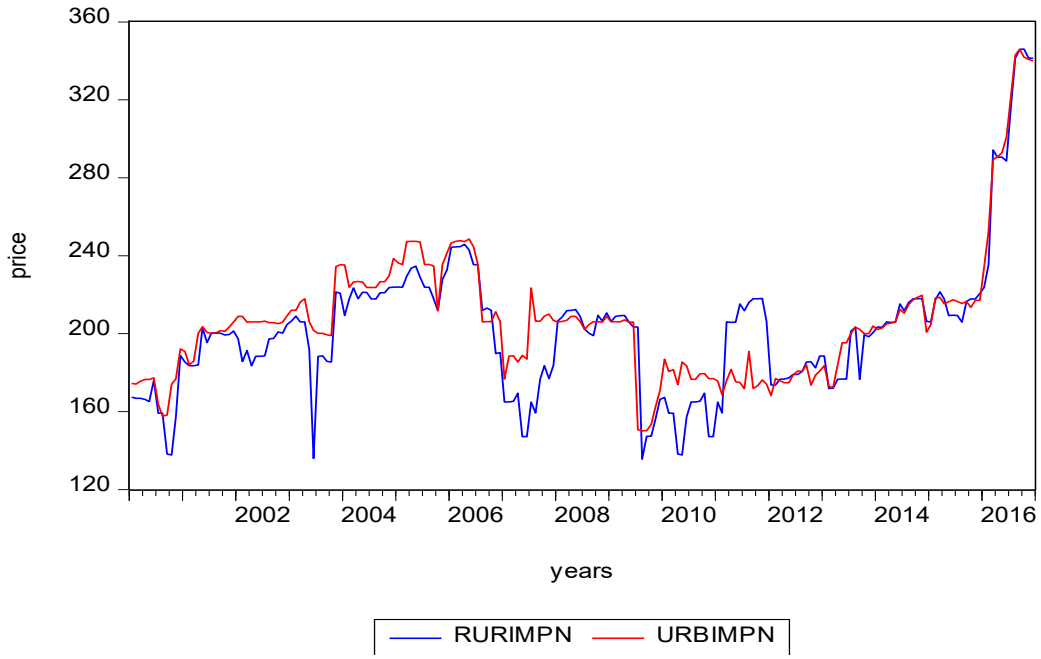

Figure 2: Trend in prices of imported rice in rural and urban markets in Niger state

The graph of the trend in prices of local rice in rural and urban markets of Niger state shows a very close relationship between the prices, as the series tend to move together showing a gradual

increase in the prices from year 2000 up to 2016 as shown in figure 1, where the prices got to it peak level in 2016 having moved from 150/kg in 2015 to 250/kg in 2016 with about 75% increase.

The graph of trend in rural and urban market prices of imported rice in the state as depicted by figure 2 shows an irregular pattern in the two markets which moves together suggesting that there is price transmission (co movement of prices) between the markets. This is shown in the continuous rise in the prices especially from 2015 to 2016 where the prices appear to be virtually the same in both markets. This may not be far from the fact that both markets may have different source of imported rice, as some rice come in through some porous border communities around the rural markets especially.

Table 3: Growth rate of prices of local and imported rice in rural and urban markets of Niger state.

Variables	Pre ATA	2000-2007			ATA	2008-2016		
	PRLN	PULN	PRIN	PUIN	PRLN	PULN	PRIN	PUIN
A	3.28*** (14.40)	3.34*** (88.22)	5.01*** (156.1)	5.08*** (253.24)	4.70*** (145.41)	4.69*** (143.10)	5.37*** (-7.73)	5.40*** (250.61)
b_1	0.027*** (-8.22)	0.025*** (-8.13)	0.014*** (9.04)	0.013*** (12.13)	-0.001 (-0.92)	0.00 (0.40)	-0.011*** (10.59)	-0.012*** (17.25)
b_2	-0.00*** (82.75)	-0.00*** (-8.22)	-0.00*** (-8.33	-0.00*** (-10.24)	0.00*** (5.68)	0.00*** (4.88)	0.00*** (10.59)	0.00*** (17.25)
GR (%)	2.70	2.50	1.40	1.30	-0.10	0.00	1.10	1.20
R^2	0.889	0.890	0.477	0.665	0.781	0.811	0.673	0.836
F	371.2***	376.5***	42.41***	92.16***	186.81***	226.17***	108.22***	267.75***
N	96	96	96	96	108	108	108	108
Inference	Dec	dec	dec	dec	acc	acc	Acc	Acc

Source; data analysis 2018

Table 4: Growth rate of prices of local and imported rice in rural and urban markets of Niger state for the entire period

Variables	ENTIRE PERIOD 2000-2016			
	PRLN	PULN	PRIN	PUIN
A	3.53*** (111.15)	3.58*** (117.60)	5.31*** (158.00)	5.37*** (176.37)
b_1	0.013*** (18.66)	0.012*** (18.21)	-0.002** (-2.76)	-0.002** (-3.28)
b_2	-0.00*** (-7.72)	-0.00*** (-6.30)	0.00*** (4.03)	0.00*** (4.10)
GR (%)	1.30	1.20	0.20	0.20
R^2	0.912	0.923	0.157	0.109
F	1039.7***	1204.9***	18.69***	12.24***
N	204	204	204	204
Inference	Dec	dec	Acc	Acc

Source; data analysis 2018

Where: a is constant, b_1 and b_2 are coefficients, GR is growth rate, R^2 is coefficient of multiple determination, F is the F-ratio and N is number of observations.

*** is significant level at1% and numbers in parenthesis are t-value

The result of the exponential trend equation (for growth rate) for the price series is shown in table 3 and 4. The variables which include price of local rice in rural and urban markets and price of imported rice in rural and urban markets of Niger state where divided into three periods using the Agricultural Transformation Agenda (ATA) programme. Thus, the periods are pre- ATA, ATA and the entire period. The result shows that all the price series have a decelerated growth rate during the pre- ATA period (2000-2007), though prices were increasing but at a decelerated rate as shown by the coefficient of b_2 which the percentage was decreasing from 2.70% to 1.3%. Conversely, during the ATA period of 2008-2016 the prices have an accelerated growth rate, that is they were increasing at an increasing rate as the percentage of growth rate moves from -0.10% to 1.20%, this may attributed to the fact that during this period farmers were sensitize on the need to take farming as a business and thus, people were engaged in it in other to make profit.

Furthermore table 4 revealed that, in the entire period of 2000-2016 the prices of local rice as a decelerated growth rate while that of imported rice as an accelerated growth rate as shown by the percentage of growth rate in both rural and urban markets of Niger state. This result is in contrast with the findings of Akpan *et. al*., (2014) that discovered a constant exponential growth rate of 0.59% for all the price series.

Summary and Recommendations

The study analyzes the growth rate in local and imported rice prices in Niger state. The result shows that the maximum price for rice per kg was 259.63, 261.43, 346.02, and 345.89 for local and imported rice in rural and urban markets of the state respectively, while the minimum was 30.00, 28.97, 135.59 and 159.04 respectively. The ADF unit root test shows that all the price series became stationary after taking the first difference, thus having an order of integration of I(1).

The graph of the trend in the prices shows that a close relationship between the prices as they tend to move together in an upward and irregular pattern. The result of the exponential trend equation for the growth rate using the ATA period, shows a decelerated growth rate for all the series during the pre- ATA period and an accelerated growth rate during the ATA period.

It is recommended that government should uphold its policy on rice importation so as to ensure steady supply of our locally produced rice, also price should be regulated and consumers should develop interest in the locally produced rice so as to manage the price increase.

References

Acquah,H.D. and Rebbecca O, 2012. Spatail market integration and price transmission of selected plaintain markets in Ghana. Journal of Sustainable Development in African 14(5):208-217.

Akpan, S.B., Ini-mfon V.P. & Udoka, S.J, 2014. Analysis of Monthly Price Transmission of Local and Imported Rice in Rural and Urban Markets in Akwa Ibom State, Nigeria (2005-2013). *International Journal of Agriculture and Forestry* 4(1): 6-18.

Awe, O, 2006. Ban on Rice Importation Depresses Global Trade.Punch Newspaper, May 20. [Online] Available: http://www.punchng.com/ Accessed: Jan 20, 2015.

DAP, 2008. Development Action Plan for Niger State, 2008.

Daramola, A.G, 2005. Government Policies and Competitiveness of Nigerian Economy. A Paper Presented at the Workshop on Rice Policy and Food Security in Sub-Sahara Africa. Organized by WARDA, Cotonou, Republic of Benin.

Erenstein, O. Lançon F., Osiname, O & Kebbeh M, 2004. Operationalising the Strategic Framework for Rice Sector Revitalisation in Nigeria. Project Report – The Nigerian Rice Economy in a Competitive World: Constraints, Opportunities and Strategic Choices. Abidjan: WARDA –The Africa Rice Centre. ii-38

Federal Ministry of Agriculture and Rural Development, 2011. Agricultural Transformation Agenda Blue Print; we will grow Nigeria's Agricultural Sector.

Federal Ministry of Agriculture and Rural Development, 2016. The Green Alternative; Agricultural Promotion Policy 2016-2020. Policy and Strategy Document.

Erdogdu, E, 2007. Analysis of Electricity Demand using Cointegration and ARIMA Modelling: A Case of Turkey Energy Policy. 35(2): 1129-1146.

Gujarati D. N. (2004). *Basic Econometrics,* fourth edition. Tata McGraw-Hill Publishing Company Limited, New Delhi, India.

Imolehin E.D. & Wada A.C, 2000. Meeting the Rice Production and Consumption Demands of Nigeria with Improved Technologies , National Cereals Research Institute (NCRI) Badeggi, Nigeria,.

Mohanty, S, 2013. Trends in Global Rice Consumption. *Rice Today* 12(1):44–45 Google Scholar.

Nasirin, S., Magnus J., Björn, H., Agnes A.D. & Göran, D, 2015. Drivers of Rice Production: evidence from five Sub-Saharan African countries. *Agriculture and Food Security* 4:12

National Population Commission, 2006. Population and housing census; population distribution by sex, state, LGA and senatorial district. http://www.population.gov.ng/images/vol, (accessed 18th June, 2017).

Niger State Bureau of Statistics, 2012. Agricultural statistics 2012 edition; Niger State facts and figures.

Upender, M. 2012. Applied Econometrics 3rd Edition, Vrinda Publication Limited, 205.