EFFECT OF SHOCKS ON PRICE OF IMPORTED RICE IN RURAL AND URBAN MARKETS OF NIGER STATE, (2000-2016), NIGERIA

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ABSTRACT

The study analyzes the effect of shocks on price of imported rice in rural and urban markets of Niger State, objectives of the study are to describe trend in prices, to determine market integration and to examine the effect of shock in prices. Time series data of average monthly retailed prices of imported rice per kilogram(kg) was collected from National Bureau of Statistics (NBS) for year 2000 to 2016. Analytical tools employed in the study include trend analysis, market integration and Impulse Response Function(IRF). EViews software was used for the analyses. The result revealed that maximum prices per kg were ₦346.02 and ₦345.89 in rural and urban markets respectively, the trend revealed that prices were moving together in an undulating manner. Prices were integrated of order one I(1) and cointegration result shows that there is long run relationship between prices in rural and urban markets. The result of IRF revealed that a standard deviation shock in price of imported rice in rural market have a permanent effect in price in urban market and a shock to price in urban market have a transitory effect on price in rural market. The study recommends that necessary policies should be put in place to curb the influx of imported rice and also stability in prices, external shock especially uncontrolled rise in pump price should be regulated.

Keywords: Cointegration, impulse response function, imported rice and price,

INTRODUCTION

Nigeria is currently 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), 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 of rice (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.

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. Although Nigeria is the largest producer of rice in west Africa, it

, also the highest imported of the product lobally (Maduawuchi, 2020). Statistics hows that production increases by 5% very year, more so importation rate has lso been increasing (Nigerian Rice roduction Statistics NRPS,2017). Rice nportation in Nigeria has made up 50% f the local rice consumption rate, since omestics supply is capable of meeting up ith 49% demand (NRPS, 2017).

liger State is one of the highest rice roducing state in Nigeria, it rank first for ice production in the country in 2017 and 018 cropping season according to data rom National Agricultural Extension and Research Laison Services (NAERLS), Ahmadu Bello University ABU Zaria Maduawuchi, 2020). Despite these, there are imported rice of all form floating markets in the state.

Shock is one of the factors that affect prices of commodities. In economics, a shock is an unexpected or unpredictable event that affect an economy either positively or negatively. If a shock is due to shortage in supply, it usually results in price increase for that product and a technological shock affects productivity which in turns affects price. Awoyemi (2010) postulated that the price shock experienced by the country in 2004 was connected to the wide variation in supply and demand for rice in addition to the effect of exogenous variables which were beyond the control of producers and suppliers.

According to Tony *et al*. (2016), commodity price shocks are important type of external shock and are often cited as a problem for economic growth in sub-Sahara Africa. Commodity price shock can take the form of oil price shocks, shocks in the price of key inputs, shocks in the prices of key export and food prices shock (Atanu and Tony, 2014).

Aim and objectives

The aim of the study is to analyze the market integration of imported rice price in Niger State. However, the specific objectives are to;

I. describe the trend in the price of imported rice in Niger State,
ii. determine the market integration of imported rice in rural and urban markets in the study area, and
iii. examine the effect of shocks in the price of imported rice in the study area.

METHODOLOGY

Study Area

The study area is Niger State.The State lies between Latitudes 8°20' and 11° 30' North and Longitudes 3°30' and 7° 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 (National Bureau of Statistics (NBS), 2009). 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.

Rainfall varying from 1,100mm to 1,600mm in the southern part of the state. Its maximum temperature ranges between 21°C to 37°C (Development Action Plan for Niger State, 2008).

Figure1: Map of Nigeria Showing Niger State

Niger State

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 states in Nigeria. The second stage was the collection of average monthly retailed prices for both local and imported rice for rural and urban markets in the two states from 2000 to 2016 period (17years), thus the sample size is 204 observations.

Method of Data Collection

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

Method of Data Analysis

The tools of analysis used in this study include Vector Autoregressive Model (VAR) and Impulse Response Function (IRF).Eveiws software was used for the analysis.

...nted Dicky Fuller (ADF) test for ...narity

...esence of unit root in a time series ...s the series is nonstationary and this ...ates unreliable results regarding the ...thesis testing. According to Upender ...), one method of testing for unit root ...the order of integration of time series is the use of ADF, also according to Shrestha and Bhatta (2018), 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. Given the autoregressive process of order one AR (1).

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

...here;

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

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

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

...is can be rewritten as

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

Where; $\beta = (\phi - 1)$, and Δ is the first difference operator, thus in practice equation 3 is ...stimated 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 ...ut when $\beta \neq 0$, then $\phi < 1$ and the series Y_t is stationary.

$$\Delta Yt = \beta\, Yt\text{-}1 + \phi i\, \Sigma^{m}_{i=1}\, \Delta Yt\text{-}1 + et \qquad (4)$$

When intercept and time trend are added, the model becomes

$$\Delta Yt = \alpha 1 + \alpha 2\, t + \beta\, Yt\text{-}1 + \phi i \Sigma^{m}_{i=1}\, \Delta Yt\text{-}1 + et \qquad (5)$$

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.

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: $AIC_p = n\ln(\sigma_2) + 2p$
2. Schwarz information criterion: $SIC_p = n\ln(\sigma_2) + n_1 p \ln(n)$
3. Hannan-Quinn criterion: $HQC_p = n\ln(\sigma_2) + 2 n_1 p \ln(\ln(n))$
4. Final prediction error: $FPE_p = \ln(\sigma_2)(n + p)(- p)_1$
5. Corrected version of AIC: $AIC_p = \ln(\sigma_2) + n \dfrac{1 + \frac{p}{n}}{1 - \frac{p+2}{n}}$

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

Trend in prices

Objective 1 was achieved by the use of trend graph to visualize the pattern of movement of the prices over the period of study.

Market integration

Objective 2 which is to determine market integration, that is, how price signals are transmitted across separate markets. This was achieved by the use of Vector Auto regressive Model (VAR). The general model is specified as

$$\Delta p_t = \alpha + \Sigma^k_i \Gamma_i \Delta p_{t-i} + \Pi p_{t-1} + \mu_t \qquad (6)$$

Where:

Δ = is the first difference operator, p_t = is a n x 1 vector containing the price,

Γi = The matrix of short run coefficients, Π = The matrix of long–run coefficients,

μ_t = The normally distributed errors and K = Number of lags, that will be adequately large enough to capture the Short-run dynamics of the underlying VAR and to produce normally distributed white noise residuals.

Effect of shocks on future prices

Objective 3 was achieved by the use of Impulse Response Function (IRF), to determine the effect of shocks in the future prices of both local and imported rice in rural and urban markets. It reveals whether the shock is transitory or permanent. The IRF traces the effect of one unit shock of the variables on current and future values of all endogenous variables in a system over various time horizons (Rahman and Shahbaz, 2013; Sadiq *et al.*, (2016)

The Generalized Impulse Response Function (GIRF) as suggested by Pesaran and Shin (1998) in Sadiq *et al.*, (2016) is;

$$GIRFy\,(h, \square, \square_{t-1}) = E\left[\frac{Yt+h}{\square\square_{t-1}}\right] - E\left[\frac{Yt+h}{\square_{t-1}}\right] \qquad (7)$$

Where;

GIRFy = generalized impulse response for price

$\square_{t-1}$ = history (past value of shock)

...SULTS AND DISCUSSION

...le 1: Summary statistics imported rice prices in rural and urban markets of Niger State

...ables	RIN(₦/kg)	UIN(₦/kg)
...s	201.85	207.55
...dian	203.27	205.89
...imum	346.02	345.89
...imum	135.59	159.04
... Dev.	36.79	34.41
...ness	1.470	1.776
...osis	7.23	7.72
...ue-Bera	225.56	296.90
...bability	0.00	0.00
...ervations	204	204

...ce: Data analysis 2018.

...te: RIN- Price of Rural Imported Rice Niger State and UIN- Price of Urban ...ported Rice Niger State.

...result of the summary statistics in ...le1 revealed that maximum price and ...imum prices for imported rice in Niger ... over the period under study (2000-...) are ₦346.02 and ₦345.89, ₦ 135.59 ...₦159.04 per kg for in rural and urban ...ets of the state respectively. The ...ness showed that the data is positively skewed (value greater than zero), implying that the data has many small values and it is highly skewed, as the skewness values are greater than 0.5. The kurtosis value which is greater than three (3) shows the existence of sharp peaks in the data.

Where; RIN is Price of Rural imported rice in Niger state and UIN is Price of Urban Imported Rice in Niger state. ***implies significance at 1% level of probability, I(1) implies order of integration at level one.

The result as shown in Table 2 revealed that price 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, implying that their mean, variance and covariance are not constant. But the price series become stationary after taking the first difference for all the estimated equation (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 studies by Yusuff *et al.* (2006) who reported that commodity prices are stationary after the first differencing, Adeoye *et al.* (2011) also reported that prices were integrated of order one I(1),also the studies of Acquah and Owuso (2012) and that of Akpan *et al.* (2014) report 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.

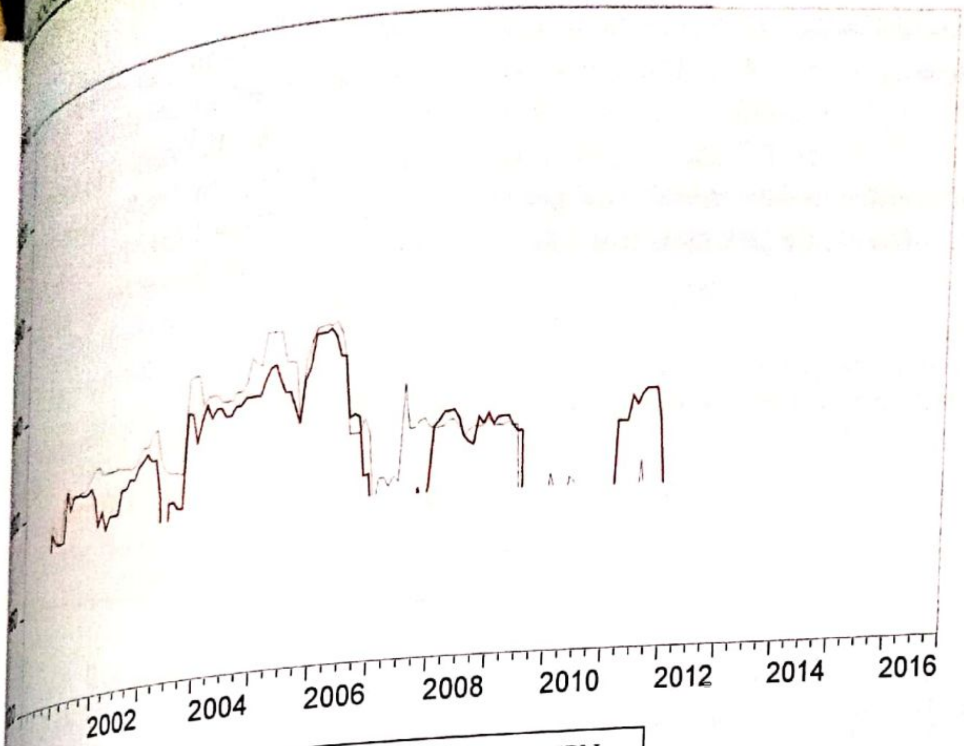
Table 3: Result of unrestricted cointegration rank test for rural imported and urban imported rice Niger (Trace Statistics and Max-eigen stat.)

Rank	Eigen value	Trace stat.	Max-eigen stat.	Critical value (5%)	Prob.	Hypothesis
None	0.097	21.446	20.502	15.495	0.006	Reject
At most 1	0.005	0.944	0.944	3.841	0.331	Accept

Source: Data analysis, 2018

The result of cointegrating of price of imported rice in rural and urban markets of Niger state shows that there is one cointegrating equation as shown by the trace statistics and max-eigen statistics which were greater than their respective critical value at 5% level of probability which leads to the rejection of the null hypothesis of cointegration and thereby implying that there is existence of long run relationship among the prices, that is the prices move together at the long run, as observed by Ojo *et al.*(2015) that rural and urban rice market prices are integrated in Niger state. Similarly, Okoh and Egbon (2015) also observed that rural and urban foodstuffs market were well integrated, which implies that prices of foodstuffs move together in the long run.

The IRF result for the price of imported rice in Niger state as visualized in figure 2, shows that a shock in the price of imported rice in rural market have a transitory effect on itself as visualized by graph 1in the figure which tends to be going down and fading away as it moves from 0.065% in the 1stmonth to 0.022 in the 12th month, thereby fading away gradually as it enters the next



...gure 1: Trend in price of imported rice in rural and urban markets of Niger state

...here; RURIMPN means price of imported rice in rural market of Niger State
...d URBIMPN means price of imported rice in urban market of Niger State.

...graph of trend in rural and urban ...t prices for imported rice in Niger ... as depicted by figure shows an ...ar pattern in the two markets which ... together suggesting that there is ... transmission (co movement of ... between the markets. This is shown ...ontinuous rise and fall in the prices. ...gh there were periods where the price ...ported rice in rural market became ...han that of urban market which is as a result of rice coming through the porous borders in some rural communities. The price series from 2015 to 2016 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.

...able 2: ADF test for prices of imported rice in rural and urban markets of Niger state

...riables	Stage	t-statistic	t-critical (5%)	Order of int.	Remarks
...N	Level	0.741	-1.942	-	Non-stationary
	1st difference	15.212***	-3.432	I(1)	Stationary
...N	Level	1.251	-1.942	-	Non-stationary
	1st difference	13.903***	-3.432	I(1)	Stationary

...rce: data analysis, 2018

year. Also the response of price imported rice in urban market to that of rural market in graph 3 of the same figure shows a transitory effect.Graph 2 and 4 shows that a one standard deviation shock to the price of imported rice have a permanent effect from rural market to urban market and also from urban to urban as the graph moves in an upward direction moving into the next year. Implying that the shock does not easily fade away as changes in the price last for a long period in the market.

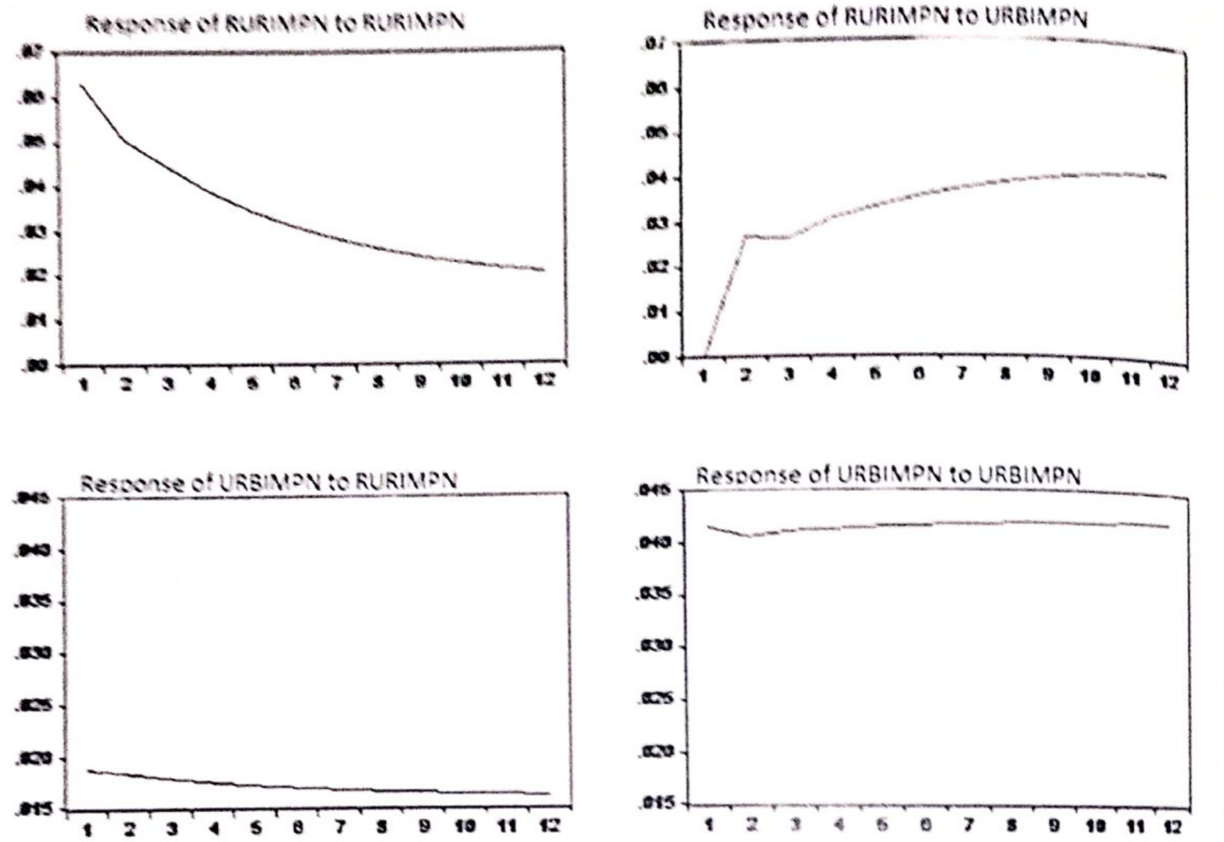


Figure 2: IRF for price of imported rice in rural market and that of imported rice in urban market of Niger State

CONCLUSION AND RECOMMENDATIONS

The study concludes that maximum prices per kg were ₦346.02 and ₦345.89 in rural and urban markets respectively, the trend revealed that prices were moving together in an undulating manner. Prices were integrated of order one I(1) and cointegration result shows that there is long run relationship between prices in rural and urban markets. The result of IRF revealed that a standard deviation shock in price of imported rice in rural market have a permanent effect in price in urban market and a shock to price in urban market have a transitory effect on price in rural market. The study recommends that necessary policies should be put in place to curb the influx of imported rice and also stability in prices, external shock especially uncontrolled rise in fuel pump price should be regulated.

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