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ABSTRACT

Most studies on local rice in Nigeria were geared toward increasing production, consumption or competitiveness. Achieving these requires a study on extent of pricing contacts in the market for local rice. Secondary data consisting of urban monthly retail price series in the six southwest states of Nigeria were collected and analyzed. Analytical techniques included Augmented Dickey Fuller (ADF), Johansen Co-integration and Granger Causality models. Empirical results indicated that growth in retail prices was highest in 2004 and in Ogun (48.69%) and Ondo (45.36%) implying that local rice was more costly in these states. Retail prices were more volatile in Lagos (37.3%) while the least price volatility was recorded in Ogun (30.4%). The ADF test showed all price series were non-stationary at their levels but were stationary after first-difference. Pair-wise market integration model indicated that prices were co-integrated at either 1% or 5% levels of significance connoting high degree of marketing efficiency. Multiple co-integration model also indicated five co-integrating equations in six, at 5% level thus validating the result of pair-wise market co-integration tests. Granger causality model revealed that the supply-deficient markets in Lagos and Osun were driving prices in other states. These results may have arisen from the storability of rice and closeness of the market locations. Despite this very high level of linkage, there is the need for all stakeholders in the market to continue to effectively perform their roles so that economic benefits derivable from this scenario of strong pricing contacts can be fully realized and sustained.

Keywords: Rice, local production, price movements, market linkage, price leadership, Nigeria.

1. Introduction

The status of rice in the average Nigerian diet has been transformed from being a luxury food item to that of a staple which is gradually taking part of the share formerly accounted for by cassava and yam (Akande and Akpokodje, 2003; Daramola, 2005 and Odusina, 2008). According to Akanji (1995) and Akpokodje *et al.* (2001), a combination of factors seems to have triggered the structural increase in rice consumption. These include: rapid urbanization and ease of preparation that fits easily to the lifestyle of urban workers. Besides the demand from households, which keeps rising, there is an increase in fast food joints as a result of increasing urbanization. It is expected that the demand for rice will continue to increase (Akande and Akpokodje, 2003; FAO, 2005, Bamidele *et al*, 2010 and Odularu, 2010). Furthermore, as more women enter the workforce both in the formal and informal sectors, the opportunity cost of their time increases and convenience food such as rice; which can be prepared quickly, become the preferred choice (Odusina, 2008 and Bamidele *et al*, 2010).

Nigeria's annual rice demand is estimated at 5 million tonnes out of which only about 2.2 million tonnes is produced locally. The annual rice supply gap of about 2.8 million tonnes (or 56% of demand) is bridged by importation (Daramola, 2005; Rahji and Adewumi, 2008; Kassali *et al.*, 2010 and Odularu, 2010).

Over the years, most research efforts have been geared toward increasing local rice production with the quest for self-sufficiency in its production, the desire to make local rice compete favourably with imported rice, and also the desire to stop the excessive outflow of foreign exchange for importing rice and indeed the desire to raise local rice consumption in Nigeria (Daramola, 2005; Bamidele *et al*., 2010). Sadly, little importance has been given to research and development of the country's rice marketing and distribution system to the extent it deserves. Only few studies have been devoted to examining the competitiveness and efficiency of the local rice market in Nigeria. However, unless agricultural markets are integrated, producers and consumers will not realize the gains from trade liberalization, since the correct price signals will not be transmitted from one market to another and the consequence of this is that, farmers will not be able to specialize according to long-term comparative advantage. Making the market and the distribution systems work better for the farmers, processors and consumers is a continuing challenge (Intal and Ranit, 2001) that should be adequately met through an expanded research programme.

The major objective of this paper therefore, is to examine the price co-integration of the markets for locally produced rice in South west, Nigeria. The specific objectives are to (i) determine the extent of variability in retail prices; (ii) determine the degree and extent of market integration between different spatial markets and (iv) identify markets exhibiting leadership positions in price formation and transmission.

2. Theoretical framework

Co-integration is a statistical property possessed by some time series data that is defined by the concept of stationarity and order of integration of the series. It deals with relationship among

a group of variables where (unconditionally) each has a unit root. It means that despite being individually non-stationary, a linear combination of two or more time series can be stationary.
A stationary series is one with a mean value which is time invariant. In contrast, a non-stationary series will exhibit a time varying mean. The order of integration of a series is given by the number of time the series must be differenced in order to produce a stationary series. A series generated by the first difference is integrated of order I denoted as I(1). Thus, if a time series is 1(0), it is stationary; if it is (1), then its change is stationary and its level is non-stationary.

The concept of co-integration and the method for estimating a co-integrated relation or system (Engle and Granger, 1987; Johansen, 1988; Johansen and Juselius, 1990 and Juselius, 2006) provide a framework for estimating and testing for long run equilibrium relationships between non-stationary integrated variables. If two prices in spatially separated markets (or different levels of the supply chain) p_{1t} and p_{2t}, contain stochastic trends and are integrated of the same order, say I(d), the prices are said to be co-integrated if:

$p_{1t} - \beta p_{2t} = \mu$ is I(0)

β is referred to as the co-integrating vector (in the case of two variables, a scalar), whilst the equation p1t $-\beta$p2t is said to be the co-integrating regression. Co-integration implies that these prices move closely together in the long run, although in the short run they may drift apart, and this is consistent with the concept of market integration. Co-integration analysis thus provides a powerful discriminating test for spurious correlation: conducting co-integration analysis between apparently correlated I(1) series and finding co-integration confirm the regression.

Several methods have been used to measure market integration. Advocated by Granger and Elliot (1967), simple bivariate correlation coefficients, also called the Law of One Price (LOP), have long been the most common measure used. Later this method was strongly criticized, most notably by Harriss (1979) and Ravallion (1986). Advances in time series econometrics led to the development of models that address some of the perceived weakness in the correlation coefficient approach. In this respect, Ravallion (1986) proposed a dynamic model of spatial price differentials incorporating time lags.

One major drawback however remained. Both the LOP and Ravallion model test whether price changes in one market will be translated on a one-for-one basis to the other market, either instantaneously (LOP) or with lags (Ravallion). But prices in different markets will only move on a one-for-one basis if the inter-market price differential is equal to transfer costs. Thus, price movements inside the band-with set by the transfer costs do not harm the hypothesis of market integration, whereas these models possibly reject this hypothesis.

Palakas and Harris-White (1993) and Alexander and Wyeth (1994) extended Ravallion's model using co-integration and Granger causality ordinary least squares (OLS) techniques. This allowed testing for more general notions between markets and measures whether prices in two markets wander within a fixed band (Baulch, 1997). A limitation of these models, however, is that all models are in fact "static". Markets are either integrated or not. This requires the assumption of a constant market structure throughout the sample period. It implies that when observations for different sub-periods are limited, then doing integration analysis is not feasible.

Presently, the most common approach to test for market integration is the Johansen co-integration technique and Vector Error Correction Model applied among others by Mafimisebi (2008), Rufino (2008) and Mohammad and Wim (2010). This paper used this approach.

3. Methodology

3.1. Sources and Scope of Study

The secondary data used for this study were sourced from National Bureau of Statistics, Nigeria (NBS). These are monthly retail prices of urban local rice markets in the six south western states of Nigeria which comprises Lagos, Oyo, Osun, Ogun, Ondo and Ekiti. The data covered from January 2001 - December 2010, giving a total of 120 data points per state.

3.2 Analytical Procedure

The data analytical techniques that were used in this study comprised of descriptive statistical techniques and co-integration technique (Johansen co-integration test).The descriptive statistics that were used included frequency counts, means and co-efficient of variation. Augmented Dickey Fuller Tests (ADF) and Philip Perron (PP) tests were used for the stationarity tests. Johansen co-integration test was used to test for long run market integration between spatial markets that are stationary of at the same order.

3.2.1 Mean Spatial Prices and Variability Index

Average monthly growth rate of prices for the whole period considered were computed as well as coefficients of variation (CV).

3.2.2. Test for Order of Econometric Integration (unit root test)

A stationary series is one with a mean value which will not vary with the sampling period. In contrast, a non-stationary series will exhibit a time varying mean (Juselius 2006). Before examining integration relationships between or among variables, it is essential to test for unit root, and identify the order of stationarity, denoted as I(0) or I(1). This is necessary to avoid spurious and misleading regression estimates.

The framework of ADF methods is based on analysis of the following model;

$$\Delta p_t = \alpha + \beta \rho_{t-1} + \gamma T + \sum_{k=1}^{n} \delta_k \Delta p_{t-k} + \mu_t \quad (1)$$

Here, p_t is the rice price series being investigated for stationarity, Δ is first difference operator, T is time trend variable, μ_t represents zero-mean, serially uncorrelated, random disturbances, k is the lag lengths; $\alpha, \beta, \gamma \ \ and \ \delta_k$ are the coefficient vectors. Unit root tests were conducted on the β parameters to determine whether or not each of the series is more closely identified as being I(1) or I(0) process. Test statistics is the t statistics for β. The test of the null hypothesis of equation (1) shows the existence of a unit root when $\beta = 1$ against alternative hypothesis of no unit root when $\beta \neq 1$. The null hypothesis of non-stationarity is rejected when the absolute value of the test statistics is greater than the critical value. When p_t is non-stationary, it is then examined whether or not the first difference of p_t is stationary (i.e. to test $\Delta p_{t-}\ \Delta p_{t-1}$~I(1) by repeating the above procedure until the data were transformed to induce stationarity.

The Philips-Perron (PP) test is similar to the ADF test. PP test was conducted because the ADF test loses its power for sufficiently large values of "k," the number of lags (Ghosh *et al*,

1999). It includes an automatic correction to the Dickey-Fuller process for auto-correlated residuals (Brook, 2008). The regression is as follows:

$$y_t = b_0 + b_1 y_{t-1} + \mu_t \quad (2)$$

Where y_t is the rice price series being investigated for stationarity, b_0 and b_1 are the coefficient vectors $and\ \mu_t$ is serially correlated.

3.2.3. Testing for Johansen Co-integration (trace and eigenvalue tests)

If two series are individually stationary at same order, the Johansen and Juselius (1990) and Juselius (2006) model can be used to estimate the long run co-integrating vector from a Vector Auto regression (VAR) model of the form:

$$\Delta_{p_t} = \alpha + \sum_{i=1}^{k-1} \Gamma i\ \Delta p_{t-1} + \Pi p_{t-1} + \mu_t \quad (3)$$

Where p_t is a nx1vector containing the series of interest (rice price series) at time (t), Δ is the first difference operator. Γi and Π are nxn matrix of parameters on the *i*th and *k*th lag of p_t, $\Gamma i = \left(\sum_{i=1}^{k} A_i\right) - I_g$, $\Pi = \left(\sum_{i=1}^{k} A_i\right) - I_g$, Ig is the identity matrix of dimension g, α is constant term, μ_t is nx1 white noise vector. Throughout, p is restricted to be (at most) integrated of order one, denoted I(1), where I(j) variable requires *j*th differencing to make it stationary. Equation (2) tests the co-integrating relationship between stationary series. Johansen and Juselius (1990) and Juselius (2006) derived two maximum likelihood statistics for testing the rank of Π, and for identifying possible co-integration as the following equations show:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{m} In(1 - \lambda_i) \quad (4)$$

$$\lambda_{max}(r, r+1) = -T \mathrm{In}(1 - \lambda_{r+1}) \quad (5)$$

Where r is the co-integration number of pair-wise vector, λ_i is ith eigenvalue's value of matrix Π. T is the number of observations. The λ_{trace} is not a dependent test, but a series of tests corresponding to different r -value. The λ_{max} tests each eigenvalue separately. The null hypothesis of the two statistical tests is that there is existence of r co-integration relations while the alternative hypothesis is that there is existence of more than r co-integration relations. This model was used to test for; (1) integration between pair-wise price series of local rice in the six markets, (2) integration among the six rice price series in local rice market taken together as a unit.

3.2.4. Test for Granger-causality

After undertaking co-integration analysis of the long run linkages of the various market pairs, and having identified the market pair that are linked, an analysis of statistical causation was conducted. The causality test uses an error correction model (ECM) of the following form;

$$\Delta p_t^i = \beta_0 + \beta_1 p^i (t-1) + \beta_2 p^j (t-1) + \sum_{k=1}^{m} \delta_k \Delta p^i (t-k) + \sum_{h=1}^{n} \sigma_h \Delta p^j (t-h) + \mu_t$$

Where

m and n are number of lags determined by Akaike information Criterion (AIC).

Rejection of the null hypothesis that prices in market j do not Granger cause prices in market i (by a suitable F-test) that $\sigma_h = 0$ for h = 1, 2 ….n and β=0 indicates that prices in market j Granger-cause prices in market i. If prices in i also Granger cause prices in j, then prices are determined by a simultaneous feedback mechanism (SFM). This is the case of bi-directional

Granger causality. If the Granger-causality runs one way, it is called uni-directional Granger-causality and the market which Granger-causes the other is referred to as the exogenous market (Mafimisebi, 2010).

4. Results and Discussion

4.1. Descriptive Analysis

4.1.2. Average Growth Rate in Retail Prices of Local Rice

Analysis of prices of local rice indicates that the growth in retail prices of local rice was highest in 2004 in most of the states in the region. Table 1 shows that growth was highest in Ogun (48.69%), followed by Ondo (45.36%) and Lagos (36.01%). This implies that local rice costs more in these states than in other states during that year. In 2010, growth in retail prices was negative in most states with the least occurring in Lagos (-11.91%), followed by Osun (-5.56%) and Ondo (-5.51%). This implies a fall in the price of the commodity in these states during that year. The average growth rate of retail prices for the entire period of observation was highest in Lagos (15.72%), followed by Ekiti (11.80%) and Osun (11.70%) but least in Ogun (10.49%).

The negative value recorded in the average growth rates of the retail prices of rice in most states in the year 2009 and 2010 is a response to government policy on liberalization of rice imports in these years to provide a short term solution to increasing rice prices. If this negative growth rate in local rice prices continues, then the welfare of rice consumers may be secured at the expense of sufficiency in rice production which can be achieved on the long run. This will result because local rice producers will experience relatively low price increases which may not yield sufficient profit incentives for continued production. This will serve as a disincentive to further investment in rice cultivation

The implication of this negative growth rate is a further decline in the level of local rice output and its attendant increase in the prices of the product which may engender further increase in foreign rice importation and depletion of the foreign exchange earnings of the country. The negative growth in rice prices observed in recent years could be a reflection of deliberate government policies toward securing cheap food items for its citizens. These findings concur with that of Akande and Akpokodje (2003).

Table 1: Growth Rates in Retail Prices of Local Rice (%)

Period	Lagos	Ogun	Ondo	Osun	Oyo	Ekiti
2002	34.90	7.95	4.84	7.41	-6.10	2.60
2003	9.70	14.78	7.02	23.27	21.36	19.05
2004	36.01	48.69	45.36	25.20	19.16	18.64
2005	26.47	-3.48	14.12	18.03	22.01	20.55
2006	-4.77	19.98	0.95	-5.16	0.70	11.70
2007	-5.00	-16.45	1.85	2.88	-5.25	-2.31
2008	39.74	16.82	6.12	33.88	39.15	12.06

2009	16.37	11.61	19.72	5.32	10.37	19.76
2010	-11.91	-5.51	-0.25	-5.56	0.09	4.15
Average	15.72	10.49	11.08	11.70	11.28	11.80

Source: Computed from National Bureau of Statistics (NBS) data

4.1.3. Variability in Average Retail Price

Variability is one of the major attributes that explains the characteristics of most price data. This attribute has important implications for policy and the welfare of food consumers and a nation's economy. The degree of variability in the prices of rice is reflected in the coefficient of variation computed for local rice in the region (Table 2). The retail prices of local rice are more volatile in Lagos (37.29%) while the least price volatility was recorded in Ogun (30.41%). In general, the relatively low price variability in local rice implies that, all things being equal, consumers can effectively plan their expenditure with a fairly high degree of expectation that prices are not likely to substantially deviate from their prevailing levels. On the part of policy, this makes for effective planning of both production and consumption.

Table 2: Coefficient of variation in retail prices of local rice

State	Coefficient of Variation **(%)**
Ekiti	33.81
Lagos	37.29
Ogun	30.41
Ondo	30.47
Osun	32.68

Source: Computed from National Bureau of Statistics (NBS) Data

4.1.4. Order of Econometric Integration of Local Rice Price Series

The augmented Dickey-Fuller (ADF) test shows that all rice price series in the model were non-stationary at their level; this means that they all contained a unit root since the absolute values of their test statistics is less than their critical values at levels both at 1% and 5% levels of significance. However, stationarity was reached after the first difference as shown in Table (3). As discussed in the methodology section, this means that all the price series are integrated of order one 1(1), a requirement for Johansen's co-integration analysis (Johansen and Juselius, 1990 and Juselius, 2006).

To bolster our findings concerning the 1(1) and 1(0) nature of the price series and their level and their first difference respectively, the Phillip-Perron (PP) test was also conducted in order to confirm the test results of the ADF. The PP test, like the ADF test, indicated significance for all variables, rejecting the null hypothesis of stationarity at the 1% and 5% levels of significance. The findings here concur with earlier findings and conclusion by previous authors that food commodity price series are mostly stationary of order one i.e. 1(1) (Mafimisebi, 2001; Okoh and Egbon, 2003; Oladapo, 2003 and Mafimisebi 2008). According to Mafimisebi (2008),

the result is probably explained by the fact that most food price series have trends in them because of inflation, therefore leading them to exhibit mean non-stationarity.

Table 3: Results of Econometric Test of Price Series

Variables	Price Level 1(0)		First Difference 1(1)	
(Market Price Series)	ADF Statistics	PP Statistics	ADF Statistics	PP Statistics
Ekiti	-1.4409	-1.6042	-11.5337	-19.2139
Lagos	-1.0567	-1.7997	-8.8527	-41.2822
Ogun	-1.3519	-1.5975	-18.9991	-30.5026
Ondo	-1.5214	-1.6406	-11.6777	-18.4598
Osun	-1.2456	-2.2268	-8.9768	-43.6053
Oyo	-0.9827	-0.9979	-14.7398	-14.7208

Source: Compiled from results of stationarity test

Notes: Critical values are -3.4870 and -3.4861 at the 99% and -2.8859 and -2.8861 at the 95% Confidence levels for price level and first difference series, respectively.
If the absolute value of the ADF or PP is lower than their critical statistics, we fail to reject the null hypothesis of non-stationarity.

4.1.5. Long-run Integration Test Results

The co-integration test result for local rice is presented in Table 4. The results indicate price co-integration in all the market pairs at both 1% and 5% level of significance. Since the test statistics was greater than the critical value for all the market pairs, we reject the null hypothesis in favour of the alternative for both the maximal eigenvalue and trace tests. Thus, it can be said that 100% of local rice markets in the South West Nigeria are strongly linked together in the long-run despite a potential short-run divergence between them. This implies that there is high degree of marketing efficiency in local rice market in the region since market integration is a proxy for marketing efficiency (Hopcraft, 1987; Okon and Egbon, 2003 and Mafimisebi, 2008).

Table 4: Pair-wise Co-integration Test Result

Market Pairs	Trace Test Statistics	Maximal Eigenvalue Test Statistics
Pi-Pj		
Lagos/Ogun	26.671**	25.056**
Lagos/Ondo	28.903**	27.540**
Lagos/Osun	29.791**	28.077**
Lagos/Oyo	24.077**	23.452**

Lagos/Ekiti	24.984**	23.594**
Ogun/Ondo	29.815**	27.545**
Ogun/Osun	29.576**	27.021**
Ogun/Oyo	23.925**	23.635**
Ogun/Ekiti	32.098**	29.579**
Ondo/Osun	21.876**	19.300**
Ondo/Oyo	20.716**	20.362**
Ondo/Ekiti	27.349**	25.562**
Osun/Oyo	41.043**	39.479**
Osun/Ekiti	22.765**	20.721**
Ekiti/Oyo	26.396**	26.175**

Source: Compiled from the result of Co-integration Test

* (**) means significant at 5%(1%) level

The critical values for trace test and maximal eigenvalue test are 19.937 and 18.520 at 99%, and 15.495 and 14.265 at 95%, respectively.

4.1.6 Multiple Co-integration in Local Rice Market

The Johansen's multiple results for local rice price series is displayed in Table 5. Both the Trace tests and Maximum eigenvalue statistics indicate five (5) co-integrating equations at the 5% level, indicating that there are five co-integrating relationship existing in the local rice markets in the region. This, according to Johansen procedure means that, there are five linear combinations that exist among the variables over the entire period of study. This result further validates the findings of pair-wise markets co-integration tests earlier carried out. The overall economic implication of the result is that, local rice markets in South West Nigeria during the study period are strongly linked together thus suggesting a stable long-run equilibrium.

Table 5: Multiple Co-integration Results

Null hypothesis	Trace Statistics	95% critical value	Maximum eigenvalue	95% critical value
r=0	932.71*	95.75	619.56*	40.08
r=1	313.15*	69.82	146.08*	33.88
r=2	167.06*	47.86	83.69*	27.58
r=3	83.37*	29.80	53.26*	21.13
r=4	30.11*	15.49	28.78*	14.26
r=5	1.33	3.84	1.33	3.84

Source: Compiled from the result of Co-integration Test

Both Trace and Maximum eigenvalue tests indicate 5 co-integrating equation(s) at the 0.05 level

* denotes rejection of the null hypothesis at the 0.05 level

4.1.7. Exogeneity in Local Rice Market Price Series

The result of pairwise Granger causality test for local rice markets is shown in Table 6. Twenty (20) market pairs out of the 30 market pairs tested rejected the null hypothesis of no causality. Ten (10) market links of the 20 displayed bi-directional (two-way) Granger causality.

The remaining 10 exhibited uni-directional (one-way) causality. In the fifth (5^{th}) market link, Lagos was stronger as it Granger-caused Osun prices at 1% level while the latter Granger-caused the former at 5% level. Ekiti was also stronger in the twelfth market link as it Granger caused Ogun prices at 1% level of significance while Ogun prices Granger-caused Ekiti prices at 5% level. In the 2^{nd}, 3^{rd}, 8^{th}, 9^{th}, $16^{th}$and 17^{th} market pairs, the markets shown in the link demonstrated equal strength as they Granger themselves at 1% level. This means that they influence one another in terms of price formation and transmission probably stemming from the proximity between these states thus facilitating free flow of price information. It is also interesting to note that, apart from Lagos Market which exhibits bi-directional causality with Ondo and Osun Markets, it also displayed uni-directional causality with Ogun, Oyo and Ekiti Markets.

Worthy of note is the case of Osun that displayed bi-directional causality with Lagos and also exhibited uni-directional causality with Ondo. Based on these results, Lagos and Osun Markets could be said to be occupying leadership positions in the local rice price formation process in South west Nigeria. While Lagos leads price formation process in Ekiti, Ogun and Oyo Markets, Osun Market however leads prices in Ondo Market. The implication of these findings is that, the local rice deficit markets of Lagos and Osun drive the market for local rice in the region. Since rice production statistics for South west Nigeria revealed that Lagos and Osun States have the lowest local rice production output in the region, this may mean that the forces of demand are stronger than that of supply in local rice price determination.

Table 6: Pair-wise Granger-causality Test for Local Rice Markets

Null hypothesis	F-Statistics	Probability
Lagos→Ogun	9.039**	0.0002
Ondo→Lagos	4.706**	0.0109
Lagos→Ondo	8.643**	0.0003
Osun→Lagos	3.997*	0.0210
Lagos→Osun	6.569*	0.0020
Lagos→Oyo	9.708**	0.0001
Lagos→Ekiti	7.638**	0.0008
Ondo→Ogun	6.701**	0.0018
Ogun→Ondo	6.353**	0.0024
Osun→Ogun	10.867**	5.E-05
Oyo→Ogun	7.717**	0.0007
Ekiti→Ogun	6.243**	0.0027
Ogun→Ekiti	3.668*	0.0286
Osun→Ondo	5.763**	0.0041
Oyo→Ondo	4.647**	0.0115
Ekiti→Ondo	5.276**	0.0064
Ondo→Ekiti	4.898**	0.0091
Osun→Oyo	13.457**	6.E-06

Osun→Ekiti	5.941**	0.0035
Oyo→Ekiti	10.285**	8.E-05

Source: Compiled from the result of Granger-Causality Test
* (**) means significant at 5% (1%) level
→ indicates direction of causality

5. Summary, Recommendations and Conclusion

5.1. Summary and Recommendations

This study examined spatial price co-integration of local rice markets in South-west Nigeria. The trend analysis in retail prices of local rice shows that, there was less fluctuations in the retail prices of the commodity over the study period. The smaller values of the coefficient of variation provide more evidence to support this position. The negative growth rate in the retail prices of rice observed in some years could be a reflection of deliberate government policies toward securing cheap food items for its citizens.

The economic implication of this is that, if growth in price maintains this trend, then the welfare of rice consumers in the study area may be secured. This however, will be at the expense of local rice producers, who will be experiencing relatively small increase in the prices of their products. This could bring about disincentive to further investment in rice farming activities, increase in price occasioned by reduction in local rice output and loss of foreign exchange to other countries from which the country shall be forced to import rice to meet the increasing shortfall.

The result of the stationarity tests indicated that the price series for local rice exhibited stationarity after first differencing. The study discovered existence of a high level of spatial pair-wise integration in local rice markets across the six states. All market pairs for local rice have long-run price linkages. The multiple (Johansen) co-integration tests also largely confirmed these results. This implies that short-run deviations from equilibrium will be readily corrected through the efficient price setting and transmission of price signals.

The Granger causality tests conducted on all inter-state market pairs showed that Lagos and Osun, which are local rice deficient states, lead price formation process in local rice market in the region.

Based on the results of the study, some important policy implications and recommendations for the rice industry emerge for the various Governments in South west Nigeria. It is therefore recommended that the problem of highly inefficient and fragmented distribution and transportation systems be addressed for the rice traders to take advantage of high level of spatial market integration. Also, development of infrastructures in inter-state rice markets, government price support and other market-oriented policies should be pursued as they will achieve intended goals.

5.2. Conclusion

The existence of high level of integration in the markets for locally produced rice in the Southwest Nigeria has been discovered in the study. The results of the study contradict findings by past researchers of low agricultural commodity market integration in Nigeria attributed generally to fragmented distribution system and oftentimes inefficient transportation system.

This may be as a result of the fact that rice is not highly perishable agricultural commodity that stores up to one year before spoilage if well dried. The closeness of the markets examined may also have been a factor in the strong linkage detected among these markets. The result may have been widely different if samples of rice markets have been taken across all the six zones in Nigeria. There is however, the need for all the stakeholders in the Southwest rice market to continue to effectively perform their roles so that economic benefits derivable from this very high integration can be fully realized and sustained.

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