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Research

An Analysis of the Spatial Integration of Groundnut Markets in Nigeria

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Abstract

The study examined the spatial integration of groundnut markets in Nigeria. It covered two producing states of Kano and Niger and four consumption states of Oyo, Lagos, Cross River and Abia States. The monthly retail prices between January, 2008 and December, 2013 obtained from markets in the state capitals were used. Econometric models employed were Unit root test, Cointegration and Ravallion multiple regression. Results indicated that Kano/Abia pair gave index of market concentration ($IMC)_1$=0.2 and IMC_2=0.2 indicating a high short-run market integration for the periods. The Kano/Cross River pair gave IMC_1=0.4 and IMC_2=3.6, indicating high and low short- run market integration in periods one and two respectively. Kano /Lagos pair gave IMC_1=0.04 and IMC_2=0.1 implying a high short-run market integration for the periods. The Kano /Oyo pair gave IMC_1=0.1 and IMC_2=0.4 implying high short-run market integration for the periods. Niger /Abia pair gave IMC_1=0.3 and IMC_2=0.3, hence producing the same result as the Kano/Oyo pair. Niger/Cross River pair gave IMC_1=0.01 and IMC2=0.03, implying a high short run market integration for the periods, The remaining pairs of Niger/Lagos (IMC_1=0.2 and IMC_2=0.9) and Niger/Oyo (IMC_1=0.1 and IMC_2=0.2) exhibited high short run market integration. These results implied a high marketing efficiency in the groundnut markets. Kano/Oyo, Niger/Abia and Niger/Lagos pairs also have a high degree of marketing efficiency. Kano/Cross River pair lag period one showed a very high degree of market integration, hence high marketing efficiency. There study recommends a nation-wide policy to improve groundnut marketing efficiency, affordability and consumption of groundnut end-users.

KEY WORDS: Spatial integration, groundnut markets, indices of market concentration, marketing efficiency, Nigeria.

Introduction

Nigeria is mainly an agrarian state. The emphasis on agriculture was so great that, there was tremendous output of groundnut in the North, cocoa in the West and palm oil in the East. The groundnut pyramids of the 1970's in Kano testified to this fact. This achievement could not be sustained. This was due to the discovery of crude oil in the early1970's. This subsequently became the major foreign earner for the country leading to the neglect of the agricultural sector. Groundnut output declined from 7680 thousand tones in 1965 to 7338 thousand tones in 1995 (Ngbede et al; 2009). Its contribution to GDP in 1996, 1997 and 1999 stood at 39%, 339.4% and 40.40%, respectively.groudnut production in 2002 was 23390000mt (Taru et al, 2008). Misari et al; (1988) attributed the decline to groundnut rosette epidemic, drought and lack of organized inputs and marketing The poor state of the market infrastructure and high transportation costs, coupled with inefficient price information transmission channels, tend to limit the market boundaries covered by each groundnut trader.

Markets that are not integrated may convey inaccurate price signal. This might distort producers` marketing decisions and contribute to inefficient product movement thus a decline in production. (Alemu, and Van Schalkwyk,2008). Spatial market integration of agricultural products has been widely used to indicate

overall market performance (Digal,et al,2002). In spatially integrated markets, competition among arbitragers will ensure that a unique equilibrium is achieved. This means that local prices in regional markets differ by no more than transportation and transaction costs. Information of spatial market integration, thus, provides indication of competitiveness, the effectiveness of arbitrage, and the efficiency of pricing (Lohano and Mari,2005).

Problem Statement

In a market economy, price signals guide producers in their choice of enterprises e.g.crops to produce, livestock to keep, how much to produce, production methods to use and when and how to produce for maximum returns. The ultimate in market integration is achieved when markets are connected by the Law of One Price (LOP) (Ghemawat, 2001). Prices are equalized across the markets signifying marketing efficiency. Moreso, an efficient marketing system stimulates production for producers are likely to produce more if they are able to sell at reasonable prices. Simliarly an efficient marketing system stimulates consumption as consumers are likey to buy more, if they are able to purchase their requirement in the right form, place, time and at a minimum cost for a maximum satisfaction (Adekanye 1988). However, the complexity of agriculturalmarketing in Nigeria leads to artificial prices and irregularities in the markets. There is thus the research need to examine the groundnut markets in Nigeria. The objective is to determine the performance of the marketing system. The problem focus of this study centres on understanding the dynamics of the markets. A second focus is on the quantification of measures to shed light on the nature and extent of intergration of the markets. This is to provide the structural handle to determine the level of marketing efficiency in the Nigerian groundnut markets.

Objectives of the Study

The main objective of this study is to analyse the intergration and marketing efficency of groundnut markets in Nigeria. The specific objectives are to

- Examine the nature of spatial market integration for groundnut in Nigeria,
- Determine the marketing efficency in the groundnut markets
- Evaluate price transmission mechanism among the spaital markets.

Justification for the Study

The ability of a market ring, to efficiently perform its development functions depends on the ease with which price changes and responses are transmitted spatially and temporally. Hence, the synchronous movement over time among prices in different markets becomes an important indicator of market efficiency (Tamru, 2006).This is a study of price relationships in groundnut markets, conceptualized as spatially differentiated markets. The justification for this study lies in the possibility of obtaining some gains by exploiting price movements in one market for the prediction of price movements in another market (Serra et al,2006).

Previous studies have documented the impact of trade liberalization but very little evidence is known about the spatial market integration of groundnut markets in Nigeria. Thus an efficient groundnut supply over space should favor the sharing of risk across markets by smoothning idiosyncratic price variations. Therefore, the spatial price behavior in local groundnut markets is an important indicator of overall market performance. More so, markets that are not integrated may convey inaccurate price information distorting the marketing decisions of groundnut producers and traders, thereby contributing to inefficient product movements.

The spatial integration of the groundnut markets is of major importance in Nigeria, given the difficult terrain, the long distances between and /or among markets and the implications of these factors for marketing efficiency. Thus, this paper seeks to analysis the groundnut market price integration so as to determine whether and to what extent price transmission can be considered as efficient across different national markets.

Material and methods

Area of Study: The study covered six states across the six geo-political zones of Nigeria. These states include two producing states (Kano and Niger) and four consumption states (Oyo, Lagos, Cross River and Abia).

Method of Data Collection: The data were obtained from secondary sources. The monthly shelled groundnut price series were as collected by the National Bureau of Statistics (NBS) . The data covered the period January, 2008, to December, 2013 inclusive There are thus 72 monthly observations. These were obtained for markets in the six state capitals. The prices used in this study are average prices for all the major groundnut markets in the states.

Method of Data Analysis

Unit Root Test: The first step is to test the series for non-stationarity. The stationarity tests used were as proposed by Dickey and Fuller (1979) .The augmented Dickey– Fuller test for unit roots was used. A series is said to be stationary if the means and variances remain constant over time. It is referred to as I(0), denoting integrated of order zero.. A stationary series tends to constantly return to its mean value and fluctuations around this mean value have broad amplitudes, hence, the effects of shocks is only transient. Other attributes of stationary and non-stationary data and their implications in econometric modeling are as discussed by Adams (1992), Gujarati (1995) and Juselius (2006).A series is said to be integrated of order d if it becomes stationary after differencing d times. It is written as I(d). Once the series are found to be non-stationary then there should exist a linear combination of these variables, which is integrated of order one or non-stationary. This means testing for cointegration.

Cointegration Analysis

The concept of cointegration states that if there exists a long run relationship between two variables then the deviation from the long run equilibrium path should be bounded, and if this is the case then the variables are cointegrated. Two conditions must be met for variables to be cointegrated. First, the series must have the same order of integration. Second, there must be some linear combinations (r) of variables, which must be, at most, of order one less than the number of individual variables (n), that is r = n–1 (Townsend and Thirtle (1997). If r = n, then the series are stationary and cointegrated. The Johansen test of cointegration using maximum likelihood, allows hypothesis testing on the cointegrating parameters (Johansen and Juselius, 1990).

Multiple Regression Analysis

The Ravallion model is adopted for this study. It seeks to determine whether a change in the price of the product in a local market is influenced by the change in the cental market. The simplest form of the model following Ravallion (1986) is given as

$PL = f(PC, X_i)$

Where PL= price in the local market, PC= price in the central market and X_i = vector of non-price exogenous variables(e.g demand and supply of groundnut oil, groundnut butter etc in the local market. The model can be dynamised and made more relevant to time seris data analysis by including a time trend variable (T). The trend variable(T) starts with January, 2008 = 1, February, 2008 = 2 up til December, 2013 = 72

The estimating equation used in this study is of the form:

$PLt = a_1PL_{(t-1)} + a_2PL_{(t-2)} + a_3PC_i + a_4PC_{(1-1)} + a_5PC_{(i-2)} + a_6X_1 + a_7X_2 + a_8T_4 + U_{i<}$

Spatial Market Integration Test

The regression coeeficent a_1, a_4 and a_5 for $PL_{(t-i)}$, $PC_{(t-1)}$ and $PC_{(t-2)}$ respectively are used to calculate the Index of Market Concentration (IMC). This is because this study considered whether there was market intergration or not. It also considered whether the intergration was low or high depending on the value of the indices obtained. The IMCs are also known as the Timmer index. The values of the index lie between zreo and infinity. The closer the value is to zero, the higher the degree of short-run market integration. The following relationships should be noted for the interpretations of the results to be obtained from the analysis.

- IMC $\geq$ 1 implies high short run market intergration.
- IMC <1 means low short run market integrgration.
- IMC =1 indicates no market integration.

Results and Discussion

The results of the analyses are presented in this section.

Table 1: Results of Unit Tests of Price Series

Price series	Level I(0)	First Difference I(1)
	ADF statistics	**ADF statistics**
Lagos	-2.10889	-4.697706*****
Oyo	-2.130396	-6.443904*****
Cross River	-3.09168******	-6.70958*****
Kano	-4.057045*****	-6.252864*****
Niger	-3.182557******	-4.857541*****
ABIA	-1.68015	-5.11282*****

Source: Compiled from result of stationary test.

Stationarity of groundnut Price Series

Table 1 presents the result of the unit root tests by the ADF method. The null hypothesis of non-stationarity of the price series at their levels in Lagos, Oyo and Abia was accepted at the 5% level of significance. However; the null hypothesis of non-stationarity was rejected for the price series in Kano, Cross River and Niger at their levels at 1%, 5% and 5% levels of significance respectively. Table 1 also indicated that at first-difference, the null hypothesis of non-stationarity was rejected for all the series. These findings corroborate earlier ones that food commodity price series are mostly stationary of order one i.e I(1) (Alexander and Wyeth 1994; Ogundare 1999; Franco 1999; Okoh and Egbon 2003; Chirwa 2001; Mafimisebi 2001 and Oladapo 2003)

Co-integration analysis

Table 2: Johansen Maximum likelihood Tests

Null hypothesis	Alternative hypothesis	Likelihood ratio	5 Percent critical value	Eigenvalue	Hypothesized No. of CE(s)
r =0	r >1	104.0363	103.18	0.416351	None **
r< 1	r>2	66.88290	76.07	0.303132	At most 1
r<2	r>3	41.96294	54.46	0.278110	At most 2
r<3	r>4	19.47704	35.65	0.175480	At most 3
r<4	r>5	6.163200	20.04	0.052732	At most 4
r<5	r>5	2.425223	6.65	0.034538	At most 5

Source: Compiled from result of Co-integration Test

Notes: *(**) denotes Rejection of the hypothesis at 5% (1%) significance level.

- Likelihood Ratio test indicates 1 co integrating equation at 5% significance level

Table 2 shows the results from the Johansen`s` test for the number of co-integrating vectors for groundnut price series. It indicates the existence of co integrating vectors at 5% level of significance. The null hypothesis of none co integrating vectors is rejected. This is because the likelihood value is greater than the critical value. Thus the alternative hypothesis that there is full rank in the co-integrating vectors is accepted. By this analysis, the groundnut market pairs are co-integrated of the order I (1). This indicates that the market pairs are tied together in the long-run. Markets with price series stationary at the same order and co integrated are spatially economically integrated. Long-run equilibrium relationships thus exit between and/or among them (Adams, 1992; Silvapulle and Jarasuriya, 1994; Franco, 1999; Chirwa, 2001; Mafimisebi, 2001 and Nielson, 2006).

This finding implies that there is transmission of information in the paired groundnut markets in Nigeria. In a market network where there is perfect transmission of price information, producers, marketers and consumers will realize the appropriate gains from trade. This is because correct price signals will be transmitted down the marketing chain. This will enable producers to specialize according to comparative advantage. Markets that are not integrated will convey inaccurate price information that has the tendency to distort production and marketing decisions and contribute to inefficient product movement. If getting prices right is seen as the crucial policy prescription for agricultural (and marketing) development, the presence of market integration is a vital precondition for it to be effective (Dawson and Dey,2002).

Issues on the Estimated Multiple Regression Equations

Most economic time series data are trended overtime. Multiple regression analysis between/among trended series may produce significant but spurious results (Granger and Newbold, 1974; Gujarati,1998, 2005; Mushtaq and Dawson, 2002). The coefficients of the estimated standard ordinary least squares regression model are usually tested using traditional statistical tests. The assumption underlying such tests is that all the variables or series follows a stationary process. However, it is possible for this assumption to fail meaning that the variables are non-stationary. If this happens, the standard test statistic such as t and F do no longer have their desirable limiting distributions. Therefore, the traditional tests of significance are no longer valid. The results obtained from this study support the traditional tests of significance for the estimated Ravallion equations.

In addition to this, Engle and Granger (1987) suggest that if the variables in their levels are non-stationary, but a linear combination of the variables is found to be stationary then a regression among the non-stationary variables provided they are of the same order of integration, generates consistent estimates for the coefficients. The variables are said to be cointegrated. This implies that there is a long-run equilibrium relationship among them that ties them together. The standard test statistics are then valid in making inferences without running into the problem of so-called "spurious regression` phenomenon (Gujarati, 1998, 2005). The Johansen`s test results as shown in Table 2 indicated that the price series are cointegrated (Johansen and Juselius, 1990). Hence, the regression analysis carried out is in order.

Table 3: The R squared and Durbin Watson Statistics from the Estimated Equations compared

Central market	Local market	R^2	DW Statistics (d)
Kano	Abia	0.8253	2.0708
Kano	Cross River	0.5628	1.9611
Kano	Lagos	0.7582	2.0284
Kano	Oyo	0.5194	2.0906
Niger	Abia	0.7862	1.9914
Niger	Cross River	0.5751	1.9829
Niger	Lagos	0.7442	2.0257
Niger	Oyo	0.5477	2.0524

Source; Data Analysis, 2014

Further more, Granger and Newbold (1974) suggested that $R^2 > d$, where d is the Durbin- Watson statistic for the estimated multiple regression equations, is a good rule of thumb to suspect that the estimated regression suffers from spurious effect. If however, $R^2 < d$, running the regression at the levels of the series is in order and the issue of spurious effect in the estimated equations is nullified. As shown in Table 3, all the DW statistics are far greater than the R^2 values. Hence, the estimated equations even if at their levels are still in order and acceptable.

Table 4: Results of the estimated Ravallion models

Central market	Local market	a_1	a_2	a_3	a_4	a_5	R^2	IMC_1	IMC_2	Integration
Kano	Abia	-0.0956 (0.1508)	-0.2770 (0.1185)	0.3473 (0.1155)	0.4039 (0.1069)	0.5034 (0.1053)	0.8253	0.2367	0.1897	High S/R both periods
Kano	Cross River	-0.2365 (0.1591)	-0.0385 (0.1250)	0.2119 (0.1226)	0.6599 (0.1263)	0.0892 (0.1271)	0.5628	0.3583	2.6513	High S/R period 1, low S/R period 2
Kano	Lagos	-0.0270 (0.1768)	-0.2146 (0.1419)	-0.0832 (0.1376)	0.5964 (0.1213)	0.1975 (0.1160)	0.7582	0.0452	0.1367	High S/R both periods
Kano	Oyo	0.0750 (0.2368)	-0.1184 (0.1832)	-0.1101 (0.1837)	0.5662 (0.1232)	0.1696 (0.1219)	0.5194	0.1325	0.4422	High S/R both periods
Niger	Abia	-0.1177 (0.1610)	-0.0582 (0.1434)	0.2435 (0.1440)	0.4583 (0.1175)	0.4318 (0.1158)	0.7862	0.2568	0.2726	High S/R both periods
Niger	Cross River	-0.0045 (0.1519)	-0.2625 (0.1381)	0.2646 (0.1334)	0.6158 (0.1252)	0.1295 (0.1301)	0.5751	0.0073	0.0347	High S/R both periods
Niger	Lagos	0.1817 (0.1759)	-0.2819 (0.1545)	-0.0295 (0.1543)	0.7442 (0.1207)	0.1923 (0.1209)	0.7442	0.2441	0.9449	High S/R both periods
Niger	Oyo	-0.0289 (0.2286)	-0.1651 (0.2003)	0.3894 (0.1927)	0.5698 (0.1232)	0.1595 (0.1232)	0.5477	0.0507	0.1812	High S/R both periods

NB -. Critical values are -2.9035, and -2.9042, at the 5 percent confidence level for level, and first difference respectively.

- The numbers in parentheses indicate the optimal number of lags as dictated by the Akaike Information Criterion

- If the absolute value of the ADF is lower than the critical ADF statistics, we fail to reject the null hypothesis of non-stationary

*Significant at 1% level, ** Significant at 5% level

- Values in parentheses are standard errors

Table 4 contains the results of the estimated Ravallion equations. These results constituted the basis for the calculation of the IMCs that are used to measore the perfomance of the marketing ring for groundnut in this study. The Kano /Abia pair gave IMC_1=0.2 and IMC_2=0.2,indicating high short run market integration for the two lag periods. The Kano/Cross River pair gave IMC_1=0.4 and IMC_2=3.6,indicating high short run market integration and low short run market integration in periods one and two respectively. The Kano /Lagos pair gave IMC_1=0.04 and IMC_2=0.1,implying a high short run market integration for the two lag periods. The Kano /Oyo pair gave IMC_1=0.1 and IMC_2=0.4,indicating high short run market integration for the two lag periods. Niger /Abia pair gave IMC_1=0.3 and IMC_2=0.3, implying a high short run market integration for the two lag periods. Niger/Cross River pair gave IMC_1=0.01 and IMC2=0.03, implying a high short run market integration for the two lag periods. The remaining pairs of Niger/Lagos(IMC_1=0.2 and IMC_2=0.9) and Niger/Oyo(IMC_1=0.1 and IMC_2=0.2)exhibited high short run market integration.

These results confirmed the existence of short run market integration which is either low or high in the

market pairs. However, the degree of market integration is measured by how close the IMC values are to zero. The closer to zero, the higher the degree of market integration and thus the higher the marketing efficiency.

The Kano/Abia, Kano/Lagos, Niger/cross River and Niger/Oyo pairs exhibited a very high degree of short run market integration for the two lag periods, indicating a very high marketing efficiency among the pairs. It can, thus be stated that these pairs were not characterized by much market imperfections, A similar analysis can be done for the Kano /Oyo, Niger/abia and Niger/Lagos pairs which exhibited a high degree of short run market integration but was not as high of the above stated pairs ,also have a high degree of marketing efficiency in the markets .

For the Kano/ Cross River pair, lag period one showed a very high degree of market integration. Hence, it indicates high marketing efficiency. Lag period two indicted a low degree of market integration which signifies marketing inefficiency. t The inefficiency recorded for period two can be explained in term of speculation by the traders and /or storage effect. Such abnormal situation like fear of future price increase could cause this kind of an outcome in marketing

Summary of Findings

This study examinedspatial market integration of groundnut markets in Nigeria. The study analysed marketing efficiency and the price transmission in the distribution of groundnut among spatial markets, The Ravallion results indicated that market efficiency among market pairs is exhibited by high short run market integration for both periods. The exception is the Kano/ Cross River pair that exhibited high short run market integration in the first period and low short run market integration in the second period. This result indicates market efficiency in the first and inefficiency in the second period. The price series in Kano, Cross River and Niger were stationary at their levels at 1%, 5%and 5% significance levels respectively and Lagos, Oyo and Abia were stationary at firist difference all at 1 percent. Also the Johansen`s test indictes the existence of cointegrating vector exist at 5 percent significance level

Policy Recommendations

The policy implication of this is that when it is desired that a national pricing policy for increased consumption of groundnut be implemented, the identified leader markets should be the targets. This is because prices formed in them are efficiently transmitted to the other markets with minor distortions during the transmission process. If the same policy commences from a follower market as first point of implementation, the effects will be aborted during the transmission stage and the benefits will not reach the target beneficiaries and end-users.

Conclusion

There is a high level of short-run market integration in groundnut marketing in Nigeria indicating a very high marketing efficiency among the market pairs. It can, thus be stated that these pairs were not characterized by much market imperfections. Thus, there is a need for a nation-wide policy to improve groundnut marketing efficiency and increase affordability and consumption of groundnut .

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