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Market Integration and Price Dynamics of Sesame in Nasarawa State, Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author TAKA designed the study, wrote the first draft of the manuscript and performed the statistical analysis. Author SANDC wrote the protocol, supervised the work and edited the manuscript. Author AIA managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

The study was to principally determine the efficiency of the marketing system of sesame in Nasarawa State, Nigeria. This is to provide empirical knowledge on the level of efficiency and competitiveness useful for improving the marketing system for economic development. Analysis of spatial integration of 13 main rural and urban sesame markets was carried out in Nasarawa State of Nigeria, covering all the agricultural zones of the State. Time series data used in the analysis were monthly retail prices of sesame collected by Nasarawa Agricultural Development Programme (NADP) for 84 months. Cointegration analysis and error correction model (ECM) were the main analytical tools used. Steps to cointegration analysis involved augmented Dickey Fuller (ADF), Granger causality and augmented Engle Granger (AEG) tests on the retail prices from the 13 markets. Results showed that retail price series in many sesame markets were segmented. Only 34 pairs of market prices (about 21.8%) were integrated and the rate of price adjustment within one month was very high in nearly all the integrated pairs.

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Reversing the trend and improving efficiency will certainly involve, among others things, improving infrastructure such as rural roads and providing market information outfit that will disseminate timely information to the marketers.

Keywords: Sesame; prices; price adjustment; markets; integration; stationarity; cointegration.

1. INTRODUCTION

Ethiopia, Nigeria, Sudan, and Uganda, are among the seven world's leading producers of sesame and their estimated annual output of over 3.5 million metric tonnes accounts for over 75% of the global output [1]. After cocoa, sesame is the second most important export crop in Nigeria with annual revenue estimates of US$20 million (€14million) [1]. Sesame has been a major cash crop produced in commercial quantities in Doma, Lafia, and Nasarawa Local Government areas of Nasarawa State. Its annual output in the State exceeds 41570 metric tonnes [2]. This is well over 40% of the national output of more than 93250 metric tonnes [3-4]. Apart from being a foreign exchange earner, it is used in food preparation and derivatives such as oil and cake are suitable for industrial and domestic uses [5]. A developed marketing system of sesame can stimulate consumption, output and economic development. Marketing is therefore an integral component of farm decision process and important in harnessing the immense potential of the crop for steady agricultural and economic development.

Market integration is an aspect of marketing central to the assessment of market performance and a useful measure of pricing efficiency, competitiveness and interdependence between markets and middlemen. Spatial market integration ensures that a regional balance occurs among food-deficit, food-surplus and non-food producing areas through transmission of price signals [6]. Consequently, volatility of prices is reduced, specialization is promoted, gains from trade are realized and welfare of market participants is enhanced through the normal profits they are expected to make. Spatial market integration has been widely used in evaluating pricing efficiency as well as competitiveness in markets. Spatial market integration refers to the degree of co-movement of prices in spatially separated markets and the transmission of prices across the markets [7-8]. Simply, spatial market integration refers to the extent to which price change in one market is associated with price changes in other markets [9]. Two markets may be spatially integrated if the difference in price between them is as a result of transportation and other transfer costs involved in moving the product between them [6]. Although conceptually and empirically controversial, several tests of market integration have been cited in the literature. A preponderance of approaches emerged over the years. They include correlation analysis, law of one price, index of market concentration, parity bound models, autoregressive distributed lag model and cointegration [6-7]. There have been several criticisms on the use of any one of them as sufficient condition for measuring integration. Correlation analysis for instance, tends to ignore the presence of exogenous factors such as general price inflation, seasonality, population growth and procurement policy [7]. Time series price data often used in integration do not reflect trade flows, ignore transfer and transaction costs and are non-stationary especially in correlation analysis, law of one price, index of market concentration and Ravallion models [6-10]. In view of the criticisms of the integration management techniques, researchers may use one or several approaches that may be relevant to make a particular situation clearer. For example, Chikwendu [10] used index of market concentration and correlation analysis, Minot and Goletti [7] used both correlation and cointegration, while Jones [11] employed correlation analysis alone.

Cointegration is a test of integration employed by Chirwa [6], Olatunde and Rufina [12], Intodia [8], Ali and Rahman [13] and many others. In the preceding four examples of cointegration, time series price data were tested for stationarity by use of augmented Dickey-Fuller (ADF) test. For the first two, cointegration test is the Johansen test while the latter two applied augmented Engle-Granger (AEG) test. The study followed the procedure by Intodia [8] associated with ADF test of stationarity, AEG test and the determination of short-run price dynamics. Cointegration of prices from two different markets would mean that the two markets are integrated, suggesting that there is a long-run linear, or equilibrium relationship between them [7-8].

The first step in cointegration analysis is to test for stationarity. A stationary series exhibits constant mean, variance and autocorrelation over time [8]. A series is non-stationary if means and variances vary over time and the variances are infinite. If the original series is found to be nonstationary, the first differences of the series are tested for stationarity. Thus, the number of times a series must be differenced before it becomes stationary is referred to as the order of integration. Stationary time series are differenced in the order of I(0). If the series attain stationarity after differencing for the first and d times it is said to be in the order of I(1) and I(d), respectively. Spatial transmission of prices due to shock involves dynamic adjustment processes. Short-run behaviour of the price transmission, measured by Error Correction Model (ECM), enables the determination of the speed of adjustment of prices to their equilibrium relationship possible [14].

Market performance of sesame in Nasarawa State is still characterized by low initial investment/capital, high transportation cost, poor storage facilities, inadequate access to formal credit, heavy imposition of taxes/levies and to some extent, ineffective dissemination of information [15]. These are undoubtedly traces of a poorly developed marketing system. Presently, empirical information on the domestic marketing of sesame in Nigeria and in particular Nasarawa State has been scanty. Exploratory marketing research on sesame in Nasarawa State by Achike and Anzaku [15], Anzaku and Achike [16] and Anzaku, Bello, and Onuk [5] dwelt essentially on the quantity of sesame sold, farmers' response to fluctuations in prices, analysis of marketing channels, capability of market participants, factors that affect them and the constraints they face. The study is concerned principally with spatial integration of sesame markets in Nasarawa State. The specific objectives included, 1) analyzing retail prices of sesame, 2) determining which of the sesame markets are integrated, short-run price dynamics and speed of price adjustment.

2. METHODOLOGY

The study area was Nasarawa State. It lies between latitudes 7° 45´ and 9° 25´ N and longitudes 7° and 9° 37´ E of the Greenwich meridian, and has a land area of 27,137.8 square kilometres with a population of 1,863,275 people [17]. Mean annual rainfall in the State ranges from 1100 – 1600 mm and temperature could rise as high as 39℃ and fall as low as 17℃ [18]. The thirteen Local Government areas that make up the state are Akwanga, Awe, Doma, Karu, Keana. Keffi, Kokona, Lafia, Nasarawa, Nasarawa –Eggon, Obi, Toto and Wamba. Major crops produced in the State are rice, yam, cassava, sesame, *egusi*, groundnut and cowpea.

Time series data used consisted of monthly retail prices of sesame collected by Nasarawa Agricultural Development Programme (NADP) for 84 months (2004 - 2010). Updating the data set on retail prices of sesame at the time of the study in 2013 was not possible because NADP was yet to publish its 2011-2015 data set. The main rural and urban sesame markets in Nasarawa State from which retail prices were collected were Lafia, Doma, Obi, Assakio, Kadarko, Nasarawa-Eggon, Akwanga, Wamba, Andaha, Keffi, Nasarawa, Gadabuke and Tudun Uku. Analysis of data was by descriptive statistics and cointegration in three successive steps; augmented Dickey-Fuller (ADF) test for stationarity, Granger causality test and augmented Engle-Granger test of cointegration. Error correction methodology which incorporated short-run and long-run price movements was used in computing the time period required for price adjustment in the pairs of markets [8].

2.1 ADF Test for Stationarity

This is one of the standard and mostly used procedures for determining the order of integration of a time series and consists of estimating the regression.

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha i \sum_{i=1}^{m} \Sigma \, \Delta Y_{t-1} + \varepsilon t \quad (1)$$

Where:

Yt = prices of sesame in market Y during period t,
ΔYt = first difference series in Y, i.e. $Y_t - Y_{t-1}$
t = trend variable (1, 2, 3.., n), n being the length of data series in years.
m = number of lag differences (based on Modified Akaike Information Criterion),
ε_t = error-term, and
$\beta_1 + \beta_2 + \delta$ and α = estimated parameters

The ADF test considers the null hypothesis that a given series is non-stationary. If the coefficient of Y_{t-1} in the ADF equation is not statistically different from zero, the series has a unit roof and therefore non-stationary.

2.2 AEG Test for Cointegration

Since in time series data there is likelihood of spurious result for using price series that are non-stationary, AEG test values are used to obtain more valid inference. The procedure for AEG test involved specifying and estimating the cointegrating relation as well as performing a unit root test on the residuals. Values of estimated AEG test which are more negative or higher in absolute term than the critical value at 1, 5 and 10%, indicate cointegration. The cointegrating regression is stated as:

$$\rho^i_t = \alpha + \beta\rho^j{}_t + \ + \varepsilon_t \quad (2)$$

Where ρ^i_t and ρ^j_t are prices in market $_i$ and j respectively; α is intercept, β is the coefficient, ε_t is the error term.

Note that the AEG test was preceded by Granger causality test to determine prices that drive others.

2.3 ECM

Short-run changes in cointegrated price series are determined by using the formula:

$$\Delta Y_t = \propto_0 + a_1 \Delta X_t + a_2 U_{t-1} + \varepsilon_t \quad (3)$$

Where:

- Δ = first difference operator,
- Y_t and X_t = price series,
- U_{t-1} =equilibrium error term (captures the adjustment towards long-run), and
- $\mathcal{E}_t$ = random error

While, the residual can be stated as:

$$\varepsilon_t = P^i_t - \alpha - P^j_t$$

This shows the impact of short-term changes of the independent price series and the equilibrium error term lagged one period on the short run changes of the dependent price series.

The generalized form of the equation for k lags and intercept term for computing the speed of adjustment is as follows:

$$\Delta Y_t = a_{oo} + \sum_{i=0}^{k-1} a_{i1} \Delta X_{t-1} + \sum_{i=1}^{k-1} a_{i2}\, \Delta Y_{t-i} + m_o\left(m_1 X_{t-k} - Y_{t-k}\right) + \varepsilon_t$$

$$m_o = \left(1 - \sum_{i=1}^{k} a_{i2}\right) \quad and \quad m_1 = \frac{\sum_{i=0}^{k} a_{i1}}{m_o} \quad (4)$$

Where:

- Y_t = The dependent variable (1st price series),
- X = Independent variable (second price series),
- a_{ij} = Coefficients that capture the short-run effects,
- m_j = Coefficients which represent the stationary long-run inputs of the right hand variables, and
- m_o= rate of adjustment of the short-run deviations towards the long-run equilibrium (lies between 0 and 1; the value of 0 denotes no adjustment and 1 indicates instantaneous adjustment; a value between 0 and 1 indicates that any deviations will have gradual adjustment to the long-run equilibrium value.

The formula is derived from the autoregressive distributed lag (ARDL) model by substituting the terms Y_{t-1} and $a_{i1}X_{t-1}$ into the ARDL equation: $Y_t = \alpha_{oi}X_t + \alpha_{i1}X_{t-1} + \alpha_{i2}Y_{t-1} + \mathcal{E}_t$ [19].

3. RESULTS AND DISCUSSION

3.1 Analysis of Retail Prices

Statistics of the retail prices of sesame in ₦/kg from 2004 to 2010 are presented in (Table 1). Their interpretation can be useful in investment decisions, sales planning and operation. Minimum prices ranged from ₦40.83/kg for Assakio to ₦72.73/kg for Wamba. Maximum prices were in the range of ₦ 213.64/kg for Andaha and ₦ 300/kg for Lafia, while Doma, Obi, Assakio, Kadarko and Wamba had a maximum of ₦250/kg each. Similarly, Lafia had the highest mean value of ₦150.41/kg while Andaha had the lowest mean value of ₦108.88/kg. Over the period under consideration, the values of the coefficient of variation indicated that the retail prices of sesame in Andaha market were most stable, followed closely by Wamba and Nasarawa Eggon. The indications for other markets such as Doma, Assakio and Nasarawa showed that they were the most unstable. The fluctuation of the retail prices of sesame in the various markets from month to month reflected the magnitude of the stability of these prices. Factors which could cause fluctuation include demand and supply, activities of middlemen, seasonality, population growth, general price inflation and procurement policy [7-20].

Table 1. Statistics of retail prices (₦/Kg) of sesame in Nasarawa state

Market centre	Statistic				
	Minimum	Maximum	Mean	Standard deviation	Coefficient of variation
Lafia	50.00	300.00	150.41	56.49	0.38
Doma	50.90	250.00	118.01	51.42	0.44
Obi	51.89	250.00	123.09	49.21	0.40
Assakio	40.83	250.00	115.11	49.21	0.43
Kadarko	54.16	250.00	121.80	42.59	0.35
Nasarawa Eggon	65.00	232.15	125.90	36.78	0.29
Akwanga	65.33	266.67	122.67	39.42	0.32
Wamba	72.73	250.00	132.49	37.36	0.29
Andaha	68.19	213.64	108.88	26.19	0.25
Keffi	61.53	260.00	129.22	52.59	0.40
Nasarawa	62.49	260.00	121.06	51.67	0.43
Gadabuke	62.53	250.85	121.46	48.31	0.40
Tudun Uku	56.08	280.00	120.53	49.73	0.41

1US$ varies between ₦190 to ₦200

3.2 Integration of Price Series

The result of the augmented Dickey - Fuller (ADF) unit root test in level and first difference is presented in (Table 2). The nonsignificance of ADF statistic in level at 5% level of significance for all the price series is an indication that the null hypothesis is accepted. Thus, at this level, all the 13 price series are nonstationary. Differencing the series once rendered all of them significant. The null hypothesis is therefore rejected, implying that all the price series for all the markets were stationary in the first difference and hence integrated of the order 1, I (1).

Augmented Engle – Granger (AEG) test was preceded by Granger causality test to determine which of the price series could be used as dependent and independent variables at 5% level of significance. The second price series shown in (Table 3) Granger caused the first. Data of the causality test is bulky and therefore not presented here. Out of the 156 bivariate regressions run, only the 34 cointegrated pairs, constituting about 21.8%, are shown in (Table 3). The result of the AEG test revealed relatively low levels of cointegration among retail prices in the various markets of sesame in Nasarawa State. This meant that long-run or equilibrium linear relationships existed between only a few pairs of retail price series in sesame markets of the State. To a large extent, retail price series in many markets of the product were segmented. For the vast majority of sesame markets that were not integrated, due largely to the lack of effective system of information communication and poor road infrastructure [15-21], inaccurate or no price signals between these markets could make them vulnerable to exploitation by middlemen. The interdependence and interconnectedness of the few integrated markets of sesame enabled price signals to get to the geographically separated markets. Reversing the trend and improving efficiency will certainly involve among other things, formulating and implementing policies that will target improving infrastructures such as rural roads and providing market information outfit that will disseminate timely information to the marketers.

3.3 Short-run Price Dynamics and Speed of Price Adjustment

Error correction mechanism (ECM) is a measure of the short-run behaviour of the price transmission process which includes the time or speed it takes for prices to adjust back to their equilibrium relationship. The third and fourth columns of (Table 4) show the short-run dynamics of the integrated retail prices of sesame computed from equation (3). The positive sign of the coefficients of the short-run market prices used as independent variables have positive impact on the short-run changes of the dependent market price series. The statistical significance of 29 of the 34 price series is an indication that short-run changes in the independent variables have positive and significant impact on the short-run changes in about 85% of the dependent market price series. Similarly, the expected sign and statistical significance of the error term coefficients implied that there was adjustment back to the long-run equilibrium. Speed of adjustment was computed from equation (4). The rate of adjustment (speed of adjustment) is shown in the last two columns of (Table 4) at lag 1, which represents one month, the partial adjustments for nearly all the integrated pairs were very high. This implies that a very high percentage of previous month's changes in retail prices were transmitted in any current month.

Table 2. Result of the augmented dickey-fuller test

Level (1(0)) price series	First difference (1(1))	
	Test statistics	Test statistic
Lafia	-2.8962	-5.8836*
Doma	-2.5007	-7.0606*
Obi	-2.6454	-6.4349*
Assakio	-2.7583	-5.7251*
Kadarko	-2.0981	-5.9822*
Nasarawa Eggon	-2.3585	-5.5427*
Akwanga	-2.9071	-5.3415*
Wamba	-2.2691	-9.1233*
Andaha	-2.2288	-5.8604*
Keffi	-2.2040	-5.2932*
Nasarawa	-2.4862	-6.6741*
Gadabuke	-2.7528	-6.1152*
Tudun Uku	-2.4536	-3.8377*

Significant at 1% and 5%, Critical values at 1% = - 3.550, 5% = -2.914

Table 3. Result of augmented engle-granger (AEG) test for cointegration

Dependent	Independent	AEG statistic
Price series		
	Akwanga	-3.0755**
Keffi	Kadarko	-3.8318*
Keffi	Nasarawa Eggon	-3.2933**
Keffi	Nasarawa	-4.9935*
Keffi	Tudun Uku	-3.8250*
Gadabuke	Tudun Uku	-3.1675**
Nasarawa	Nasarawa Eggon	-4.2663*
Nasarawa	Tudun Uku	-2.9649**
Tudun Uku	Gadabuke	-3.4568**
Wamba	Akwanga	-3.9450*
Wamba	Andaha	-4.1924*
Wamba	Assakio	-4.9853*
Wamba	Kadarko	-3.2947**
Wamba	Lafia	-4.3849*
Wamba	Nasarawa Eggon	-4.2155*
Wamba	Tudun Uku	-4.0688*
Wamba	Nasarawa	-4.2155*
Nasarawa Eggon	Andaha	-3.3167**
Nasarawa Eggon	Assakio	-4.2133*
Nasarawa Eggon	Kadarko	-5.7396*
Nasarawa Eggon	Lafia	-4.6072*
Nasarawa Eggon	Tudun Uku	-4.2663*
Obi	Akwanga	-3.1501**
Obi	Assakio	-3.4650**
Obi	Gadabuke	-5.5713*
Obi	Nasarawa Eggon	-3.2178**
Obi	Tudun Uku	-3.1261**
Doma	Gadabuke	-3.0454**
Doma	Nasarawa	-3.2441**
Doma	Tudun Uku	-3.3381**
Lafia	Gadabuke	-3.6503*
Lafia	Kadarko	-3.8318*
Assakio	Doma	-3.1313**
Kadarko	Keffi	-3.9378*

**significant at 1%, **significant at 5%, Critical values: 5% = - 2.913, 1% = -3.548*

Table 4. Result of error correction mechanism (ECM) analysis and speed of adjustment

Dependent	Independent	Short-run coefficient	Short-run error term coefficient	Rate of adjustment	% rate of adjustment
Price series					
Keffi	Akwanga	0.10077*	-0.0015202	0.8290	83
Keffi	Kadarko	0.21742*	-0.00089086	0.9520	95
Keffi	Nasarawa Eggon	0.40963*	-0.0028999	0.8160	82
Keffi	Nasarawa	0.75627*	-0.0061661	0.9070	91
Keffi	Tudun Uku	0.42645*	-0.0058876	0.8860	89
Gadabuke	Tudun Uku	0.22530*	-0.0065394	0.5930	59
Nasarawa	Nasarawa Eggon	0.39771*	-0.0036877	0.8510	85
Nasarawa	Tudun Uku	0.066699	-0.0038724	0.7790	78
Tudun Uku	Gadabuke	0.22883*	-0.0035193	0.9660	97
Wamba	Akwanga	0.14444*	-0.0045059	0.8480	85
Wamba	Andaha	0.38800*	-0.0056529	0.8550	86
Wamba	Assakio	0.062802	-0.0040573	0.8950	90
Wamba	Kadarko	0.17582*	-0.0034578	0.9020	90
Wamba	Lafia	0.027912	-0.0020301	0.8620	86
Wamba	Nasarawa Eggon	0.22271*	-0.0018292	0.8700	87
Wamba	Tudun Uku	0.099922	-0.0017860	0.8620	86
Wamba	Nasarawa	0.036963	-0.0018217	0.8050	81
Nasarawa Eggon	Andaha	0.0.58333*	-0.0040044	0.8400	84
Nasarawa Eggon	Assakio	0.25759*	-0.0052083	0.9430	94
Nasarawa Eggon	Kadarko	0.22740*	-0.0047924	0.8890	89
Nasarawa Eggon	Lafia	0.26708*	-0.0036483	0.9960	100
Nasarawa Eggon	Tudun Uku	0.11548*	-0.0044157	0.9390	94
Obi	Akwanga	0.17397*	-0.0027941	0.7750	78
Obi	Assakio	0.16354*	-0.0049776	0.7430	74
Obi	Gadabuke	0.18983*	-0.0051795	0.7920	79
Obi	Nasarawa Eggon	0.31156*	-0.0019678	0.7400	74
Obi	Tudun Uku	0.23884*	-0.0029836	0.7460	75
Doma	Gadabuke	0.43957*	-0.0061534	0.9650	97
Doma	Nasarawa	0.31735*	-0.0059394	0.6340	63
Doma	Tudun Uku	0.10049*	-0.0053697	0.5880	59
Lafia	Gadabuke	0.26091*	-0.0036513	0.8560	86
Lafia	Kadarko	0.48628*	-0.0046600	0.8440	84
Assakio	Doma	0.41450*	-0.0055223	0.8430	84
Kadarko	Keffi	0.12862*	-0.0037115	0.7890	79

** Significant at 5% level of probability*

The speed of the response of the prices could relate to the efficiency of the marketing system, as the shorter the time to complete the adjustment process, the better the integration of the markets. The speed of adjustment was therefore an indication of the efficiency of the marketing system of sesame for the integrated pairs of markets. Instantaneous integration of markets and short period of adjustment of prices after a shock are ideal conditions for marketing efficiency.

4. CONCLUSION

Market participants comprising farmers, middlemen, government and the entire society desire efficient and competitive sesame markets for maximum benefits and sustained economic development. These benefits include competitive and favourable prices at producer, wholesale, retail, and consumer levels, high return and enhanced welfare for farmers and middlemen, and rapid transmission of price changes in spatially separated markets. Findings from the study of market integration using cointegration analysis showed that only 21.8% of the market pairs were integrated. The remaining pairs of markets were segmented. The markets are largely inefficient because many of the rural roads in Nasarawa State are not readily accessible, seasonal and in a state of disrepair. These reflect in high cost of farm produce and impede the rapid flow of market information. Establishment of market information dissemination centres, rehabilitation and construction of rural roads are necessary interventions required for enhanced market integration, and hence the efficiency of the marketing system of sesame. Of course, ameliorating other marketing constraints such as lack of grades and standards, inadequate credit and poor storage facilities is vital. To improve the integration of these markets, the need for government to provide infrastructure such as good roads and information dissemination gadgets and centres becomes evident and important as these are public goods. It is also imperative for government to facilitate and work with the farmers in standardizing and grading the product to desired specific quality characteristics. Mobile phones are means of marketing information dissemination farmers and middlemen can readily use to convey information on the different aspects of sesame marketing through the diverse geographical space.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Spore: The magazine for agricultural and rural development in ACP countries. No.154. August- September; 2011.
2. NADP. Nasarawa State Aricultural Development Programme. NADP Newsletter: A House Journal of Nasarawa ADP. March edition. 2010;4(1).
3. RMRDC. Raw Materials Research Development Council. Report on survey of agro raw materials. Maiden edition; 2004.
4. NBS. National Bureau of Statistics. Agricultural survey report; 2007.
5. Anzaku TAK, Bello M, Onuk EG. Analysis of farmers' response to fluctuations in prices of sesame in Nasarawa State, Nigeria. Nigerian Agricultural Journal. 2011;42:21–27.
6. Chirwa EW. Liberalization of food marketing and market integration in Malawi. The AERC Biannual Economic Research Workshop, Nairobi, Kenya. May 27-June 1 2000.
7. Minot N, Goletti F. International Food Policy Research Institute, Washington DC. Research Report 114; 2001.
8. Intodia V. Cointegration and market integration: An analysis of tea markets in India. Indian Journal of Economics. 2005; 85(340):97–105.
9. Gabre-Madhin EZ. Market institutions, transaction costs, and social capital in the Ethiopian grain Market. International Food Policy Research Institute. Washington. Research Report 124; 2001.
10. Chikwendu DO. Price communication and market integration: The case of banana and plantain in Nigeria. Samaru Journal of Agricultural Research. 2003;19:29–35.
11. Jones WO. Marketing staple food crops in tropical Africa. New York: Cornell University Press; 1972.
12. Olatunde OM, Rufina AO. Retail: rural urban market integration of plantain and banana in Enugu State. Nigerian Journal of Horticultural Science. 2005;10:99–104.
13. Ali A, Rahman SA. Cointegration and market integration: An application to selected sorghum and maize market. In: Olojede AO, Okoye BC, Ekwe KC, Chukwu GO, Nwachukwu IN, Alawode O (ed). Global food crisis and Nigerian agriculture. Proceedings of 43rd annual conference of the Agricultural Society of Nigeria held at the National Universities Commission and Raw Materials Research and Development Council, Abuja, Nigeria. 20-23 October. 2009;277-281.
14. Getnet K, Verbeke W, Viaene J. Modeling spatial price transmission in the grain markets of Ethiopia with an application of ARDL approach to white teff. Agricultural Economics. 2005;33:491-502.
15. Achike AI, Anzaku TAK. Economic analysis of the marketing margin of beniseed in Nasarawa State, Nigeria. Agro-Science. Journal of Tropical Agriculture, Food, Environment and Extension. 2010;9(1):47-55.
16. Anzaku TAK, Achike AI. Socio-economic determinants of market performance among sesame farmers in Nasarawa State, Nigeria. International Journal of Agricultural and Rural Development. 2010; 1(3):21-28.
17. Marcus ND, Binbol NL. Introduction. In: AkwaVL, Binbol NL, Samaila KL, Marcus ND (Ed). Geographical perspective on Nasarawa State. Department of Geography, Nasarawa State University, Keffi, Nigeria. Onaivi Printing and Publishing Co. 2007;1-2.
18. Binbol NL (2001). Climate. In: Akwa VL, Binbol NL, Samaila KI, Marcus ND, (Ed). Geographical perspective on Nasarawa State. Department of Geography,

Nasarawa State University, Keffi, Nigeria. Onaivi Printing and Publishing Co. 2007;35-43.
19. Acquah HD, Owusu R. Spatial market integration and price transmission of selected plantain markets in Ghana. Journal of Sustainable Development in Africa. 2012;14(5):208-217.
20. Olukosi JO, Isitor SU. Introduction to agricultural marketing and prices: Principles and applications. Nigeria: Living Books series, Abuja; 1990.
21. Njoku JE. Marketing strategies for sustainable agricultural investment in Nigeria. Nigerian Agriculture. March/April edition; 2000.

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