International Journal of Innovative Research and Advanced Studies (IJIRAS)
Volume 3 Issue 5, May 2016

ISSN: 2394-4404

Analysis Of Spatial Integration Of Citrus Markets In Benue And Kano States, Nigeria

Ashiko, Felix Terfa Gaase
Department of Agribusiness,
University of Agriculture, Makurdi, Nigeria

Ayilla, Vivien Nguwasen
Institute of Food Security,
University of Agriculture, Makurdi, Nigeria

Ior Jacobs Adzenga
NAERLS,
Ahmadu Bello University, Zaria, Nigeria

***Abstract:** This paper examines the impact of spatial price originated in Benue State Citrus Market on the price formation of geographically distant Citrus Market in Kano, Nigeria. The study uses the monthly time series prices of Citrus in these markets from January 2000 to December 2011. The outcome of the cointegration analysis suggests that prices in these markets were integrated both in the short-run and long-run perspectives with the Benue Price granger-causing the Kano price. This has important implications for food and agricultural policy: government interventions at the Central Benue Market are effective in the Kano Regional Markets.*

***Keywords:** Spatial Price; Cointegration; granger-causality;*

I. INTRODUCTION

Citrus propagation has continued to increase in Nigeria, particularly in the Benue valley area with output increasing. The variety of sweet orange commonly found in Nigeria include 'washington', 'ibadan sweet', and 'valencia'. In 2012, Nigeria had moved up to the eighth position in citrus production with an output of 3.9 million tons cultivated on 800,000 hectares. This represented a world share of 3% (FAO, 2012).

Citrus is the most important tree crop in Benue state having a total estimated population of about 2 million trees with an area of 925,073 ha (Ortese *et al*., 1999; BNARDA, 2010).The Benue Agricultural and Rural Development Authority (BNARDA, 2006) has stated that among the leading geopolitical areas identified for citrus production in the Benue area are: Ushongo, Buruku, Gboko, Vandeikya, Konshisha, Gwer, Ohimini and Oju Local Government Areas of Benue state.

Citrus trees and other perennial tree crops are used by farmers to supplement income from cash crops and other annual crops, which fetch short-run quick returns. Over time, farmers have sought a vent for the surplus produced in the state. One of the most significant and readily identifiable destinations for oranges produced in Benue is Kano (Dav, 2003; BNARDA, 2010). Other important trade destinations include Maiduguri, Nasarawa, Abuja, Taraba and Ebonyi states among others.

II. SPATIAL MARKET INTEGRATION AND PRICE TRANSMISSION

Price transmission refers to the way a price at one level of the supply chain responds to a price change at another level of the chain (Bunte, 2006). Price is also a means by which information is passed vertically along a supply chain. Imperfect price transmission can therefore imply imperfect information transmission. Price transmission is important because it can help us understand the relative bargaining positions of the chain actors. The adjustment to price shocks along the chain from producer to wholesale and to retail levels, and vice versa, is an important characteristic of the functioning of markets. That is, a common concern of policy makers relates to the assertion that, due to imperfect price transmission (perceived to be caused by market power and oligopolistic behaviour), a price reduction at the farm level is only slowly, and possibly not fully, transmitted through the supply chain (Vavra and Goodwin, 2005). According to Clemens (1994) elements of performance include: integration of markets and analysis of price differences. Market integration is therefore another important indicator of market performance.

The necessity of the distributive trade due to geographical separation of the producers and consumers gives rise to the intermediation of distributors referred to as wholesalers (Adekanye, 1988). Without spatial price analysis of the markets, price signals will not be transmitted from food deficit to food surplus areas, prices will be more volatile, agricultural producers will fail to specialize according to a long-term comparative advantage and the gain from trade will not be realized (Chirwa, 2000). In order to facilitate agricultural development process, analysis of marketing margin and pricing efficiency of foodstuff is considered very pertinent and, it is expected that favourable pricing efficiency will stimulate more of the products concerned to be produced. Over the years, food shortages coupled with high prices in Nigeria have indicated that domestic output has not been able to provide most Nigerians food at affordable prices. It is therefore logical to find out the factors (particularly transportation and marketing information) that are responsible for the price hike.

In theory, Spatial Price determination models suggest that if two markets are linked by trade in a free market regime, excess demand and supply shocks in one market will have an equal impact on price in both markets. The implementation tariffs in general will allow prices to be fully transmitted to local consuming markets in relative terms (Ardeni, 1989). Thus, a proportional increase in the producer market price will be fully transmitted in equal proportional increase in the consumer market. However, agricultural policy instruments such as subsidies, taxes, quotas, tariffs and other intervention mechanisms hinder the full transmission of price signals by affecting the excess demand or supply schedules of commodity markets (Baffes and Ajwad, 2001; Abdulai, 2000; Sharma, 2002). Apart from these policies, the fruit markets can also be partly insulated from large marketing margins that arise due to high transfer costs. This is even more relevant in the case of developing countries like Nigeria with poor infrastructure, transport and communication services.

Rapsomanikis *et al.* (2004) have observed that most of the studies on price transmission have utilized time series econometric analysis techniques that test for the co-movement of prices. The development of these techniques, which include co-integration and error correction models, have become a standard tool for analyzing spatial market relationships, replacing earlier empirical tools such as bivariate correlation coefficient and regressions. Nevertheless, time series analysis has also been criticized as unreliable (Barrett and Li, 2002); with recent research focusing on switching regime models that incorporate data on prices, volumes traded and transactions costs. Blauch (1997) provides a review of the debate on the application of methodology for testing for market integration and price transmission and examines the statistical performance of econometric tests for market integration.

III. CO-INTEGRATION TECHNIQUE

The theoretical framework for this technique has been succinctly provided by Jayasinghe – Mudalige (2005) as follows: The conventional demand – supply theory explains that the actual price of a commodity in a given market (citrus in this case) at a given point in time is higher than the equilibrium price when the product is "deficit" (*i.e.* excess demand where the demand is greater than domestic supply) . However, the price is lower than the equilibrium price when it is "surplus" (*i.e.* excess supply where the domestic supply is greater than the demand). Consequently, there exists an opportunity for trade between these two types of markets (*i.e.* from surplus to deficit regional market), and ultimately these two markets become integrated by adjusting into a single price.

Much work has been done to integrate the dynamics of food prices all over the world. Spatially Separated Markets which have been identified for playing significant roles in the marketing of specified commodities are usually used in the various studies. Various techniques for spatial price analysis have been employed in various studies. Nyange (2010) and Yusuf (2012) suggest that co-integration techniques and Ravallion Model have found common and extensive use to determine if prices in each individual market respond not only to their own supply and demand, but also to the supply and demand of the set of all markets. Yusuf (2012) has also identified Timmer Index analysis, Regression analysis and Correlation analysis as stages through which spatial price analysis has evolved.

Regression analysis based on time series data assumes stationarity of the data. This implies that the mean, variance and auto covariance are constant over time. The Dickey-Fuller (DF) and Augumented Dickey-Fuller (ADF) tests are often used to find out if the time series contains a unit root and hence stationary. The DF and ADF test can be applied to determine whether a time series is trend stationary (which has a deterministic trend) or difference stationary (which is a variable or stochastic trend).

To avoid the phenomenon of spurious regression which often results from the regression of one time series variable on one or more time series variables, it is imperative to investigate if the time series used in regression are co-integrated. Co-integration means that despite being individually non stationary, a linear combination of two or more series can be stationary; and for this purpose, the Engle-Granger (EG), Augment Engle-Granger and Co-integrating Regression Durbin-Watson (CRDW) tests are used (Gujarati, 2007). Co-integration of two or more time series suggest a long-run or equilibrium relationship between series data: the error correction mechanism (ECM) developed by Engle and Granger is used to reconcile short-run behaviour of an

ISSN: 2394-4404

economic variable with its long-run behaviour (Thomas, 1997; Gujarati, 2007).

A prerequisite for the VECM estimation is the determination of the characteristics of the time series variables in the model as to whether they are stationary or non-stationary. The VECM is a restricted vector autoregression (VAR) designed for use with non stationary variables that are known to be co-integrated. VECM specification restricts the long run behaviour of the endogenous variables to converge to their co-integrating relationships while allowing for short-run adjustment dynamics. Vector error-correction models (VECMs) are widely used to model economic variables that are non-stationary individually but linked by long-run relationships.

A "standard" VECM assumes that these variables follow a linear adjustment process towards their long-run equilibrium. Granger (1987) showed that if the variables, say Xt and Yt is found to be cointegrated, there will be an error representatives which is linked to the said equation, which gives the implication that changes in dependent variable is a function of the imbalance in cointegration relation (represented by the error correction term) and by other explanatory variables.

In general, if there exists a stationary linear combination of non-stationary random variables, the variables combined are said to be cointegrated. Therefore, before testing for cointegration it is important to test first individual time series for their order of integration. For most economic variables, individual variables should be stationary after first differences and non-stationary in base levels, that is the variables should contain a stochastic trend (unit root). Therefore, a unit root test is conducted on each market price before testing whether they are cointegrated.

The way in which the tests for the components of transmission are being ordered is to some extent *ad hoc*. In this study, the Co-integration technique was used to determine whether the citrus markets in Kano and Benue are cointegrated or fragmented using the following sequence:

A. BASIC DICKEY-FULLER (DF) TEST

Unit root tests were conducted on each of the time series market price using the DF, before testing whether they are cointegrated. In this procedure a null hypothesis was developed:

Y_t is integrated of order 1(i.e the series for this test is not stationary). If the null hypothesis is found to be true, the series shall be differenced until stationarity is achieved (it is well documented that economic variables generally achieve stationarity when differenced once or twice). If this is the case, the next step which requires the use of the Augmented Dickey-Fuller is employed to test for stationarity.

The order of integration of time series say Yt is based on the following regression (assuming that the data – generating process can be represented by simple first – order autoregression):

$$Yt = \alpha + pYt\text{-}1 + \varepsilon t,$$

when reparametrized this looks as follow:…..….… ….(1)

$$\Delta Yt = \alpha + (p\text{-}1)Yt\text{-}1 + \varepsilon t \quad \text{(2)}$$

B. AUGMENTED DICKEY-FULLER (ADF) TEST

The modified DF test takes in to account any serial correlation present by entering lagged values of the dependent variable. The null hypothesis in the ADF test is also unit root (p=1).The number of lagged values (n) is chosen to ensure that the residuals are white noise. The Schwarz Criterion (SC) is applied to determine the lag length. The order with the lowest value is then chosen as optimal (Arshanapalli and Doukas, 1993). If the Yt is trend stationary, then a constant and a linear time trend should be included.

C. COINTEGRATION TEST

With stationarity established among the time series prices from the two states, the null hypothesis in the procedure was that of no cointegration, with the alternative hypothesis of cointegration. The Johanson cointegration test was run and relevant critical values for cointegrating tests available from Comprehensive Monte Carlo Simulation by MacKinnon-Haug-Michelis (1999) p-values.

D. GRANGER CAUSALITY TEST

After the long-run relationships were evaluated in the Cointegration test, attention and empirical procedures shifted to endogeneity of the price variables and the short-run relationships and question. The Granger Causality test within a Vector Autoregression (VAR) framework to assess price transmission between the markets or along the supply chain followed in the procedure.

In this study, the aim is to test whether P_b causes P_k or vice versa. To achieve this, we consider the following pair of regression in testing the null hypothesis that Kano price does not granger cause Benue price and vice versa:

$$Pb_t = C_1 * Pk_{t-i} + C_2 * Pb_{t-j} + u_{1t} \quad \text{……………………….(3)}$$

$$Pk_t = C_3 * Pb_{t-i} + C_4 * Pk_{t-j} + u_{2t} \quad \text{…………..…...……..(4)}$$

Where Pk and Pb are Kano and Benue prices respectively

E. ERROR CORRECTION MODEL (ECM)

The short-run adjustment to restore the long-run equilibrium is possible in the ECM. The procedure evaluates whether prices adjust in the short-run or over the long-run to changes in a given variable. Engle and Granger (1987), have developed a model known as Error Correction Model (ECM) that enable us to differentiate between long run and short run relationships of time series analysis. As the series show long run relationship, the ECM needs to be applied to investigate further on short run (casually) interaction between variables. When non stationary variables in a model are cointegrated, the following ECM can be employed. The ECM is adapted for single equation as in this case and is chosen over the Vector Error Correction Model, VECM which is used in a system of equations.

www.ijiras.com | Email: contact@ijiras.com

The ECM model estimated for this study is as follows:

$$\Delta P_b = \alpha + \beta_1 \Delta P_k + \delta u_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(9)$$

Where:

ΔP_b and ΔP_k are the first differenced variables for Benue and Kano prices respectively.

α is the intercept

β_1 is the estimated short run coefficient to the long run solution,

δ is the speed of adjustment parameter,

ε_t is the white noise error term

The δu_{t-1} is the one period lag residual of the regression estimation at level. It is also known as equilibrium error term of one period lag. It guides P_b and P_k of the system to restore to equilibrium. The sign of the error term should be negative and significant to validate existence of a long equilibrium relationship between P_b and P_k. The coefficient of the error correction term also tells at what rate it corrects the previous period of disequilibrium of the system.

When the non-stationary citrus price time series were confirmed to be cointegrated, the Error Correction Model (ECM) was used to enable the study to differentiate between long run and short run relationships of time series citrus prices. The efficiency of the ECM was also tested using the normality test (Jarque-Bera statistic), Autoregressive Conditional Heteroscedasticity (ARCH) test and Breusch-Godfrey serial correlation.

IV. RESULTS AND DISCUSSION

A. TRENDS IN THE PRICES OF CITRUS IN BENUE AND KANO MARKETS (2002 -2012)

The trend in prices of sweet oranges in Benue and Kano show many similarities. Figure 1 shows many coinciding fluctuations tracing a nearly uniform periodic pattern. However, the trend for prices in Kano have more dramatic fluctuations as shown by a higher standard deviation (Table 1) and is generally more upward trending. The fluctuations follow the pattern of seasonal demand, which in turn are influenced by religious activities such as fasting. Throughout the period, the wholesale price of orange in Kano is always higher than that of Benue because as a producing area, the state has a higher supply of fruits in the local market at a relatively lower cost of supply.

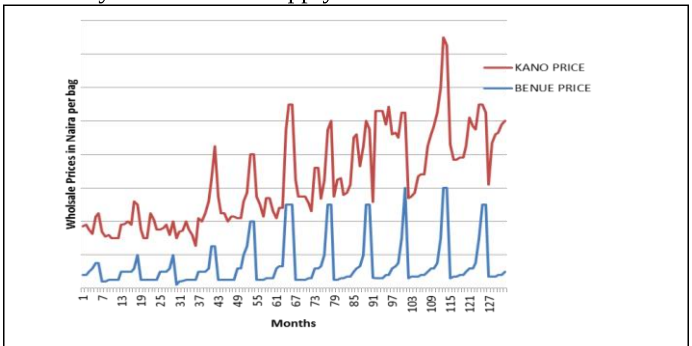

Figure 1: Trends in the mean prices of citrus in Benue and Kano Markets between January 2002 and December 2012)

Benue state has a lower price standard deviation of ₦ 1196.33 and a mean price of ₦ 1391.67 per bag compared to Kano's ₦ 2212.2 and ₦ 5082.20 per bag respectively. These stable and lower prices are the result of stability in the supply of the citrus from the orchards. Farmers have continued to adopt the practice of propagation of different varieties of citrus with varying periods of fruit maturity.

Estimate	Benue	Kano
Mean (₦/bag)	1391.67	5082.20
Median (₦ /bag)	800.00	4500.00
Maximum(₦/bag)	6000.00	10050.00
Minimum(₦/bag)	200.00	2000.00
Std. Dev.	1196.33	2212.552
Coefficient of variation	85.96%	43.54%

Table 1: Statistical characteristics of prices of citrus in Benue and Kano Markets (2002 - 2012) Years

B. STATIONARITY OF CITRUS PRICES IN BENUE AND KANO

The result of the unit root test of citrus prices in Benue and Kano states is presented in Table 2. This is a test for stationarity in prices in each location. This involves testing the hypothesis that the price series in each location is integrated of order 1, i.e the series was not stationary and need to be differenced once before stationarity is achieved.

The stationarity test was carried out using Augmented Dickey- Fuller (ADF) test. In both Benue and Kano markets, the unit root test was first determined without any differenciation and the ADF value in both states were lower than the critical values at 1% level of significance. At first difference, the ADF value was higher than the critical value at 1% level of probability in both states in absolute terms. This implies that the series in the two states must be differenced once before stationarity is achieved. Therefore, the null hypothesis that the series of order 1 is accepted and the alternative is rejected in both markets. Johansen cointegration test therefore becomes appropriate for assessing the existence of long-run relationships among price series.

Location	Critical values	No difference	1st difference	ADF value
Benue markets	1%	-3.485586		-1.333636
	5%	-2.885654		
	10%	-2.579708		
	1%		-3.485586	-15.47294
	5%		-2.885654	
	10%		-2.579708	
Kano markets	1%	-3.480818		-2.276051
	5%	-2.883579		
	10%	-2.578601		
	1% level		-3.482035	-8.063594
	5% level		-2.884109	
	10% level -		2.578884	

Table 2: Unit root test for both Benue and Kano markets

C. COINTEGRATION OF PRICES IN THE TWO MARKETS

Cointegration was conducted using Johansen cointegration test. The Schwartz Information Criterion (SIC)

ISSN: 2394-4404

was used to select the optimal truncation lag length to ensure the errors are white noise in ADF. In this study, the Schwarz Criterion (SC) and the Likelihood Ratio (LR) test suggested that the value p = 5 is the appropriate specification for the order of VAR model.

The null hupothesis tested was that the two series are cointegrated of order 0, i.e. the prices in the two locations are not cointegrated.

The result of Johansen cointegration test is presented in Table 3. Johansen Trace test showed the existence of one cointegrating equation at 5 percent probability level implying that there is a common trend in the process . Also, the maximum Eigen value was greater than the critical value at 5% level of probability, indicating at most 1 cointegrating vector in the two markets. This implies that the price variables are cointegrated and have long run direct relationship with each other. Thus, there is long run relationship in the market prices of citrus in the two locations. Therefore, the null hypothesis is rejected while the alternative hypothesis accepted.

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No of CE(s)	Eigen value	Trace statistic	5% critical value	Probability level**
r=1*	0.263630	42.55068	20.26184	0.0000
r ≤ 1	0.028605	3.685857	9.164546	0.4609

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No of CE(s)	Eigen value	Max-Eigen statistic	5% critical value	Probability level
r=1*	0.263630	38.86482	15.89210	0.0000
r ≤ 1	0.028605	3.685857	9.164546	0.4609

Trace statistic and Max-eigenvalue test indicate 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Table 3: Summary of Johansen cointegration test result

D. ESTIMATE OF THE LONG RUN RELATIONSHIP

When the prices are cointegrated or have long run equilibrium as revealed by the cointegration result, the regression model becomes a long run model and the coefficient of the Kano price, PK, of 0.090637 is the long run coefficient. The p-value of the long run coefficient is significant at 10%. This implies market integration across the states. Table 15 provides a summary of the long run model between the prices.

Dependent Variable: PB

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	931.0292	303.4413	3.068235	0.0026
PK	0.090637	0.054777	1.654667	0.1004

R-squared	0.220627	Mean dependent var	1391.667
Adjusted R-squared	0.013093	S.D. dependent var	1396.331
S.E. of regression	1387.160	Akaike info criterion	17.32294
Sum squared resid	2.50E+08	Schwarz criterion	17.36662
Log likelihood	-1141.314	Hannan-Quinn criter.	17.34069
F-statistic	2.737922	Durbin-Watson stat	0.932994
Prob(F-statistic)	0.100405		

Table 4: The long run relationship of Citrus prices between Benue and Kano States

E. GRANGER CAUSALITY TEST

Granger causality test was further conducted to see the direction of relationship in the two markets (i.e. to see which market influences the other). The result of the test is presented in Table 16. The null hypothesis is that Benue prices did not influence Kano prices and Kano prices did not influence Benue prices. The p-value of the F-statistic for HO_1 was 0.0376 and significant at 5%. This implies that we could reject HO_1 and accept the alternative hypothesis that Kano price does granger cause Benue price. This means that Benue Price depends on or is a function of Kano price. The result further shows that Benue price does not granger cause Kano price. This finding provides evidence that price information in Kano Market determine the prices at the base market and farm gate.

	Null hypothesis	Observations	F-statistic	Probability
HO_1	Kano_price does not granger cause Benue_price	132	2.45155	0.0376
HO_2	Benue_price does not granger cause Kano_price	132	0.76791	0.5747

Table 5: Granger causality test result with 5 lags

F. ERROR CORRECTION ESTIMATE (ECM)

The existence of co-integration among the prices and their fundamentals necessitated the specification of ECM for this study. The study provided ECM estimates for the prices taking Benue price as the dependent variable. The short-run estimates as well as diagnostic statistics are shown for the model.

G. ERROR CORRECTION ESTIMATE WITH BENUE PRICE AS DEPENDENT VARIABLE

The short run coefficient is the first difference of kano price, D(PK) and it has a value of 0.133492 . Its p value of 21.68% is not significant at 5%. This means that Kano price is not significant in explaining Benue Price. A possible explanation for this result is the weak relationship between the prices in the long run.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	10.42183	101.7397	0.102436	0.9186
D(PK)	0.133492	0.107542	-1.241301	0.2168
U(-1)	-0.469973	0.073634	-6.382512	0.0000

R-squared	0.246888	Mean dependent var	1.526718
Adjusted R-squared	0.235121	S.D. dependent var	1329.834
S.E. of regression	1163.038	Akaike info criterion	16.97809
Sum squared resid	1.73E+08	Schwarz criterion	17.04394
Log likelihood	-1109.065	Hannan-Quinn criter.	17.00485
F-statistic	20.98072	Durbin-Watson stat	1.684244

Prob(F-statistic)	0.000000

Table 6: Result of estimate of ECM showing short runs effect

The error correction term u(-1) is negative, significant at 1% eignificant level and less than one. This meets the criteria for long run relationship (Abiodun and Salau, 2010) and indicates that a long-run relationship exists between the two markets i.e. Kano prices cause Benue prices in the long-run. This validates the result of the cointegration result that there is a long run equilibrium relationship, albeit weak, between the prices in Benue and Kano citrus markets. The coefficient of the error correction term is -0.469973 and further indicates that the speed of adjustment towards long-run equilibrium is 47% monthly. Table 17 provides details of the ECM estimates. The R-square statistic of the ECM is 24.69%, which is less than its Durbin-Watson statistic of 168.42%. This means that the model is not a spurious model.

H. EFFICIENCY OF THE ERROR CORRECTION MODEL

The Efficiency of the ECM is tested to verify its reliability. The normality tests are based on skewness and kurtosis. Figure 2 provides a pictorial view of the spread of the residuals of the model. The Null Hypothesis is that the residual are normally distributed. The Jarque-Bera statistic, which provides a statistical summary of the distribution of the residuals is 48.22236 and is significant at 1%. So the Null hypothesis cannot be rejected. Consequently, we reach the conclusion that the residuals are normaly distributed. This is a desirable characteristic of all regression models.

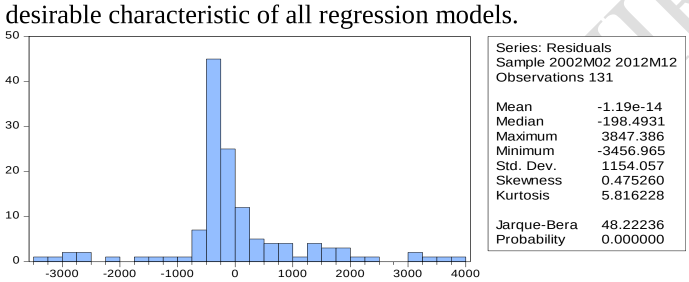

Figure 2: Summary of residual Normality test

Table 7 presents the result of the Lagrange multiplier (LM) test. The Null Hypothesis is that there is no serial correlation. The p-value of the Chi-square is significant at 5% level of probability. This means the Null hypothesis cannot be rejected and therefore it is accepted implying the absence of residual autocorrelation. This is also a desirable characteristic of the regression model and further confirms the efficiency of the model.

F-statistic	5.709710	Prob. F(2,126)	0.0342
Obs*R-squared	10.88597	Prob. Chi-Square(2)	0.0743

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-1.700655	98.19299	-0.017320	0.9862
D(PK)	0.059047	0.105630	0.559002	0.5772
U(-1)	-0.358296	0.235140	-1.523759	0.1301
RESID(-1)	0.521813	0.232501	2.244348	0.0266
RESID(-2)	-0.004975	0.157629	-0.031559	0.9749

R-squared	0.083099	Mean dependent var	-1.19E-14
Adjusted R-squared	0.053991	S.D. dependent var	1154.057
S.E. of regression	1122.470	Akaike info criterion	16.92187
Sum squared resid	1.59E+08	Schwarz criterion	17.03161
Log likelihood	-1103.383	Hannan-Quinn criter.	16.96646
F-statistic	2.854855	Durbin-Watson stat	2.005754

Table 7: Breusch-Godfrey Serial correlation LM Test

Table 8 presents the result of the Autoregressive Conditional Heteroscedasticity (ARCH) test. The Null Hypothesis is that there is no ARCH effect. The p-value of the Chi-square is less than the elected critical value of 5%. This means the Null hypothesis is rejected and therefore the alternative hypothesis is accepted. This revealed the presence of residual Heteroskedasticity. This is not a desirable characteristic and adversely affects the efficiency of the model. However, cointegration tests are robust against moderate residual ARCH effects according to Juselius (2003).

F-statistic	4.518692	Prob. F(5,120)	0.0008
Obs*R-squared	19.96428	Prob. Chi-Square(5)	0.0013

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1230237.	324597.0	3.790045	0.0002
RESID^2(-1)	0.194219	0.091058	2.132917	0.0350
RESID^2(-2)	0.249956	0.091170	2.741663	0.0070
RESID^2(-3)	-0.082688	0.093674	-0.882722	0.3792
RESID^2(-4)	-0.188067	0.091151	-2.063247	0.0412
RESID^2(-5)	-0.070451	0.091049	-0.773766	0.4406

R-squared	0.158447	Mean dependent var	1372132.
Adjusted R-squared	0.123382	S.D. dependent var	2957974.
S.E. of regression	2769489.	Akaike info criterion	32.55267
Sum squared resid	9.20E+14	Schwarz criterion	32.68773
Log likelihood	-2044.818	Hannan-Quinn criter.	32.60754
F-statistic	4.518692	Durbin-Watson stat	2.006291
Prob(F-statistic)	0.000826		

Table 8: Heteroskedasticity Test: ARCH

Beside the Autoregressive Conditional Heteroscedasticity (ARCH) test, the other test statistics provide evidence that the ECM can be relied upon to describe the data well.

The result of this study is similar to the report by Moshood and Momoh (2007). Their study tested the market integration of selected pineapple markets in Nigeria using time series monthly pineapple price data. The analysis showed that the flow of information across the states was weak. This implied that market integration across the states is weak, which suggests market inefficiency and low competitiveness.

V. CONCLUSIONS AND POLICY IMPLICATIONS

This study examined empirically the spatial impact of price originated in a central market (Benue State) on the price formation of a distant regional market (Kano). The results suggest that prices in the markets were integrated both in the short run and long run perspective. The outcome of the analysis has some implications for food and agriculture related policy. The integration of markets in this industry means that information flow and the infrastructure is reasonably in place, and it can be toughened by strengthening the institutions set up for these purposes. It also proves that the government can intervene effectively at the Benue Markets, directly and/or indirectly to adjust the prices in Kano regional markets.

REFERENCES

[1] Abdulai, A. (2000). 'Spatial price transmission and asymmetry in Ghanaian maize market'. *Journal of Development Studies*, 30:303-328.

[2] Abiodun, E. O. 1 and Salau A.S. (2010). Agricultural Response to Prices and Exchange Rate in Nigeria: Application of Co-integration and Vector Error Correction Model (VECM). J Agri Sci, 1(2): 73-81 (2010).

[3] Adekanye, T.O. (1988). *Readings in Agricultural Marketing*, Longman, Nigeria.

[4] Arshanapalli, B., and J. Doukas, 1993, "International stock market linkages: Evidence from the pre- and post-October 1987 period," Journal of Banking and Finance, 17, 193-208.

[5] Baffes J. and Ajwad, M. (2001). 'Identifying price linkages: a review of the literature and an application to the World Market of cotton. *Applied Economics*, 33:1927-1941

[6] Barrett C.B and J.R. Li (2002). Distinguishing between equilibrium and integration in market Analysis'. *American Journal of Agricultural Economics*, 79:477-87

[7] Blauch, B. (1997). 'Testing for food market integration revisited', *Journal of Development Studies*, 33: 477-487.

[8] Chirwa, E.W. (2000). Liberalization of food marketing and market integration in Malarise. Final Report of an AERC Sponsored Research Work Presented at the Bi-annual Economic Research Workshop Nambi.

[9] Clemens, H. (1994). The Functioning of the Maize Market in Benin. Spatial and Temporal Arbitrage on the Market of Staple Food Crops, University of Amsterdam, Netherlands.

[10] Granger C. W. J. (1969). 'Investigating causal relationships by Econometric models and cross spectral Methods'. Agricultural Economics, 10:07-316

[11] Gujarati, D. N. and Sangeetha (2007). *Basic Econometrics*, Tata McGraw-Hill Publishing Company, Inc., New York.

[12] Jayasinghe – Mudalige U.K. (2005). 'An Economic Analysis on Spatial Integration of Regional Rice Markets in Sri Lanka'. http://wwwslageconr.net/sjae81f/sjae08104. Accessed on 26 May 2011.

[13] Juselius, K. (2003): *The Cointegrated VAR Model: Econometric Methodology and Macroeconomic Applications*. Oxford University Press, Oxford.

[14] Moshood O. and Momoh S. (2007). 'Food price differences and market integration in Oyo state, Nigeria', Science Alert, An Open Access Publisher, http://scialent./net. Accessed 25th August, 2011.

[15] Nyange D. A. (2010). 'Inter- Regional Maize Market Integration in Tanzania'. http://www.egfar.org/egfar/ifm/gphi-documents/02-region specific-documents/A-Sub-saharan-Africa. Accessed 3rd October 2011.

[16] Rapsomanikis, G., Hallam D. and Confort P. (2004). 'Market Integration and Price Transmission in Selected Food and Cash Crop Markets of Developing Countries: Review and Applications'. *Commodity Market Review 2003-2004*, Economic and Social Development Department; FAO Corporate Document Repository.

[17] Sharma, R. (2002). 'The transmission of world price signals: concepts, issues and some evidence from Asian cereal markets', Paper submitted to the OECD Global Forum on Agriculture, OECD CCNM/GF/AGR(2002) 10.

[18] Thomas, R.L. (1997). *Mordern Econometrics*; Addison Wesley Longman Ltd, England.

[19] Yusuf, O. (2012). 'Comparative Analysis of Processing and Marketing of Animal Hides and Skin into leather and *Pomo* in Kano Metropolis'. A PhD Thesis submitted to the Department of Agricultural Economic and Rural Sociology, Ahmadu Bello University Zaria, Nigeria.