PRICE INTEGRATION OF COWPEA RETAIL MARKETS IN NIGER STATE, NIGERIA

Ibrahim Faith Debaniyu

Department of Agricultural Economics, School of Agriculture and Agricultural Technology,
Federal University of Technology, Niger State.
NIGERIA.

idfaith006@yahoo.com

ABSTRACT

The study investigated cowpea market integration in Niger State, Nigeria. Data was sourced secondarily. Multistage stratified random sampling was employed to select markets, a total of six (6) markets comprising Kontagora and Salka markets (from production strata); Minna and Bida markets (from consumption strata) and Sabon wuse and Mokwa markets (from transitory strata) were selected for the market integration study.. Data was analysed variously through the use of the Augmented Dicky Fuller unit root test, Johansen co-integration test, Error correction model and Granger causality tests. Results from the market integration study revealed that markets in Niger State present a relatively long run integration in cowpea prices. A strong spatial price linkage exists between Kontagora vs. Sabonwuse and Bida vs. Sabonwuse markets. This was adduced to the ease, flow and use of market information, competition among market participants and the presence of arbitrage. Results from the Granger causality tests indicated both bidirectional and unidirectional causation. Recommendations from this study included the need for the provision of adequate market information on current price dissemination to market participants through government agencies. Creating an environment for competition amongst market participants to enhance integration of cowpea prices. Improve infrastructures, such as good and accessible roads and telecommunication network.

Keywords: Market integration, Johansen co-integration, bidirectional and unidirectional causation

INTRODUCTION

Market integration refers to the co-movement of prices and/or flows between them. More generally, it also refers to the smooth transmission of price signals and information across spatially separated markets. (Goletti, et al., 1995). It is a concept that explains the relationship between two markets that are spatially or temporarily separated. Market integration studies attempts to investigate the extent of a market by analyzing the development of prices over time for potential competing products. (Asche, et al; 2005).

The study of market integration can suggest to the producer as to where, when and how much to sell, which in turn will have a bearing on their production strategies and hence resource allocation. Integrated markets are those where prices are determined interdependently (Yogisha, 2006). Fulton *et al.,* (2008); observed that, the examination of the extent of how markets were integrated was an important way of understanding whether sufficient market information was available to the market participants.

Cowpea (*Vigna unguiculata (L)Walp*) is a global legume of African origin. Davies *et al.* (2005) and Jafferson (2005) attested that cowpea is an ancient crop whose cultivation began in Africa more than 5000 years ago. Today, the crop is widely grown across continents of the world. It is cultivated around the world primarily as a pulse, but also as a vegetable (for both

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grains and the green peas) as well as a cover and fodder crop (Faye, 2005). In Africa, cowpea is the most popular legume and the largest part of the world's production comes from the continent.

The principle of market integration is hinged on the 'law of one price' (LOP), which is the hallmark of the model or the theory of perfect competition. A central prediction of the theory of perfect competition is that the price of all transactions will tend to uniformity allowing for differences in transportation costs between different spatial markets (Okoh *et al;* 2005).

The study of market integration has usually tried to characterize the degree of comovement of prices across spatially separated markets. Wyeth (1992) remarked that, market integration was restricted to the interdependence of price changes across spatially separated locations in a market.

Accordingly Okoh *et al.*(2005), defined market integration as a phenomenon of synchronous movement of prices of a commodity or a group of commodities overtime in spatially differentiated markets. They were of the view that market integration helped in understanding the movement of equilibrium paths of demand and supply for a particular produce or group of commodities.

Economic literature distinguishes three forms of market integration (Bopape and Christy 2002). These forms are

1. Integration across time
2. Integration across product and
3. Integration across space.

Markets are said to be integrated across time (inter-temporarily integrated) when the expected price differential does not exceed the cost of storage. Integration across product form shows that markets are vertically integrated and the price differentials between two related commodities should not exceed transportation and processing costs. Markets are integrated across space if, when trade takes between them, price in the importing market equals price in the exporting market plus transportation and other costs of moving the product between the two markets.

Market locations across space often lack integration due to inadequate provision of public goods (such as infrastructure), inefficient flow of information, imperfect competition, and incomplete or missing institutions for risk management like credit and insurance all of which qualify as sources of market failures. Historical evidence suggests that these forms of market failures have been important causes of food insecurity, including famine in extreme cases.

Economic theory tells us that policy interventions are justified, in the sense that they may increase aggregate welfare, if the interventions are properly designed and implemented to address those market failures in the short run; and to alleviate them all together in the long run. This implies that the policy objectives should focus on improving infrastructure, providing access to information, promoting competition, and developing risk management institutions (Rashid, Minot Lemma and Behute; 2010).

I. The main objective of this paper is to determine the degree of integration between selected market pairs. Specific objectives are to:
II. estimate the speed of adjustment and price transmission of integrated markets in the short run
III. analyze which market causes the integration and identify direction of movement of causality.

Information on market integration from this study will provide specific evidence on the competitiveness of the market, the effectiveness of arbitrage and the efficiency of pricing. Furthermore, market integration analysis determines the possibility of obtaining gains by trading across commodity markets, exploiting price movements in one market (urban) for the prediction of price movements in another (rural). Knowledge of spatial market integration can provide information for the prediction of price movements.

METHODOLOGY

This study was conducted in Niger State of Nigeria. The State's capital is minna and it comprises of twenty five (25) local government areas grouped into three agricultural zones: A, B and C with the zones having 8, 9 and 8 Local Government Areas (LGAs), respectively.

Niger State falls within latitudes 6° 30' to 11° 20' North and longitude 2° 30' to 10° 30' East. The State is located in the Southern Guinea Savanna ecological region of Nigeria. The study area experiences two distinct climatic seasons in a year, the (rainy and dry seasons) respectively. Rainfall is steady and is evenly distributed falling usually between May and November, varying from 1,100mm in the North to 1,600mm in the South, peaking in August.. The dry season commences in November and the relative humidity could be as low as 14%-40% between December and January and as high as 66%- 88% in the rainy season. The maximum temperature does not exceed 37^0C, and is recorded between March and June, while the low temperatures are recorded in December to January (Niger State Agricultural Development Project, 2002). Niger State covers a land area of 86,000 km^2 which is about 10 percent of the total land area of the country..

Amultistage stratified random sampling technique was employed. Firstly, the markets were stratified on the basis of production regions, transitory and consumption regions. Secondly, two (2) markets were randomly selected from the production zone, two (2) from the transitory zone and two (2) from the consumption zone giving a total of six (6) markets. This is shown in figure 1 and table 1.

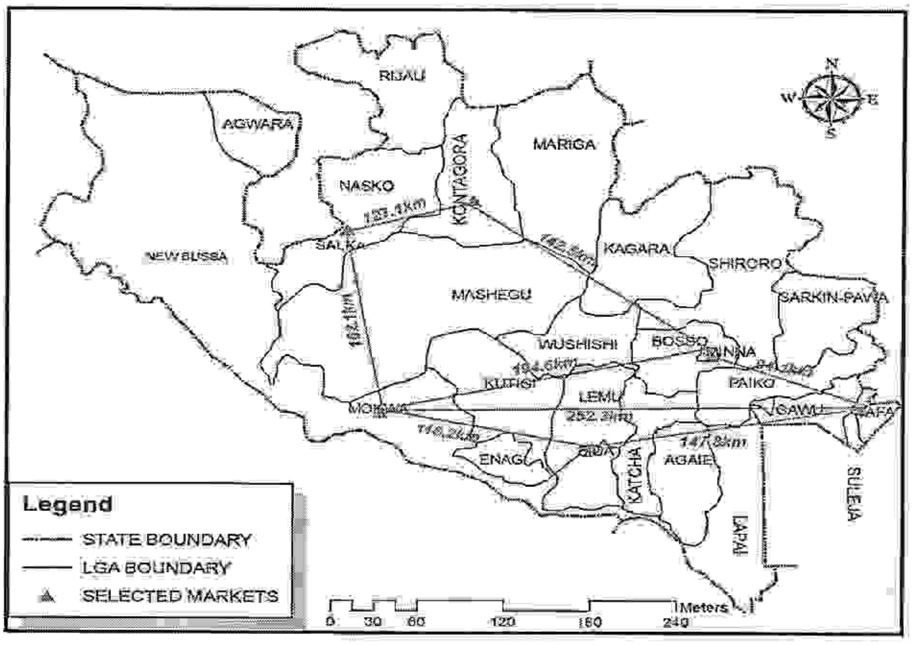

Figure 1. Map of Niger State Showing Location of Selected Markets

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Table 1. Market Location Selection

Sr no	*Strata*	*Regions / Location*	*Market*	*Market type*
1	Production	Kontagora West	Modern market	Urban
		Salka	Salka market	Rural
2	Consumption	Minna	Central market	Urban
		Bida	Modern market	Urban
3	Transitory	Tafa	Sabon Wuse	Rural
		Mokwa	Mokwa	Urban

Data was obtained from secondary sources. The data was obtained from market survey data of various years, from Niger State Agricultural development.

Augmented Dickey Fuller unit root test (ADF), Co-integration tests, Error correction model analysis and Granger Causality test were used to analyse the data.

The ADF was expressed as:

$$\Delta P_{it} = \alpha + \beta_i T + \delta_i P_{it-1} + \sum_{i-1}^{p} bi\Delta P_{it-1} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots(1)$$

Where:

P_{it}= Price of cowpea at in market I at time t. (series under investigation)

Δ= Differencing operator i.e $\Delta P_{it} = P_{it} - P_{it-1}$

α = Drift parameter

T = Time trend

β_1, $\delta 1$ and bi = Coefficients

ε_t= error term (White noise error term)

The ADF tests the null hypothesis that the price series (P_{it}) has a unit root and price series are not stationary (i.e non stationary). This done by calculating a t-statistics for $\delta i = 0$ in equation 1. If the value of the ADF statistic is less than the critical value at the conventional significance level (usually the five per cent significant level) then the series (P_{it})) is said to be stationary and vice versa. If $P_{it}$is found to be non-stationary then it should be determined whether $P_{it}$is stationary at first differences i.e. $P = (P_{it} - P_{it-1}) \sim I(0)$ by repeating the above procedure. If the first difference of the series (P) is stationary then the series (P) may be concluded as integrated of order one that is $P_{it-1} \sim I(1)$. Now we can move to the second step to check co-integration.

Co-integration

If integration is accepted, the second step involves testing for co-integration by Johansen (1988). Basic idea of co-integration test by Johansen relies on the relationship between the rank of a matrix and its characteristics roots, or Eigen values.

Let P_t, be a vector of n time series variables, each of which is integrated of order (1) and assume that P_t can be modeled by a vector auto regression (VAR):

$$P_t = \sum_{i=1}^{k} \Pi_i P_{t-j} + \prod k\, P_{i-k} + \mu + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where

Each ∏ was an n x n matrix of parameters and μ is a constant term. The system of equations was written in error correction form as: ECM

$$\Delta P_t = \sum_{i=1}^{k-1} \Gamma_i P_{t-i} + \Gamma_k P_{i-k} + \mu + e_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where

$\Gamma i = -1 + \prod 1 + \ldots + \prod 1$ and $1 = 1, k-1$ .... (4)

Here Γk is the long run solution to equation (4). If ΔPt is a vector of I (1) stationary variables, then the left hand side and the first k-1 variables on the right hand side of the equation (6) are stationary I (0) and the error term, et is by assumption, stationary. Hence, either Γk must be a matrix of zeros or Pt contains a number of co integrating vectors. The rank of Γk, defined by r, determines how many linear combinations of Pt are stationary.

If $r > 0$, then the variables are stationary in level,

if $r = 0$, there exists no linear combinations that are stationary,

and if $0 > r < N$, there are r stationary linear combinations of Pt.

In this framework, there were two asymptotically equivalent tests for co-integration,

a trace test and the maximum eigen value test.

The calculated statistics for the trace test and the maximum eigen value tests were used to test the null hypothesis that there existed no co- integrating vector ($r = 0$) (the alternative hypotheses for the trace & maximum eigen value test being $r > 0$ and $r = 1$, respectively) and that there existed less than or equal to one co integrating vector ($r \leq 1$) (the alternative hypotheses for the trace and maximum eigen value tests were $r > 1$ and $r = 2$, respectively).

The basic relationship to be investigated is then:

$\text{Ln } P1t = \alpha + \beta \ln P2t$ .... (5)

Where α is a constant term (the log of a proportionality coefficient) that captures transportation costs and quality differences and β gives the relationship between the prices. Apriori conditions specify that

if $\beta = 0$, there are no relationships between the prices

if $\beta = 1$, the law of one price holds and the relative price is constant.

This implies that the two markets are perfectly spatially integrated, which further shows that price changes in one market were fully reflected in the alternative market. Where $0 \leq \beta \leq 1$, there exists a relationship between the prices but the relative price is not constant and the goods will be imperfect substitutes. The degree of integration is evaluated by investigating how far the deviation of β is from unity.

Granger Causality tests

The Null hypothesis for the Granger causality states that a single price of a particular market does not drive all prices in the integrated market.

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Following Trotter (1992), the Granger causality test is denoted as:

$$\Delta P_{it} = \lambda_0 + \lambda_1 P_{it-1} + \lambda_2 P_{jt-1} + \lambda_3 \Delta P_{jt-1} + \lambda_n \Delta P_{jt-1} \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (13)$$

Where

P_{it} = market i, (denoting market under investigation) in time t.

P_{jt} = Market j, (denoting market under investigation) in time t.

$$Ho{:} = \lambda_1 = \lambda_2 = \lambda_3 = \lambda_n = 0$$

If the F- value is smaller than the critical value, then price changes in market j, have no effect on price changes in market i, ie$\lambda_1 and \lambda_n$ are not significantly different from zero. Granger causality tests was carried out on all integrated market pair series.

RESULTS AND DISCUSSION

Descriptive statistics of the time series data on cowpea prices is given in Table 2. Results here show that most of the price series are not normally distributed, which is verified by the Jarque- Bera statistics, and the skewness and kurtosis tests. Standard deviations on the other hand reveal closeness among variables, with wide variations in Salka (X_2) and Central market Minna (X_3) prices.

Table 2. Summary Statistics of Monthly Market Price series of cowpea

Statistics	*Kontagora market (X1)*	*Salka market (X2)*	*Minna market (X3)*	*Bida market (X4)*	*Sabonwuse market (X5)*	*Mokwa market (X6)*
Mean	77.41369	70.87845	116.7780	81.25488	102.7354	75.26262
Median	75.86000	55.56000	106.9050	82.75500	100.0000	82.40000
Maximum	150.0000	910.0000	1142.800	129.4100	171.4200	120.0000
Minimum	30.00000	26.67000	40.00000	11.65000	53.33000	5.860000
Std. Dev.	27.52976	95.60189	119.3526	26.82323	31.38938	25.35723
Skewness	0.209873	8.183268	7.669718	-0.256695	0.047353	-0.328498
Kurtosis	2.247478	72.37797	66.61270	1.964779	1.695926	2.017890
Jarque-Bera	2.598669	17784.08	14986.56	4.673377	5.983526	4.886642
Probability	0.272713	0.000000	0.000000	0.096647	0.050199	0.086872
Sum	6502.750	5953.790	9809.350	6825.410	8629.770	6322.060
Sum Sq. Dev.	62904.68	758596.9	1182338.	59717.29	81779.36	53368.08
Observations	84	84	84	84	84	84

Source: Field survey Data 2011 *Time series market prices from 2005-2011(84 months),collated from Niger State Agricultural and Development Project various months.

Table 3. Unit Root Tests For Monthly Cowpea Market Prices At Level/Intercept

Price Series /Locations	*Observation*	*Lags*	*ADF-Values*	*t-statistics (Critical values)*	*Order Levels*	*P-Value*
X1(Kontagora)	84	0	8.98	3.51[a] 2.89[b]	I (1)	0.000
X2 (Salka)	84	0	8.05	3.51[a] 2.89[b]	I (0)	0.000
X3(Central)	84	0	8.53	3.51[a] 2.89[b]	I (0)	0.000
X4(Bida)	84	2	7.64	3.51[a] 2.89[b]	I (1)	0.000
X5 (Sabon wuse)	84	1	7.97	3.51[a] 2.89[b]	I (1)	0.000
X6 (Salka)	84	3	6.04	3.52[a] 2.89[b]	I (1)	0.000

Lag lengths were chosen according to Akaike information criterion (AIC).
[a, b] Critical values are significant at 5% and 1%. ADF analysis carried out in E-Views 7.0

Stationarity Tests for Price Series

Integration tests concerns the stationarity of any time series. Stationarity means that the stochastic properties of a time series i.e. mean, variance of the mean and covariance of the mean are stationary and do not vary with time. Most economic time series data are not stationary because the mean of the series changes with time as a result of inflation or seasonality (Trotter, 1992). The Augmented Dickey Fuller (ADF) unit root tests of stationarity were used to achieve this.

The Augmented Dickey Fuller (ADF) unit root tests of stationarity, was presented in Table 4. The market price series x2 and x3 were stationary at levels while the series x1,x4 x5 and x6 were stationary after the first difference Tests statistics and p-values of market series x2 andx3 indicated that the null hypothesis was rejected at levels thus making the series integrated of order zero i.e. I (0) process. The null hypothesis for price series x1, x4, x5 and x6 were rejected after the first difference making the series integrated of order one i.e. I (1) process.

Co-integration Tests

Johansen tests were used to investigate co-integration, with a dynamic regression analysis employed to indentify the most significant cointegrating vector. The Johansen co-integration tests for cowpea market pairs) are shown in Table 4. Result for cowpea market pair between Kontagora (x1) and Sabonwuse (x5) reveals that null hypothesis of no cointegrating vector r = 0 was rejected at p< 0.005. This implies that cowpea prices in both markets were cointegrated with one cointegrating vector. This provides evidence that cowpea prices in these two markets form part of a system of cowpea prices that may vary independently in the short run but in the long run will vary simultaneously as part of a single market.

The market pair between Bida and Sabonwuse indicates that the null hypothesis of no cointegrating vector (r=0) was rejected at p<0.05. This implies that cowpea market price in Bida and Sabon wuse were integrated with at least one cointegrating vector in our estimation. Furthermore the results show that the markets are stationary in one direction depicting a long run equilibrium relationship.

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Trace results for market pair between Sabonwuse and Mokwa provides evidence for a long run equilibrium relationship.

Table 4. Pair wise Result of Johansen Co-integration for cowpea markets

Market Pairs	*Null*	*Trace Test*	*Max-eigen Test*	*Critical value*
Kontagora(x1) / Sabonwuse(x5)	r = 0	18.3188**	15.9829**	15.49
	r ≤ 1	2.3359	2.3359	3.84
Bida(x4) / Sabonwuse (x5)	r = 0	15.6831**	13.4362	15.49
	r ≤ 1	2.2469	2.2469	3.84
Sabonwuse (x5) / Mokwa(x6)	r = 0	15.7659**	13.6727	15.49
	r ≤ 1	2.0932	2.0932	3.84

Source: Field survey Data, 2013
(*)** Indicates significance at1% and 5% level. Number of observation = 81 after adjustments. Number of lags = 1-2.

Summarily the results of trace using the Johansen Co-integration tests indicates that the rank Π (i.e. r) reaches 1 (at 95% level of significance) for the market pairs Kontagora (x1) versus Sabon Wuse(x5), Bida (x4) versus Sabon Wuse(x5) and Sabon Wuse(x5) versus Mokwa(x6). This means there is at least one (1) cointegrating equation from each of the market pairs in our estimation. The results show further ,that there is one cointegrating equation and one common trend from each pair studied, suggesting that these Cowpea markets are stationary in one direction and non-stationary in one direction. According to Johansen procedure this shows that there are three linear combinations that exist among the variables over the entire period of study.

Reasons for market integration amongst these markets could be adduced to proper and efficient use of market information. The economic interpretation for this result is that, among other factors there is reason to suggest that arbitrage which binds the prices together over time is a possible contribution for integration. This may not be unrelated to the storable nature of the commodity. This finding corroborates studies carried out by Okoh and Egbon 2005, who adduced the long run integration of market food products to arbitrage. The results further agrees with Abba(2009), in which he reported that, the possibility of traders being able to store their products, avails them the opportunity of obtaining reliable information about prices and demand between markets thus promoting integration between markets.

Furthermore the study also shows that both short run and long run integration of prices of cowpea exists between markets in the Production region (i.e. Kontagora, x1) and the transitory region (Sabon Wuse x5), Consumption region (Bida x4) and Transitory region (Sabon Wuse x5) and also between the two markets from the Transitory regions (i.e. Sabon wuse x 5 and Mokwa x6).

It can be inferred from this results that Cowpea market price in Sabon Wuse(x5) has a cointegrating relationship with markets in the production, consumption and even transitory regions, indicating that market participants in this market are well informed about price changes and adapt variously to it. Furthermore, the closeness of Sabon Wuse(x5) to the Nation's capital Abuja FCT provides great opportunities to market participants with regards to good infrastructures such as transportation and Communication network. This is in accordance with Hussein et al (2010), who reported that markets that are better connected with the transportation and communication network are expected to be well integrated.

Additionally the study reveals that the market price series of cowpea was stationary at levels for Salka market and Central market Minna. This indicates that there exists a long run equilibrium relationship between these markets and that the markets are integrated and spatially linked. The implication here is that prices of cowpea in these two markets move together for a long period of time.

Market Segmentation

Market segmentation refers to the case when two markets (e.g. A and B) do not exhibit co-integration either in the direction from A to B or B to A. According to Goletti et al 1995 and Abba 2009, they reported that in testing for co-integration it made sense to consider only those pairs of markets that are close. If markets A and B are very far away from each other the lack of co-integration may be due to transportation costs. Goletti and Elene (1995), further affirmed that it became more interesting to focus on those markets, that inspite of being separated by less than a critical distance ; do not exhibit co-integration. A critical distance as defined by Francesco and Elena (1995) is for example the maximum distance that could be covered by a one day trip of a truck loaded with the commodity under consideration. Under the assumptions, segmented markets can be defined as those markets that are not cointegrated with each other and that are separated by less than a critical distance.

The market pairs between Production region Kontagora(x1) vs. Consumption region Minna (x3); Production region Salka (x2) vs. Consumption region Bida (x 4); Consumption region Minna (x3) vs. Consumption region Bida (x 4); Consumption region Minna (x3) vs. Transitory region Mokwa (x6) and Production region Kontagora (1) vs. Production region Salka (x2) revealed clear market segmentation in prices of cowpea. This indicates that prices between these markets have no long run tendency towards an equilibrium state. The reasons for lack of integration between these markets could be adduced to lack of information flow across the markets and also the uncompetitive conduct of the participants.

Granger Causality

Another method used to investigate the degree of market integration is the Granger causality test. The approach is used to determine how price changes in one market explain price changes in another. Granger Causality tests focuses on the presence of at least unidirectional causality linkages as an indication of some extent of integration (Gupta and Mueller, 1982). It also assesses whether price movements follows a well defined path, i.e. if price movement starts around demand or production zones and spreads across other markets (Nath and Samantha 2003; Ohen et al, 2007 and Hossain and Verbeke, 2010). The results for causality are inferred from the F statistics and P-values shown in Table 5.

Table 5. Granger Causality Tests Results

Null Hypothesis From Causal variable	*To Variable X1 (Knt)*	*X4 (Minna)*	*X5 (Sabon Wuse)*	*X6 (Mokwa)*
X1 (Knt)		3.501** (0.0350)	7.934*** (0.0007)	0.974 (0.9748)
X4 (Bida)	3.88** (0.0247)		2.024 (0.1390)	2.579* (0.0823)
X5 (Sabon Wuse)	1.459 (0.2386)	2.681*** (0.0749)		1.859 (0.1627)
X6 (Mokwa)	7.636*** (0.0009)	5.839*** (0.0044)	8.789*** (0.0004)	

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Note: The figures indicate the calculated F values associated with the hypothesis that there is no Granger causality from the causal variable to the variable and vice versa. P-values in parenthesis.*Significant at the 10 % level **Significant at the 5% level ***Significant at the 1% level

From Table 5, the null hypothesis that X1 does not Granger cause X4 was rejected, this implies that price changes in X1 (Knt) "Granger cause" price changes in X4 (Bida) at the 5% level of significance. The Null hypothesis that X1 does not "Granger cause" X5 was also rejected, indicating that price changes in X1 affects price changes in X5 at the1% level of significance. The Null hypothesis that X1 does not "Granger cause" (X6) was not rejected implying that price changes in X6 was not affected by price changes in X1. The results further imply that cowpea prices in X1(Knt) leads the price formation process in X4 (Bida) and X5(Sabonwuse). This is as expected since X1 (Knt) is a major producing region, while X4 and X5 are both consumption and transitory regions.

The results further shows that price changes in X4 (Minna) "Granger cause" price changes in X1 (Knt) and also in X6 (Mokwa) at 5% and 10% level of significance. This indicates a two way (bidirectional) causation of prices between X1(Knt) and X4 (Bida). No causality was found from X4 to X5.

From X5 to X1 and X6,, no causality was found but price changes from X5 was seen to "Granger cause" price changes in X4 at 10% level of significance.

Mokwa X6 is a transitory market surrounded by a number of rural areas which produce relatively large quantities of cowpea. The results reveal that price changes in X6 (Mokwa) "Granger cause" price changes in X1, X4 and X5 at the 1% level of significance. This implies that there is a unidirectional causation between markets X6 and X1 and X5, while a bidirectional price formation linkage exists between X6 and X4.

Kontagora (X1) a major cowpea producing region is a price leader for X5 Sabonwuse market. However same cannot be said for X4(Bida) and X6 (Mokwa) in which a two way causation exists. Mokwa X6 is a transitory market in which results here indicates that it drives the market prices in X1 and X5. This is expected being that the market price could be influenced by the producing areas around it.

On the basis of the Granger causality results, it is concluded that there is no dominant market whose price changes influences all other markets. The bivairate model reveals that price changes of cowpea in the markets studied appear to be organized around more than one market. These results agree with the nature of markets in Developing countries, in that those markets are usually more complex than is portrayed by the Ravallion radial configuration of markets. Granger (1986), proposed that co-integration between two variables is indicative of the existence of causality between them. Additionally, if two markets are integrated, the price in one market would be found to have an impact on the price in the other market. The markets which have revealed both unidirectional and bidirectional causation from the results of Granger causality tests are consistent with such a statement.

Short Run Dynamics and Price Transmission

It is important to know the extent to which markets are integrated; this requires distinguishing between the short and long run impacts of price changes from one period to the other. The speed of adjustment, the length of time needed for prices to be transmitted from one market to another can be studied by dynamic adjustments.

Table 6. Vector Error Correction Estimates

Error Correction	*D(Kontagora)*	*D(Bida)*	*D(Sabon Wuse)*	*D(Mokwa)*
Co-int Eq1	- 0.084838 (0.06389) [-1.32792]	-0.237491 (0.07078) [-3.35528]	-0.002585 (0.05015) [-0.05155]	0.116544 (0.07326) [1.59074]
D(X1(-1))	-0.158935 (0.13025) [-1.22021]	0.357195 (0.14430) [2.47529]	0.264709 (0.10224) [2.58897]	-0.037367 (0.14937) [-0.25017]
D(X1(-2))	-0.100375 (0.13164) [-0.76250]	0.235479 (0.14584) [1.61461]	-0.216171 (0.10333) - [0.03574]	0.005396 (0.15096) [0.03574]
D(X4(-1))	0.1866443 (0.13300) [1.40183]	-0.248748 (0.14735) [-1.68815]	0.009547 (0.10440) [0.09144]	-0.040022 (0.15252) [-0.26241]
D(X4(-2))	0.160777 (0.10860) [1.48045]	-0.025269 (0.12032) [-0.21002]	0.025078 (0.08525) [0.29417]	-0.081279 (0.12454) [-0.065264]
D(X5(-1))	0.111141 (0.14593) [0.76161]	-0.113228 (0.16167) [-0.67720]	-0.077574 (0.11455) [-0.67720]	-0.152647 (0.16734) [-0.91217]
D(X5(-2))	-0.158908 (0.13987) [-1.13614]	0.004412 (0.15496) [0.02847]	-0.142980 (0.10979) [-1.30227]	-0.124256 (0.16039) [-0.77470]
D(X6(-1))	0.081532 (0.17770) [0.45882]	-0.508984 (0.19687) [-2.58536]	0.149667 (0.13949) [1.07296]	-0.301884 (0.20378) [-1.48144]
D(X6(-2))	0.172394 (0.13604) [1.26721]	-0.193527 (0.15072) [-1.28402]	0.107567 (0.10679) [1.00728]	0.034092 (0.15601) [0.21853]
C	-0.025477 (1.73770) [-0.01466]	0.874499 (1.92519) [0.45424]	0.149699 (1.36406) [0.10974]	0.626778 (1.99272) [0.31453]
R-squared	0.187264			
Adj. R-square	0.084466			
Sum sq. resids	17195.05			
S.E. equation	15.56226			
F-statistics	1..820083			
Log likelihood	-331.9301			
Akaike AIC	8.442719			
Schwarz SC	8.738330			
Mean dependent	0.298025			
S.D dependent	16.26430			

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Determinant resids covariance (dof adj.)	1.98E+09
Determinant resids Covariance	1.17E+09
Log Likelihood	-1305.277
Akaike Information Criterion	33.31548
Schwarz Criterion	34.61617

Source: Field Survey Data, 2013
Standard errors and t-statistics in parenthesis and the number in the first column is the lag order.

A Vector Error Correction model (VECM) was estimated to ascertain speed of adjustment and transmission of price series. Based on the Akaike information criterion (AIC) and the nature of the commodity under study lags were chosen. The lags that best suits the actual price changes in the market were tested and the lag that best minimized the AIC was chosen. This yielded a VECM of 2 lags; this implies that prices are expected to change significantly within one to two months from the studied markets.

The short run dynamics among these markets are evaluated by examining the significance and signs of the estimated lagged coefficients presented in Table 4.6. The short run results from the VECM revealed that the coefficient values range from 0.004 at 5% and 0.874 indicating that the speed at which the price of cowpea in the markets studied approach their points of equilibrium within a month is weak. The speed of adjustment is given by the size of adjustment coefficient. In co-integration equation 1, price changes in Bida market (X4) and Mokwa (X6) during the studied period were transmitted to other markets at a rate of 23% and 11% respectively after a month's period. On the other hand, adjustment towards the long run is especially slower in the case of price changes in Kontagora (X1) at 8% and SabonWuse (X5) at 5%.

CONCLUSION

It can be concluded from the study that markets in Niger State display a relatively long run integration of cowpea prices. The reasons for the long run integration of these markets is adduced to the flow, ease and use of market information between these markets, the competitive conduct of the market participants and the presence of arbitrage.

The market pairs which showed high segmentation in cowpea prices was attributed to lack of information across markets, uncompetitive conducts of the participants, poor infrastructure for ease of accessibility and effect of critical distance which affects transfer costs.

The speed of adjustment varies widely across studies, ranging from just one week to six months.

On the Granger causality tests markets exhibited both unidirectional and bidirectional causation. No market was revealed as a market leader whose price changes influenced all other markets.

RECOMMENDATIONS

Recommendations drawn from the findings of the study include:

1. Adequate market information on price dissemination, through media outlets, extension service delivery be established by government. To keep market participants informed about current prices.
2. Promote competition among participants. Competition can be promoted by reducing administrative and regulatory barriers to entry into the marketing business of cowpea.
3. Improve market information, particularly with the use of information and communication technology.
4. Establishment and enforcement of credit and insurance institutions that enhance risk management for market participants..
5. Improve public infrastructures such as construction of accessible and motorable roads. This would reduce transfer cost which usually gets translated to the prices of the cowpeas, especially across markets in critical distance.

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