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MONTHLY PRICE ANALYSIS OF COWPEA (BEANS) AND MAIZE IN AKWA IBOM STATE, SOUTHERN NIGERIA

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Abstract

The study examined the price transmission and market integration of Maize and Beans in the rural and urban markets of Akwa Ibom State, Nigeria. Average monthly prices (measured in naira per kilogram) of Maize and Cowpea in rural and urban markets were used in the analysis. The data was obtained from the quarterly publications of the Akwa Ibom State Agricultural Development Programme (AKADEP). The data covered the period; January 2005 to June 2013. The trend analysis showed that, prices of Maize and Beans in the rural and urban markets had exponential growth rates that were less than unity, which suggested a possible co-movement of these prices in the study area. Also, the Pearson correlation coefficient generated for the pair of rural and urban prices of Maize and Beans revealed significant linear symmetric relationships. The result implies the existence of symmetric market information flows between the rural and urban markets for Maize and Beans in the state. The Granger causality test revealed bi-directional relationships between the rural and urban price of Maize and Beans in the study area. The co-integration test revealed the presence of co-integration between the rural and urban prices of Maize and Beans. The coefficients of the price variables in the co-integration equations for Maize and Beans markets converged to unity or law of one price which implied perfect market integration in the long run. The results of the error correction model (ECM) also confirm the existence of the short run market integration between the rural and urban prices of Maize and Beans in the study area. In addition, it was discovered that, the rural price of Maize adjusted faster to the stable state in the long run than the urban price. Likewise, the urban price of Beans adjusted faster than its corresponding rural price. The index of market connection (IMC) supported the high short run market integration for prices of Maize and Beans in rural and urban markets. Based on the findings, it is recommended that, the Akwa Ibom State government should continue to provide marketing infrastructures and reduced externality costs in order to improve further the symmetric nature of information flow among Maize and Beans markets in the state. Also, individuals, trade unions, NGOs' and government should established market information units and awareness programmes on mass media to facilitate efficient communication flows of Beans and Maize markets in the state.

Keywords: *Market, Maize, Beans, price, integration, agricultural, Akwa Ibom, Nigeria*

1. Introduction

Agricultural production plays an important role in the economic development of Nigeria. An estimated 60% - 70% of Nigerians' live in the rural areas and majority is engaged in small scale agricultural production (Okunneye, 2003; Adegboye, 2004). Sustainability of agricultural activities is hinged on effective price system. In the recent past, the market for agricultural commodities in Nigeria has shown a pattern of long- term price fall and short-term price instability (IMF, 2000). The volatility in price of agricultural commodities in Nigeria has been attributed to various factors including variances in bargaining power among consumers, cyclical income fluctuation among sellers and consumers, seasonality of production, natural shocks such as flood, pests, diseases, and inappropriate response by farmers to price signals (Gilberts, 1999, Udoh & Sunday, 2007; Adebusuyi, 2004). Short-run fluctuations in agricultural commodity prices occur between production seasons (Cashin & Pattillo, 2000). During harvesting periods, prices of farm product are generally low due to surpluses; in the off season, prices rose due to reduce production and seasonal changes (Akpan, 2002). Hence, agricultural commodity price is one of the major determinants of quantity of commodities supplied by farmers and demanded by consumers. Product price instability among agricultural commodities is a regular phenomenon in markets across Nigeria (Akpan, 2007). Instability in commodity prices among markets could be detrimental to the marketing system and the economy as a whole. It could cause inefficiency in resources allocation among sellers and consumers depending on the source of variability (that is, whether it is induce by supply or demand side or both). It could also increase poverty level among low income earners in the society (Polaski, 2008). On the order hand, a unified product price among markets is not a rational policy to pursue in a developing country like Nigeria. This is because of the deteriorating marketing infrastructures, increase in cost of externalities and the nature of most agricultural products which often resulted in significant differences in the total variable costs incurred by sellers and consumers in these markets.

Beans or cowpea (*Vigna unguiculata)* (white beans) and Maize (*Zea mays*) (white maize) are among staple grains (Ayinde & Adejobi, 2002), whose prices are highly unstable between seasons in Akwa Ibom State in southern Nigeria (Akwa Ibom State Agricultural Development Programme (ADP), 2013). Consumers pay different amounts for the same product in different markets separated by few kilometers. Price instability of agricultural commodity would be considered a normal phenomenon, if it does not significantly differ from one market to another. On the contrary, if products prices are significantly different among markets it will distort resources flow, which might have adverse effect on the self food sufficiency policy of the federal governments. Over the years, there have been a number of studies on price transmission or market integration of foodstuffs in Nigeria's markets. Some of the major studies on this issue include: Adekanye (1988), Ejiga (1988), Dittoh (1994), Okoh (1999), Okoh and Akintola (1999), Okoh and Egbon (2005), Akpan and Aya (2009), and Akpan *et al.*, (2014) among others. Some of these studies employed methods like correlation analysis, trend and time series analyses. Comparison of results of various methods has been largely neglected by majority of researchers in Nigeria. Also, majority of these researches were conducted in other regions apart from the Southern region of Nigeria (Dittoh, 1994; Okoh, 1999; Okoh & Egbon, 2005; Adenegan & Adeoye, 2011); and some of these results were used to generalize for all regions in the country. This situation might give wrong signals to price transmission system which might lead to faulty marketing policies and programmes in the Southern region of the country. This research was purposefully designed to fill these identified gaps in the literature.

Akwa Ibom State government over the years had initiated several agricultural programmes to boost the performance of the grain sub-sector in the state. Such programmes like; fertilizer subsidies, Fadama cultivation, agricultural credit and seed distribution

programmes among others were meant to improve arable crop production in the state. As part of several ways to increase agricultural production and economic growth of the state, efficient marketing policy based on sound empirical facts is one of the prerequisites. Hence, understanding the direction and magnitude of grain price transmission between the rural and urban markets in the state will provide indispensable input to policy makers to formulate workable policies for the agricultural sector in the state. For instance, the extent of market integration has often been used to measure the success of market liberalization and structural adjustment policies in developing countries (Mushtaq, 2006). Therefore, such information can help the government to decide the extent to which price transmission can be considered as efficient across different geo-political zones in the state. However, this area of research is in juvenile stage in the state; as such a study like this, will provide useful literature and serve as a benchmark for improvement and to stimulate wider researches on agricultural price transmission in the region and the country at large.

1.1 Objective of the Study

The main objective of the study was to analyze the monthly price transmission and market integration of Cowpea (Beans) and Maize from 2005 to 2013 in Akwa Ibom State, Southern Nigeria. To achieve the above objective, the present study specifically aims to:

- examine the trend in price of Maize (white) and Cowpeas (white) in the rural and urban markets of the study area,
- examine the efficiency of information flow or price transmission of Maize and Beans commodity in the rural and urban markets of the state and,
- test the hypothesis of the short and long run market integration in the rural and urban prices of Maize and Beans in the state.

2. Literature Review of Some Empirical Studies on Price Transmission and Market Integration in Nigeria

Several researchers have dealt on food crop price transmission and market integration issues in Nigeria. For instance, Amusa, (1997) in her study of the trend analysis of agricultural food prices in Nigeria reported that, food items such as vegetable oil, Garri, brown beans, ripe plantains, fresh tomatoes, green vegetables, onion bulbs, shelled melon seeds, experienced increase and fluctuations in their prices. Okoh (1999) and Okoh and Akintola (1999) cited in Okoh *and* Egbon (2005) adopted the Mendoza and Rosegrant (1995) methodology, to study price transmission and market integration of agricultural commodities in Nigeria. The study showed that cassava root and Garri markets in the study area were weakly associated. The study also showed the presence of some form of price leadership in the market system. Okoh *and* Egbon (2005) examined the integration of Nigeria's rural and urban foodstuffs markets. The study concludes that, the rural and urban foodstuffs markets were well integrated. The result further suggested that, the urban market price of food stuffs drive their corresponding rural market price. The size of the adjustment coefficient for the rural foodstuffs price revealed that, the speed of adjustment from disequilibrium was moderate. The persistence profile further showed that, it would take about five months for the effects of a shock on the market system to die out. Ohen *et al.,* (2007) studied the vertical and horizontal price linkages for live catfish in Nigeria. The price variables used in the analysis were non-stationary and therefore were made stationary by first difference. The Johansen co-integration analysis was used to test for the long run relationship between the prices. Results indicated that producer and export prices were co-integrated. Furthermore, the Granger causality Wald test suggested that, the retail prices do have a causal relationship

with producer prices. The dynamic regression analysis of prices also revealed that, the markets for live catfish have strong price linkages and thus are spatially integrated. Adeoye *et al.,* (2011) examined the price transmission and market integration of banana and plantain in Oyo state in Western Nigeria. Six market links rejected their respective null hypothesis of no Granger causality (P>0.05), two of the market links exhibited bi-directional Granger causality or simultaneous feedback relationship; while four market links exhibited uni-directional Granger causality at 5% and 10% level of significance. Urban plantain market occupies the leadership position in the commodity price formation and transmission in the markets investigated. The Index of market concentration (IMC) indicated that the markets exhibit low short run market integration. Adenegan and Adeoye (2011) examined the level of market integration in tomato markets in rural and urban markets of Oyo State, western Nigeria. Secondary data on tomato price spanning from 2003 to 2010 were sourced from Oyo State Agricultural Development Programme (OYSADEP). The results of the analyses revealed that, prices of tomato were stationary at their level. Also, the urban price of tomato market did not Granger causes rural tomato market (P > 0.05), while rural tomato market Granger causes urban tomato market (P< 0.05). None of the markets links exhibited bi - directional Granger causality or simultaneous feedback relationship. Ojiako *et al.,* (2012) studied the spatial integration and price transmission in selected cassava products' (Lafun) markets in Nigeria. The study employed vector error correction model (VECM) methodology that revealed the presence of the long-run equilibrium following exogenous shocks in the markets. Also, the result discovered unilateral Granger causality that runs from the rural to the urban market. The impulse response analysis revealed that the rural price was more responsive to shocks emanating from the rural market compared to the reverse action. The study further discovered that, the effects of rural prices' shock on urban price were very negligible at 3.2% after 10 weeks. The error correction model revealed significant causality link between the peripheral and central markets, suggesting a clear trend in price leadership. Also, Akintunde *et al.,* (2012) studied the long run price integration of grains in Oyo state, western Nigeria. Empirical results revealed that the price series in all the markets were non-stationarity at their levels at 5% significance level. The integration test showed that none of the markets examined had prices tied together in the long- run. The Index of market concentration (IMC) indicates that the markets exhibited low short run market integration. In the South-South region, Akpan *et al.,* (2014) examined the price transmission and market integration of local and foreign rice in rural and urban markets of Akwa Ibom State. The findings showed that, price of local and foreign rice in rural and urban markets had constant exponential growth rate of 0.59%. Also, the Pearson correlation coefficient matrix revealed that, the rural price of local and foreign rice has linear symmetric relationships with their corresponding urban prices. The Granger causality test revealed bi-directional relationship between rural and urban price of local and foreign rice. The results of the co-integration test revealed the presence of co-integration between the rural and urban prices of local and foreign rice as well as support the hypothesis of perfect price transmission between the two markets. The results of the error correction (ECM) model also confirm the existence of the short run market integration between the rural and urban prices of local and foreign rice in the study area. In addition, the result shows that, the price of local rice in both rural and urban markets adjusted faster than prices of foreign rice once there is an exogenous shock in the marketing process of rice. The index of market connection (IMC) supported the high short run market integration between prices in rural and urban markets for local and foreign rice commodities in the study area.

3. Research Methodology

3.1 Study Area and Data Source

The study was conducted in Akwa Ibom State. The state is located in the coastal South-South region of Nigeria. The region is popularly called the Niger Delta region or the oil rich region of Nigeria. The state is located between latitudes $4°32^1$ and $5°33^1$ north and longitudes $7°5^1$ and $8°25^1$ east. It has a total land area of areas of 7,246km^2. It is bordered on the east by Cross River State, on the west by Rivers State and Abia State, and on the South by the Atlantic Ocean. Akwa Ibom State has a population of about 3,902,051 (NPC, 2006). The state is basically an agrarian society where crops like maize, okra, cassava, yam and rice are cultivated in large quantities. Politically and for ease of administration, the state is divided into 31 Local Government Councils or Areas; it has six distinct Agricultural Development Project (ADP) Zones.

3.2 Source of Data

Secondary data were used in this study. The data came from the quarterly publication of the Akwa Ibom State Agricultural Development Programme (AKADEP). It consists of the average monthly retailed price in naira per kilogram of Maize and Beans from sampled markets in rural and urban areas of Akwa Ibom State. The study period covers January 2005 to June 2013. A total of 102 weeks' retailed average monthly prices (₦/Kg) of Maize and Beans were used in the study.

3.3 Analytical Techniques

The study applied statistical and econometric techniques to test for the relationship between the rural and urban prices of Maize and Beans in Akwa Ibom State. The tests used in the study include: the trend analysis, bivariate correlation analysis, Granger causality tests, cointegration and error correction model as well as the Index of market connection (IMC). Each of the tests is explained in both explicit and implicit forms as shown below:

3.3.1 The trend Analysis of monthly retailed prices of Maize and Beans in Rural and Urban Markets in Akwa Ibom State, southern Nigeria

To investigate the nature of growth rate in prices of Maize and Beans in rural and urban markets in Akwa Ibom State, we specified the exponential growth rate equation as thus:

$$log_e P_t = b_0 + b_1 t + U_t \quad (1)$$

Where exponential growth rate is given as (r) $=(e^{b1} - 1) * 100$ (2)

To ascertain whether the growth rate in prices of Cowpea (beans) and Maize in the rural and urban markets actually increase at accelerated or decelerated rates over the period considered, the quadratic exponential trend equation was specified as thus:

$$log_e P_t = b_o + b_1 t_1 + b_2 t_2^2 + u_t. \quad (3)$$

If $b_2 > 0$; the price variable investigated had accelerated growth rate: when $b_2 < 0$; the price variable has decelerated growth rate over time. In this study, "P_t" was represented by:

$P_{1t} = Monthly\ nominal\ Price\ of\ Maize\ (white)\ in\ rural\ market\ measured\ in\ naira/Kg$
$P_{2t} = Monthly\ nominal\ Price\ of\ Maize\ (white)\ in\ Urban\ market\ measured\ in\ naira/Kg$
$P_{3t} = Monthly\ nominal\ Price\ of\ Beans\ (white)\ in\ rural\ market\ measured\ in\ naira/Kg$
$P_{4t} = Monthly\ nominal\ Price\ \ of\ Beans\ (white)\ in\ urban\ market\ measured\ in\ naira/Kg$

The exponential growth rate equation was adopted in this study to investigate the nature of monthly growth in prices of Maize and Cowpea in rural and urban markets because of the escalated prices of arable crop often experienced in the state during the lean or off seasons (AKADEP, 2013).

3.3.2 Pearson Correlation Matrix of Monthly Retailed Prices of Maize and Beans (Cowpea) in Rural and Urban Markets in Akwa Ibom State in Nigeria

To test for the linear and symmetric association between the rural and urban price of Maize and Beans in Akwa Ibom State, the Pearson correlation coefficients were estimated. The formula is as described below:

$$P_r = \frac{n\sum P_{1t}P_{2t} - (\sum P_{1t})(\sum P_{2t})}{\sqrt{\{n\sum P_{1t}^2 - (\sum P_{1t})^2\}\{\sum P_{2t}^2 - (\sum P_{2t})^2\}}} \quad (4)$$

Where, "Pr" is the correlation coefficient between urban and rural market prices of Maize and Beans in the study area. A significant relationship between the rural and urban prices of Maize and Cowpea in the area will suggest a perfect or symmetric price transmission between the two markets; while insignificant association indicates otherwise.

3.3.3 Bilateral Granger Causality test on Average Monthly Retailed Prices of Maize and Beans in the Rural and Urban Markets in Akwa Ibom State, Southern Nigeria

Granger causality test is one of the important econometric tools used to determine whether past change in time series variable say "X" has impact on the current variable "Y" or whether the relation works in the opposite direction (Oyatoye *et al.,* 2011). The Granger causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another. A time series *X* is said to Granger-cause *Y* if it can be shown, usually through a series of t-tests and F- test on lagged values of *X* (and with lagged values of *Y* also included), that those *X* values provide statistically significant information about future values of *Y* (Granger,1969). As usual, we use the term "Granger-cause" when the historical values for one time series contain additional information that is useful in explaining and predicting another time series (Baumöh & Tomáš, 2010). If a time series is a stationary process, the test is performed using the level values of two (or more) variables. If the variables are non-stationary, then the test is done using first (or higher) differences. To ascertain the number of lags (and to control for serial correlations) in a model, the Akaike, Schwarz or Hannan-Quinn information criteria are generally applied (Baumöh & Tomáš, 2010). This test assumes that, the information relevant to the prediction of X and Y is contained solely in the time series data on these variables (Gujurati & Dawn, 2009). In this study, the bilateral Granger Causality tests were conducted on the average monthly retailed prices of Maize and Beans in urban and rural markets in Akwa Ibom State. The primary model in Vector Autoregressive Regression forms are represented as thus:

$$\left.\begin{aligned}\Delta LnP_{1t} &= \beta_0 + \beta_1 \sum_{i=1}^{n} \Delta LnP_{1t-1} + \beta_2 \sum_{i=1}^{n} \Delta LnP_{2t-1} + \varepsilon_{1t} \quad (5)\\ \Delta LnP_{2t} &= \delta_0 + \delta_1 \sum_{i=1}^{n} \Delta LnP_{2t-1} + \delta_2 \sum_{i=1}^{n} \Delta LnP_{1t-1} + \varepsilon_{2t} \quad (6)\end{aligned}\right\}$$

$$\left.\begin{aligned}\Delta LnP_{3t} &= \gamma_0 + \gamma_1 \sum_{i=1}^{n} LnP_{3t-1} + \gamma_2 \sum_{i=1}^{n} \Delta LnP_{4t-1} + \varepsilon_{3t} \quad (7)\\ \Delta LnP_{4t} &= \alpha_0 + \alpha_1 \sum_{i=1}^{n} \Delta LnP_{4t-1} + \alpha_2 \sum_{i=1}^{n} \Delta LnP_{3t-1} + \varepsilon_{4t} \quad (8)\end{aligned}\right\}$$

There is a bilateral Granger causality from urban markets price of maize to rural market price of maize, if $\beta_2 \neq 0$ and $\boldsymbol{\delta_2} = 0$. The market, which Granger-causes the other is tagged the exogenous market or the lead market. Market price exogeneity can be weak or strong. According to Hendry (1986) and Juselius, (2006), the weak exogeneity occurs when the marginal distribution of P_{1t-1} is independent of the joint distribution of both P_{1t-1} and P_{2t-1}. On the other hand, strong exogeneity occurs when there is no statistically significant Granger-causality from the other variable. If the two spatial prices, P_{1t-1} and P_{2t-1}, the price P_{1t-1} is weakly exogenous to P_{2t-1} if P_{1t-1} is tested to be weakly exogenous and P_{2t-1} is not weakly exogenous to P_{1t-1} . This implies that P_{1t-1} is causing P_{2t-1} to change and not vice-versa (Chirwa, 1999). Similarly, there is Granger causality from the rural market price to urban market price of Maize if $\beta_2 = 0$ and $\boldsymbol{\delta_2} \neq 0$. The causality is considered as mutual or bidirectional if $\beta_2 \neq 0$ and $\boldsymbol{\delta_2} \neq 0$. Finally, there is no link between average monthly price of maize in the rural markets and average monthly price of Maize in urban markets if $\beta_2 = 0$ and $\boldsymbol{\delta_2} = 0$. The same interpretations follow for equations 7 and 8 for cowpeas or beans. The variables are as defined previously in equation (3). A bidirectional Granger causality test indicates the presence of perfect price transmission between prices of rural and urban markets for Maize and Beans in Akwa Ibom State.

3.3.4 Co- integration Test for Retailed Prices of Maize and Beans in the Rural and Urban Markets in Akwa Ibom State in Nigeria

If the geographically separated markets are integrated, then there exists an equilibrium or long run relationship among these markets (Goodwin & Schroeder 1991; Sexton *et al.*, 1991; Gonzalez-Rivera & Helfand, 2001). The study applied the Engle and Granger two-step technique and Johansen co-integration approach to examine the co-integration relationships between rural and urban market prices of Maize and Beans in the study area. If two prices (P_{1t} *and* P_{2t}) are perfectly integrated, then $\gamma_1 = 1$ *in equation* 9. In this case, price change in the rural market (P_{1t}) are fully reflected in the urban (P_{2t}) market. When $\gamma_1 \neq 1$ ($\gamma_1 < 1$ *or* $\gamma_1 > 1$), then the degree of market integration needs to be determined by investigating the variance of γ_1 from the threshold mark of 1. Following the law of one price, the time dependent rural and urban price equation for Maize and Beans is specified as follows:

$$LnP_{1t} = \gamma_0 + \gamma_1 \sum_{i=1}^{n} LnP_{2t} + U_{1t} \quad (9)$$

$$LnP_{2t} = \gamma_0 + \gamma_1 \sum_{i=1}^{n} LnP_{1t} + U_{1t} \quad (10)$$

$$LnP_{3t} = \varphi_0 + \varphi_1 \sum_{i=1}^{n} LnP_{4t} + U_{2t} \quad (11)$$

$$LnP_{4t} = \varphi_0 + \varphi_1 \sum_{i=1}^{n} LnP_{3t} + U_{2t} \quad (12)$$

Following the Granger Representation Theorem, we specified the error correction model (ECM) for the co-integrating series in the study. The general specification of the ECM that is estimated for the rural price equations for Maize and Beans in the Akwa Ibom State is shown below:

$$\Delta LnP_{1t} = \gamma_0 + \gamma_1 \sum_{i=1}^{n} \Delta LnP_{1t-1} + \gamma_2 \sum_{i=1}^{n} \Delta LnP_{2t-i} + \gamma_3 ECM_{t-1} + U_{1t} \quad (13)$$

$$\Delta LnP_{3t} = \vartheta_0 + \vartheta_1 \sum_{i=1}^{n} \Delta LnP_{3t-1} + \vartheta_2 \sum_{i=1}^{n} Ln\Delta P_{4t-i} + \vartheta_3 ECM_{t-1} + U_{2t} \quad (14)$$

The specified variables are as defined previously in equation (3), and the coefficient (γ_3) and (ϑ_3) of the ECM_{t-1} ($-1 < \gamma_3, \vartheta_3 < 0$) measures the deviations from the long-run equilibrium in period (t_{-1}) in both P_{1t} and P_{3t}. The specification of equation 13 and 14 was to test for the short run market integration and determine the adjustment coefficient of P_{1t} and P_{3t} to equilibrium level in the long run when there is exogenous shock in the system. Also, to determine the adjustment of urban prices (i.e. P_{2t} and P_{4t}), equations13 and 14 were re-specified as follows:

$$\Delta LnP_{2t} = \beta_0 + \beta_1 \sum_{i=1}^{n} \Delta LnP_{2t-1} + \beta_2 \sum_{i=1}^{n} \Delta LnP_{1t-i} + \beta_3 ECM_{t-1} + U_{1t} \quad (15)$$

$$\Delta LnP_{4t} = \mu_0 + \mu_1 \sum_{i=1}^{n} \Delta LnP_{4t-1} + \mu_2 \sum_{i=1}^{n} Ln\Delta P_{3t-i} + \mu_3 ECM_{t-1} + U_{2t} \quad (16)$$

The specified variables are as defined previously in equation (3), and the coefficient (β_3) and (μ_3) of the ECM_{t-1} ($-1 < \beta_3, \mu_3 < 0$) measure the deviation from the long-run equilibrium in period (t_{-1}) in both P_{2t} and P_{4t}. Similarly, equations 15 and 16 were specified to test the short run market integration and the level of adjustment of P_{2t} and P_{4t} to equilibrium level in the long run.

3.3.5 Index of Market Connection (IMC)

The index of market connection (IMC) was used to measure the degree of short run price transmission or price relationship between integrated markets. Following Oladapo and Momoh, (2007) technique, the relationship between the price of Maize and Beans in rural and urban market is given by the equations below:

$$P_{1t} = \delta_0 + \delta_1 P_{1t-1} + \delta_2 (P_{2t} - P_{2t-1}) + \delta_3 P_{2t-1} + \varepsilon_{1t} \quad (15)$$

$$P_{3t} = \varphi_0 + \varphi_1 P_{3t-1} + \varphi_2 (P_{4t} - P_{4t-1}) + \varphi_3 P_{4t-1} + \varepsilon_{2t} \quad (16)$$

Then IMC = δ_1/δ_3 for Maize commodity and φ_1/φ_3 for Beans commodity. Note, when the estimated IMC < 1, it implies high short run market Integration; IMC > 1 implies low short run market Integration; IMC = ∞ implies no market integration or market segmentation; IMC = 1 implies high or low short run market integration. Other variables are as defined in equations 3.

4. Results and Discussions

4.1 Augmented Dicker Fuller Unit Root Test Result

In time series analysis, stationary of series is examined by the unit root tests. One of the most commonly used tests in the literature to ascertain the stationary levels of series is Augmented Dicker Fuller (ADF) test developed by Dickey and Fuller in 1979. The result of the ADF unit root tests is presented in Table 1. The result showed that, Maize and Cowpeas prices are non-stationary at levels but stationary (at 1% significance level) at first difference for the ADF equation that contain constant only. On the other hand, when the ADF equations were specified to include constant and deterministic trend, prices of Maize and Cowpeas were stationary at levels. To avoid the mis-specification of subsequent equations and to subject the specified variables to further empirical tests; it is concluded that, Maize and Cowpeas prices are non stationary at levels, but stationary at first difference.

Table 1. Result of the unit root test for price variables of Maize and Beans used in the analysis (Augmented Dicker Fuller Test for unit root)

Logged Variables	With Constant			Constant and Trend		
	Level	1st diff.	OT	Level	1st diff.	OT
LnP_{1t}	-3.019	-13.11**	1(1)	-5.422**	-	1(0)
LnP_{2t}	-3.180	-14.09**	1(1)	-5.390**	-	1(0)
LnP_{3t}	-2.485	-16.68**	1(1)	-4.534**	-	1(0)
LnP_{4t}	-2.502	-15.31**	1(1)	-4.403**	-	1(0)
1% (CV)	-3.50	-3.50		-4.05	-4.50	

Note: OT means order of integration. Critical value (CV) is defined at 1% significant level and asterisks ** represent 1% significance level. Variables are as defined in equation 3.

The result implies that, prices of Maize and Cowpea cannot be specified at their levels without the risk of obtaining spurious regression. Also, the result indicates that, there is need to test for the presence of co-integration between the rural and urban prices of Maize and Cowpea in Akwa Ibom State. These results are similar to the research results reported by several researchers on different food stuffs in Nigeria. They include; Okoh (1999), Okoh and Akintola (1999), Okoh *and* Egbon (2005), Ojiako *et al.* (2012), and Akpan *et al.*, (2014).

4.2 Descriptive Analysis of average monthly Prices of Maize and Cowpea in Akwa Ibom State (from January 2005 to June 2013)

The descriptive statistics of the price variable used in the analyses is shown in Table 2. The average price of Maize in rural and urban markets in Akwa Ibom State was ₦123.91/kg (i.e. $0.79) and ₦123.75/kg (i.e. $0.79) respectively. Also, the average price of Beans in the study area was ₦148.41/kg and ₦146.00/kg in rural and urban markets respectively. In addition, the coefficient of variability in price of Maize in rural and urban markets was 21.80% and 20.20% respectively. For Beans (Cowpea), it stood at 35.57% and 35.8% for rural and urban markets respectively. Furthermore, the average linear growth rate of the price of Maize in rural and urban markets was 1.487% and 1.266% respectively.

Table 2. Descriptive Statistic of Price Variables Used in the Model

Parameters	Maize Price		Cowpea Price	
	Rural Market (₦/Kg)	Urban Market (₦/Kg)	Rural Market (₦/Kg)	Urban Market (₦/Kg)
Mean	123.91	123.75	148.41	146.00
Median	120.88	118.79	146.83	143.38
Minimum	75.25	87.48	71.72	69.37
Maximum	208.50	196.75	358.03	343.11
Standard deviation	26.99	24.98	53.02	52.31
Coefficient of Variation	0.218	0.202	0.357	0.358
Skewness	0.604	0.653	1.303	1.197
Kurtosis	0.012	-0.165	2.704	2.141
Average Growth rate (%)	1.487	1.266	2.057	1.984

Note: Computed by authors, and prices are expressed in nominal terms. (1 dollar = 156 Naira)

Similarly, the price of Beans grew at the rate of 2.057% and 1.984% in the rural and urban markets respectively. It is observed that, the coefficient of variability and standard deviation of Maize and Cowpea in rural and urban market are similar. This suggests the presence of high degree of co-movement of rural and urban price of both crops over time.

4.3 Exponential Trend Analysis of Prices of Maize and Beans (Cowpea) in Rural and Urban Markets of Akwa Ibom State (2005 to 2013)

The exponential trend equations for each of the price variable specified in equation 1 and 3 is presented in Table 3. The regression estimates for each of the price variable is followed by the calculated exponential growth rate and the conclusion derived from the respective long run exponential trend equation. The result revealed that, trend in price of Maize and Beans in rural and urban markets showed positive significant association with time in Akwa Ibom State. This implies that, changes in price of maize and Beans in rural and urban markets is influenced by time. Prices of maize in rural and urban market have exponential growth rates of 0.60% and 0.50% respectively. In the similar way, about 0.90% exponential growth rate was identified for both rural and urban price of Beans. These results suggested that, there are noticeably dispersions between prices of Maize in rural and urban markets in the study area; whereas the dispersion in prices of Beans showed minimal or insignificant difference between the two spatial markets. The result indicates that, there is possibility of market integration between the rural and urban prices of Maize and Beans in Akwa Ibom State. The nature of exponential growth in each price variable investigated revealed that, over time the price of Maize in rural and urban markets showed insignificant increase. On the other hand, price of Beans in the rural and urban markets exhibited significant relationships with increase in time. This implies that, the price of beans in rural and urban markets increases at the increasing rate over time. These results are in consonance with the research report of Amusa, (1997) who asserted that, agricultural commodity prices experienced increase fluctuations in their prices. Akpan *et al.,* (2014) research report also supported increase fluctuation of grains' prices in Southern Nigeria.

To further verify the previous assertion graphically; the linear trend in prices of Maize in the rural and urban markets in Akwa Ibom State is showed in figure 1. The price trends show undulated fluctuations throughout the study period. Both prices seem to move together in

most part of the year except for few noticeably dispersions in 2006 to 2009. However, on average the rural and urban price of Maize exhibited similar pattern of fluctuations throughout the study period. The result implies that, the rural and urban prices of Maize move together in the period of investigation. Similarly, Figure 2 shows the linear trend in price of Beans (Cowpea) in rural and urban markets in Akwa Ibom State.

Table 3. Exponential Trend Analysis of Monthly Average Prices of Maize and Cowpea in Rural and Urban Markets in Akwa Ibom State (2005 to 2013)

Variables	LnP_{1t}	LnP_{2t}	LnP_{3t}	LnP_{4t}
Constant	4.51(166.5)***	4.54(181.2)***	4.49 (102.6)***	4.49(97.2)***
Time	0.006(12.3)***	0.005 (12.1)***	0.009(11.7)***	0.009 (10.9)***
F- cal.	151.17***	146.65***	137.53***	120.34***
R-square	0.602	0.595	0.579	0.546
Exponential GR (%)	0.60	0.50	0.90	0.90
Nature of Growth Rate				
Constant	4.53(109.9)***	4.55(119.1)***	4.67(74.70)***	4.69 (71.95)***
Time (b_1)	0.004 (2.35)**	0.0004 (2.60)**	-0.002 (-0.55)	-0.003(-1.04)
Time (b_2)	1.233e-05(0.71)	6.36e-05 (0.40)	9.92e-05(3.76)***	1.1e-04 (4.09)***
F- cal.	75.47***	72.78***	84.86***	77.97***
R-square	0.604	0.595	0.632	0.612
Inference	Decelerated GR	Decelerated GR	Accelerated GR	Accelerated GR

Note: Values in bracket represent t-values. The asterisks *, ** and *** represent 10%, 5% and 1% significance levels respectively. Variables are as defined in equation 3.

The result also showed undulated fluctuations in the price of cowpea (Beans) during the period of investigation. There is harmony in price dispersion of Beans in rural and urban market compared to the trend in Maize prices. This means that, the pattern of fluctuations in price of Beans is almost similar for urban and rural markets. Following this nature of fluctuations in the price of Beans in the rural and urban markets; it is suggested that, there is a strong evidence of symmetric price transmission mechanism or market integration between the two prices. Akpan *et al.* (2014) has reported similar behaviour in rural and urban price of rice in Southern Nigeria.

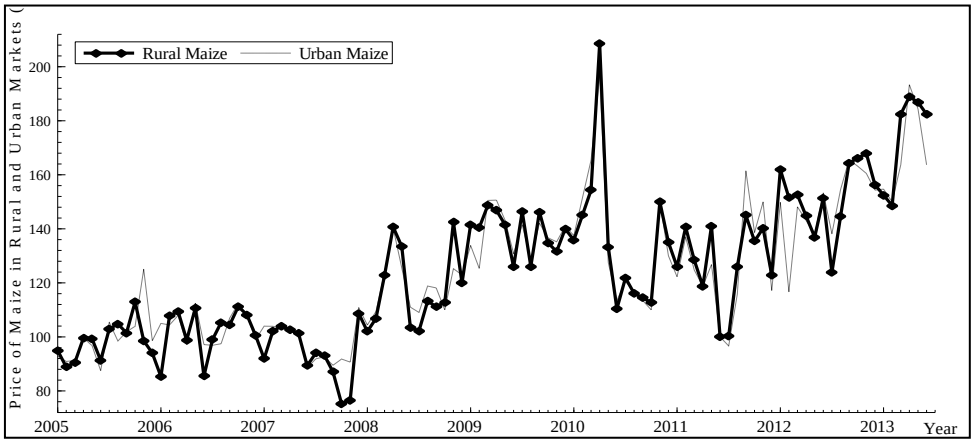

Figure 1: Trend in Prices of Maize in Rural and Urban Markets in Akwa Ibom State (2005 – 2013)

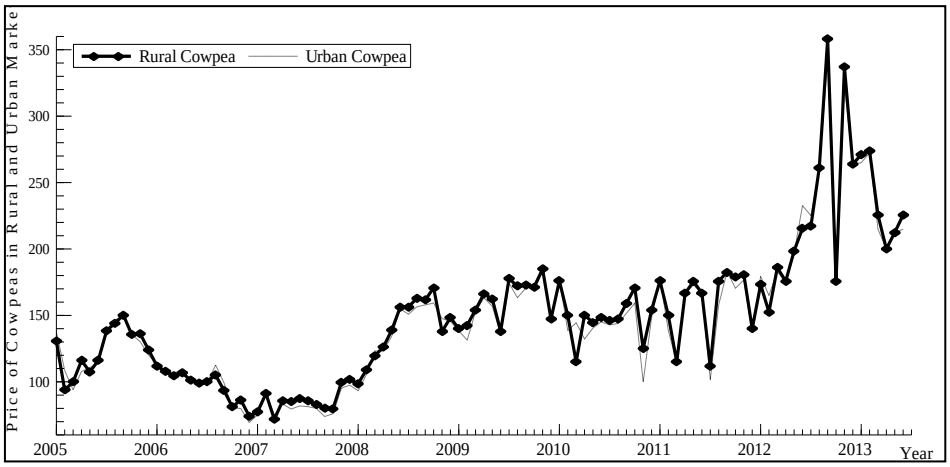

Figure 2. Trend in Prices of Cowpea (Beans) in Rural and Urban Markets in Akwa Ibom State (2005-2013)

4.4 Pearson correlation matrix of Average Monthly Price of Maize and Beans (expressed in ₦/Kg) in Rural and Urban Markets in Akwa Ibom State, Southern Nigeria

The linear and symmetric relationship between the average monthly price of Maize and Beans in the rural and urban markets of Akwa Ibom State was captured by the Pearson correlation coefficient. Table 4 presents the correlation matrix of the rural and urban prices of maize and Beans from January 2005 to June 2013 in Akwa Ibom State, Southern Nigeria. The result indicates that, prices of Maize and Beans in the rural market have positive significant (at 1% probability level) linear associations with their corresponding prices in the urban markets. This means that, the price of Maize in rural market has a strong linear relationship with its own price in urban market in Akwa Ibom State. The same result was also obtainable for the Beans market in the study area. These results further provide strong support for the existence of price integration or good price transmission mechanism between the rural and urban markets for grains (i.e. maize and beans) in Akwa Ibom State, Nigeria. It could also be deduced from the result that, factors that influence price of Maize and Beans in rural markets are almost similar to those in urban markets in Akwa Ibom State.

Table 4. Pearson Correlation Matrix for Prices of Maize and Beans in Rural and Urban Markets in Akwa Ibom State (2005 - 2013)

Variables	P_{1t}	P_{2t}	P_{3t}	P_{4t}
P_{1t}	1.000	0.954 (0.000)***	0.689 (0.000)***	0.684 (0.000)***
P_{2t}		1.000	0.705 (0.000)***	0.702 (0.000)***
P_{3t}			1.000	0.991 (0.000)***
P_{4t}				1.000

Note: variables are as expressed in equation 3. Values in bracket are probabilities of t-values; while values not in brackets are bi-variate correlation coefficients.

4.5 Bilateral Granger Causality Test for prices of Maize and Beans in rural and urban markets in Akwa Ibom State (2005 - 2013)

The Granger causality relationship between rural and urban price of Maize and Beans was tested in Akwa Ibom State. The result of the analysis is presented in Table 7. The result in Table 6 shows the optimal lag period used in the Granger causality equation specified in equations 5 to 8. The asterisks below indicate the best (that is, minimized) values of the respective information criteria, AIC = Akaike criterion, BIC = Schwarz Bayesian criterion and HQC = Hannan-Quinn criterion.

Table 6. The Optimal Lag Length for the Causality Equation

Lag	Loglikelihood	P(LR)	AIC	BIC	HQC
1	507.79	-	-9.693*	-8.959*	-9.396*
2	513.52	0.780	-9.485	-8.332	-9.019
3	524.83	0.124	-9.391	-7.818	-8.754

The corresponding lag length indicates the best lag length for generating a more parsimonious Granger causality equation for the specify series. The result of the exercise indicated that lag 1 was more appropriate for the causality equations. This implies that the causality equations generated were done by using one period lagged of the variables involved. The estimated Granger causality results is presented in Table 7.

Table 7. The Vector Autoregressive Regression Granger Causality Estimates

Hypotheses	Lag	Sample size	F-Statistic	Prob.	Decision
ΔLnP_{1t} does not Granger Cause ΔLnP_{2t}	1	101	97.609	0.000 ***	Rejected
ΔLnP_{2t} does not Granger Cause ΔLnP_{1t}	1	101	100.166	0.000 ***	Rejected
ΔLnP_{3t} does not Granger Cause ΔLnP_{4t}	1	101	9.548	0.000 ***	Rejected
ΔLnP_{4t} does not Granger Cause ΔLnP_{3t}	1	101	14.024	0.000 ***	Rejected

Note: Variables are as defined in equation 3.

The result presented in Table 7 suggests that, there is evidence of bi-directional Granger causality between urban price and rural price of Maize and Beans from January 2005 to June 2013 in Akwa Ibom State. It means that, rural price of Beans and Maize exhibited weak exogeneity or is strongly endogenous to their corresponding urban prices. The result means that, the causality runs from the price of urban market to rural market and vice versa. Alternatively, the result implies that, urban price of Maize and Beans impacted positively on their respective rural prices; and in the same manner the rural price of Maize and Beans influence their respective urban prices. In the similar way, the previous price in urban market significantly predicted the current price in the rural market for Maize and Beans in Akwa Ibom State, Southern Nigeria. The presence of the bi-directional Granger Causality between the rural and urban price of Maize and Beans indicate that, there is a perfect price transmission mechanism or market integration between the two markets in Akwa Ibom State. The flow of markets information between the rural and urban markets for Maize and Beans section in the study area could be described as symmetric because the effect of transfer costs

are not significant. The result further suggested that, the rural and urban price of Beans and Maize are tight together in the long run. Based on the magnitude of the diagnostic statistics, it appears that, the urban market is the lead or the driving market in the long run for maize and Beans marketing in the study area. This result can be attributed to the fact that, the bulk quantity of Beans and Maize consumed in the state especially during the off-season are brought from the neigbouring states. These commodities are mostly haboured in the urban markets for onwards distribution to other spatial markets. In addition, the result suggests a perfect competitive market structure and strong endogeneity in the rural and urban price of Maize and Beans markets in the region. This result corroborate the reports of Okoh *and* Egbon (2005); Adeoye *et al.* (2011), and Akpan *et al.* (2014) on different food stuffs in Nigeria

4.6 Regression Estimates for The Co-Integration Model and the Law of One Price (LOP) for Price Of Maize and Beans in the Rural and Urban Markets in Akwa Ibom State, Southern Nigeria

The result in Table 8 and Table 9 present the regression estimates to test the co-integration and law of one price in Maize and Beans markets in the study area. Results in Table 8 contain the rural price equation estimates for Maize and Beans in the study area. The R-squares for the rural price equation of Maize and Beans are 0.90 and 0.98 respectively. This implies that, about 90% and 98% of the total variability in the rural price of Maize and Beans respectively is explained by their respective urban price. The F-statistics for the two equations are significant at 1% probability level; thus confirming the significant of the estimated R-squares for the two equations. The result for the rural price of Maize and Beans indicates that, the price transmission between the rural and urban markets exhibited perfect long run integration. This is because; the integration coefficient (or elasticity coefficient) is approximately unity (i.e. 1.036 for Maize and 0.975 for Beans). These results give a strong evidence of long run price integration between the rural and urban market prices of Maize and Beans in Akwa Ibom State. The result also indicates that, the law of one price is strongly upheld between the rural and urban price of Maize and Beans when market activities flow from urban to rural markets. Akpan *et al.* (2014) also observed similar behaviour when they studied marketing and price transmission of local and foreign rice commodities in Nigeria.

Table 8. Long Run Relationships between Prices of Maize and Beans in Rural and Urban Markets in Akwa Ibom State (2005 – 2013)

Variable	$LnP_{1t} = f(LnP_{2t})$ (Maize)	Variable	$LnP_{3t} = f(LnP_{4t})$ (Beans)
Constant	-0.1756 (-1.07)	Constant	0.1432 (1.913)*
LnP_{2t}	1.0361(30.21)***	LnP_{4t}	0.9745 (64.26)***
F-cal	912.60***	F-cal	4129.13***
R^2	0.901	R^2	0.976
DW- test	1.679	DW- test	1.908
ADF test for errors from above equations			
ECM	-8.453***		-9.680***

Note: the equation for the ADF test include constant and trend. Critical value at 1% = -3.50, Values in bracket represent t-values. The asterisk *** represents 1% significance level. Variables are as defined in equation 3.

The result for the urban price also shows a strong indication or support for the law of one price especially in the Beans market. The coefficient of the long run market integration (inelastic coefficient) is approximately unity for Beans and slightly less than unity for Maize. This also indicates that, the Beans price transmission between urban and rural market exhibited perfect symmetric relationship. The integration coefficient for Maize suggested that, the rural price impact on the urban price is less relative to the impact of urban on rural price. The result implies that, when market activities flow for rural to urban market, the market integration is stronger in Beans than Maize market. The result however revealed that, Maize price has a strong market integration coefficient when the urban market is the driving market; while cowpeas price exhibited strong integration coefficient when market activities is been detected by the rural market.

Table 9: Long run Relationships between prices of Maize and Beans in Rural and Urban markets in Akwa Ibom State (2005 – 2013)

Variable	$LnP_{2t} = f(LnP_{1t})$ (Maize)	Variable	$LnP_{4t} = f(LnP_{3t})$ (Beans)
Constant	0.6267 (4.53)***	Constant	-0.0270 (-0.35)
LnP_{1t}	0.8698(30.20)***	LnP_{3t}	1.0019 (64.26)***
F-cal	912.60***	F-cal	4129.13***
R^2	0.901	R^2	0.976
ADF test for errors from above equations			
ECM	-8.523***		-9.671***

Note: the equation for the ADF test include constant. Critical value at 1% = -3.50, Values in bracket represent t-values. The asterisk *** represents 1% significance level. Variables are as defined in equation 3.

The result provided additional evidence that, the urban market is the stimulant market for the marketing of Maize; while both rural and urban market appear to play prominent role in Beans marketing in Akwa Ibom State. These results also revealed the prevalence of the competitive market structure and less arbitrage activities for Maize and Beans marketing in the study area. Okoh *and* Egbon (2005), and Akpan *et al.,* (2014) have identified similar behaviour in prices of some food stuffs in Nigeria.

4.7 The Engle Granger two step and Johansen co-integration test

The result of the Engle and Granger two-step technique of co-integration regression tests for the residuals (ECM) generated in the long run equations of Maize and Cowpeas is presented in the lower portion of Table 8 and Table 9. The results show that at 1% probability level of significance, the ADF for the residuals is greater than the critical value (-3.50). Thus the Engle–Granger co-integration tests reject the null hypothesis of no co-integration for the four price equations. Hence, there exist long run equilibrium relationships between the rural and urban price of Maize and Beans in the study area.

On the other hand, the Johansen co-integration test result showed that, the trace and maximum eigenvalue values were significant at first rank level. The result is presented in Table 10 for equation 9 and 10, and also in Table 11 for equation11 and 12. The two results are similar, the calculated trace test and maximum eigenvalue test statistics are greater than the critical values at 1% probability level. These further confirm the presence of at least one co-integration relationship among the specified price variables in equations 9 to 12. The upper part of Table 8 and Table 9 also represent the long run estimates of equation 9 to 12.

Table 10. Results of Johansen Cointegration Test (Unrestricted Constant) for $LnP_{1t} = f(LnP_{2t})$

Rank	EigenValue	Trace test	p-value	Lmax. test	p-value
0	0.2502	37.563	[0.000]	28.222	[0.000]
1	0.0909	9.3408	[0.002]	9.341	[0.002]

Unrestricted constant; Log-likelihood = 493.569 (including constant term: 215.457)

Table 11. Results of Johansen Cointegration Test (Unrestricted Constant) for $LnP_{3t} = f(LnP_{4t})$

Rank	EigenValue	Trace test	p-value	Lmax. test	p-value
0	0.2427	29.441	[0.0000]	27.515	[0.000]
1	0.0193	1.9263	[0.1650]	1.9263	[0.165]

Unrestricted constant; Log-likelihood = 490.013 (including constant term: 209.063)

4.8 Error Correction Model for the price of Maize and Beans in the Rural and Urban markets in Akwa Ibom State (2005 – 2013)

The presence of the co-integration among the specified variables demanded the specification of the Error Correction Model. Table 12 contains estimates of ECM generated for equations 13 and 15; while Table 13 contains estimates of ECM generated for equations 14 and 16. For equations 13 and 15, the coefficient of the error correction terms is negative and statistically significant at 1% probability level respectively. The result validates the existence of the long-run equilibrium relationships between the rural and urban market prices of Maize in Akwa Ibom State. The result further implies that, the rural and urban price of Maize is sensitive to departure from their equilibria levels in the previous periods. The slope coefficients of the error correction term for the rural (-0.7594) and urban (-0.7008) price of maize equation represents the speed of adjustment and also is consistent with the hypothesis of convergence towards the long-run equilibrium once the respective price equation is disturbed.

Table 12. ECM Estimates for the Rural and Urban Price of Maize

$LnP_{1t} = f(LnP_{2t})$		$LnP_{2t} = f(LnP_{1t})$	
Variable	Coefficient and t-test	Variable	Coefficient and t-test
Constant	0.00067 (0.10)	Constant	0.00169 (0.28)
$\Delta\, LnP_{1t-1}$	-0.05607 (-0.55)	$\Delta\, LnP_{2t-1}$	-0.14445 (-1.40)
ΔLn LnP_{2t}	0.91609 (15.40)***	ΔLn LnP_{1t}	0.76142 (15.60)***
ΔLn LnP_{2t-1}	0.07352 (0.65)	ΔLn LnP_{1t-1}	0.07222 (0.79)
ECM_{t-1}	-0.75937 (-5.78)***	ECM_{t-1}	-0.70082 (-5.33)***
R^2 = 0.7542; F-cal. = 72.89***; DW = 1.96; Log-likelihood = 131.74		R^2 = 0.759; F-cal. = 74.63***; DW = 1.92; Log-likelihood = 141.19	

Note: Values in bracket represent t-values. The asterisk *** represent 1% significance level. Variables are as defined in equation 3.

The diagnostic tests for the ECM model of Maize price revealed the R^2 values of 0.754 and 0.750 for the rural and urban price equation respectively. This means that the specified explanatory variables explained about 75.42% and 75.90% of the adjusted total variations in the rural and urban price of Maize respectively in the study area. The F-statistics for the two equations are significant at 1% probability level, indicating that the two R^2 are significant and this implies that, the ECM of the rural and urban price of Maize have goodness of fit.

The auto-correlation was not a serious problem in the two equations. The result revealed that, about 75.94% and 70.08% of the rural and urban price adjustments take place respectively within every month due to exogenous shock. That is, it will take about 5 weeks 2 days and 5 weeks 5 days for the rural and urban price of Maize respectively to fully adjust to equilibrium position in the long run due to shock in the marketing system in the study area. The result suggested that, the rural price of Maize adjusted faster than the urban price. The rural price of Maize is strongly endogenous to urban price in Akwa Ibom State. By implication, movements in the rural price of Maize is significantly detected by it respective urban price. The result is in consonance with the research report of Okoh *and* Egbon (2005) and Akpan *et al.* (2014) for other grains in Nigeria.

For the Beans market, the slope coefficient of the error correction term for the rural (-0.925) and urban (-0.987) price of Beans is negative and statistically significant. The coefficient of the error correction terms shows the speed of convergence to the long run equilibrium as a result of shock in the Beans price equations. This indicates that, any disequilibrium in the long run of either rural or urban price of Beans would be corrected in the short run. The significant value of the error correction term implies that, the urban price of Beans will always react to bring stability in the rural price whenever there is significant variation in the rural price and vice versa.

Table 13. ECM Estimates for the Rural and Urban Price of Beans

$LnP_{3t} = f(LnP_{4t})$		$LnP_{4t} = f(LnP_{3t})$	
Variable	Coefficient and t-test	Variable	Coefficient and t-test
Constant	0.00303 (0.62)	Constant	-0.00219 (-0.433)
$\Delta\, LnP_{3t-1}$	-0.07150 (-0.73)	$\Delta\, LnP_{4t-1}$	-0.00061 (-0.006)
ΔLn LnP_{4t}	0.91772 (29.40)***	ΔLn LnP_{3t}	0.97457 (29.240)***
ΔLn LnP_{4t-1}	0.02160 (0.23)	ΔLn LnP_{3t-1}	0.01602 (0.159)
ECM_{t-1}	-0.92535 (-6.85)***	ECM_{t-1}	-0.98746 (-7.377)***
R^2 = 0.9233; F-cal. = 286***; DW = 1.99; Log-likelihood = 162.62		R^2 = 0.9215; F-cal. = 279***; DW = 1.95; Log-likelihood = 159.354	

Note: Values in bracket represent t-values. The asterisk *** represent 1% significance level. Variables are as defined in equation 3.

The result revealed that, about 92.54% and 98.75% of the rural and urban price adjustments take place respectively within every month due to exogenous shock in the system. That is, it will take about 4 weeks 2 days for the rural price and about 4 weeks for the urban price of Beans to fully adjust to equilibrium position in the long run due to shock in the system. The result revealed that, the urban price of Beans adjusted faster than the rural price. The result further revealed that, the rural price of Beans is strongly exogenous to urban price and vice versa. By implication, movements in the rural price of Beans is significantly detected by it respective urban price. The diagnostic statistics derived from the ECM in respect to Beans price revealed R^2 values of 0.923 and 0.922 for rural and urban price respectively. This means that, the explanatory variables contained in the Beans price equation explained about 92.3% and 92.2% of the total variations in the rural and urban price of Beans respectively in Akwa Ibom state, Nigeria. The F-statistics were significant at 1% probability level, indicating that, the ECM equations have goodness of fit.

The empirical results revealed that, the long run coefficient of market integration for the rural price of Maize and Beans converges to the postulate of the law of one price. The long run market integration coefficient for each of the commodity is approximately unity (i.e. 1.03 for Maize and 0.97 for Beans). This confirms the existence of the long run market integration between prices of Maize and Beans in the rural and urban areas of Akwa Ibom State. This is

so when considering the flow of market information from urban to rural market. The constant terms in the two long run equations give the picture of the transfer cost or the extent of price differential between the rural and urban market due to arbitrage activities. The result further revealed insignificant influence of the transfer cost in the marketing process of Maize and Beans in the state. This perhaps suggests high efficiency in information transmission between the rural and urban markets and improvement in the marketing infrastructures in the state. On the other hand, the long run coefficient of market integration for the urban price of Beans converges to the postulate of the law of one price; but the coefficient was slightly less than unity in the Maize equation (i.e. 0.87 for Maize and 1.00 for Beans). This confirms the existence of perfect long run market integration between prices in rural and urban areas for Beans and slightly weak long run integration for Maize market. This is valid when considering the flow of market information from rural to urban market. This result also confirmed the insignificant influence of the transfer cost on the marketing process of the two commodities in the state. Also, the result suggests that, there is high efficiency in information transmission between the rural and urban markets and further substantiate the improvement in the marketing infrastructures in the state. In addition, this result implies that, there is limited interference in the marketing chain of Maize and Beans commodities by government agencies and trade unions in the state.

For the short run model; the behavior of the rural price equation for Maize tended to the postulate of the law of one price. The market integration coefficient of urban price of Maize is however less than unity. This result implies that, there is high degree of short run market integration between the rural and urban prices of Maize when the market information or price movement flows from urban to rural markets. This means that, the short run market integration in Maize is stronger when information or price movement flows from urban to rural market compared to the reverse flow. Similarly, the market integration coefficients in the rural and urban price equation for Beans move towards the postulate of the law of one price. The integration coefficients of rural and urban price of Beans move towards unity. This result implies that, there is high degree of short run market integration between the rural and urban prices of Beans irrespective of the direction of flow of market prices. The short run integration in Beans market however, appears to be stronger when information or price movement flows from rural to urban market than from urban to rural market. In Maize price, the short run market integration is stronger when a market activity is directed by urban market. This result has also confirmed the insignificant influence of the transfer cost in the marketing process of Maize and Beans in a short run in the study area. These results further substantiate the high efficiency in information transmission between the rural and urban markets in the Maize and Beans sub sectors and improvement in the marketing infrastructures reported earlier in the study.

4.9 Index of Market Connection (IMC) for Maize and Beans in Akwa Ibom State, Nigeria

The IMC was estimated for Maize and Beans markets in the study area. The estimates of IMC regression is shown in Table 14 for Maize and Beans market respectively. The IMC were 0.190 and 0.032 for Maize and Beans market respectively.

The IMC for Maize and Beans are less than unity. The result implies that, there is high short run market integration between rural and urban markets for Maize and Beans commodities in the state. The short run market integration is stronger in the Beans market relative to the Maize market. This however confirms the ECM results discussed previously and further substantiates the presence of perfect price transmission mechanism in the short run between the rural and urban price of Maize and Beans in Akwa Ibom State.

Table 14. Estimates of IMC Regression for Maize and Beans in Akwa Ibom State, Nigeria

$LnP_{1t} = f(LnP_{2t})$		$LnP_{3t} = f(LnP_{4t})$	
Variable	Coefficient and t-test	Variable	Coefficient and t-test
Constant	-6.1516 (-1.41)	Constant	2.3258 (1.07)
P_{1t-1}	0.1679 (1.66)*	P_{3t-1}	-0.0334 (-0.34)
$(P_{2t} - P_{2t-1})$	0.9260 (17.40)***	$(P_{4t} - P_{4t-1})$	0.9974 (44.00)***
P_{2t-1}	0.8836 (8.01)***	P_{4t-1}	1.0365 (10.30)***
R^2 = 0.914; F-cal. = 339***; DW = 1.99		R^2 = 0.984; F-cal. = 1903***; DW = 1.97	

Note: Values in bracket represent t-values. The asterisks * and *** represent 10% and 1% significance levels respectively. Variables are as defined in equation 3.

5. Conclusion

The study used statistical and econometric techniques to analyze the price transmission between the rural and urban prices of Maize and Beans in Akwa Ibom State, Southern Nigeria. Results revealed that, prices of Maize and Beans in the rural and urban markets have positive relationship with time and exponential growth rates that is less than unity. The graphical analysis showed that, there were noticeably deviations in some months in the price trend of rural and urban price of Maize; while the movement in Beans price was almost unity during the study period. The result of the trend analysis suggested the prevalence of efficient price transmission mechanism between the rural and urban market for Beans and perhaps less efficient for Maize in Akwa Ibom State. Also, the Pearson correlation coefficient matrix revealed that, the rural price of Maize and Beans have linear symmetric relationships with their corresponding urban prices in the study area. The relationship was stronger in Beans market than in Maize markets. The result connotes the existence of symmetric market information flow between the rural and urban markets for Maize and Beans in the state. The Granger causality test revealed bi-directional relationship between the rural and urban price of maize and Beans in Akwa Ibom State, Nigeria. This also suggested that, the price transmission mechanism between the rural and urban markets for Maize and Beans is efficient; and has high tendency for market integration as well as endogeneity of both prices.

The results of the co-integration regression revealed the presence of the long run market integration between the rural and urban price of Maize and Beans as well as upheld the hypothesis of the perfect or fast price transmission between the two markets in Akwa Ibom State. The results also attested to the presence of varied long run market integrations between the rural and urban market for Maize and Beans depending on the direction of flow of the market information. This means that, the rural and urban price equation for Maize and Beans exhibited varied degree of long run market integration as well as convergence to the law of one price. The results of the short run model or error correction model (ECM), confirm the existence of the short run market integration between the rural and urban prices of Maize and Beans in the study area. Similarly, the short run market integration varied in magnitude based on the direction of flow of market information or price movement between the two markets. Based on the magnitude of the coefficient of error correction term, it was discovered that, the rural price of Maize adjusted faster to the stable state in the long run than the urban price once there is exogenous shock in the marketing system in Akwa Ibom State. It was also discovered that, the urban price of Beans adjusted faster than its corresponding rural price. The estimation of index of market concentration (IMC) supported the high short run market integration between prices in rural and urban markets for Maize and Beans.

Based on the discoveries of this study, it is recommended that, the Akwa Ibom State government should continue to provide more marketing infrastructures (such as storage

facilities, good road network, modern markets etc) to improve the symmetric nature of information among Maize and Beans markets in the state. Attempts should be made by governments, trade unions and other organization to reduce excessive externality costs associated with the marketing of Maize and Beans in the state. This attempt will help to minimize the total variable cost and bring about insignificant price differential among Beans and Maize markets in the state. The government of Akwa Ibom State should established market information centers and awareness programmes on mass medias (such as radio, television and newspaper), to facilitate efficient communication among Beans and Maize markets in the state.

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