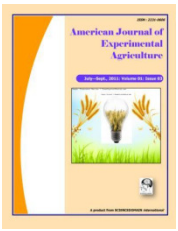


American Journal of Experimental Agriculture
4(11): 1367-1384, 2014

SCIENCEDOMAIN *international*
www.sciencedomain.org

Assessment of Price Transmission and Market Integration of Pawpaw and Leafy Telfairia in Akwa Ibom State, Nigeria

Glory E. Edet[1*], Sunday B. Akpan[1] and Ini-Mfon V. Patrick[2]

[1]Department of Agricultural Economics and Extension, University of Uyo, Akwa Ibom State, Nigeria.
[2]Department of Agricultural Economics and Extension, Akwa Ibom State University, Nigeria.

Authors' contributions

This work was carried out in collaboration among authors. Authors GEE and SBA designed the study, performed the statistical analysis and interpret the result of findings. Author IMVP managed the literature searches. All authors read and approved the final manuscript.

Original Research Article

Received 12th April 2014
Accepted 26th May 2014
Published 19th June 2014

ABSTRACT

The study investigated the dynamics of price transmission and market integration of pawpaw and leafy fluted pumpkin in the rural and urban markets of Akwa Ibom State, Nigeria. Monthly market prices (measured in naira per kilogram) of pawpaw and leafy fluted pumpkin in the rural and urban markets were used in the analysis. The data covered the period from January 2005 to September 2013. The data was obtained from the quarterly publications of the Akwa Ibom State Agricultural Development Programme (AKADEP). The trend analysis showed that, prices of pawpaw and leafy fluted pumpkin in the rural and urban markets have positive significant relationships with time and positive exponential growth rate. The Pearson correlation coefficient of each of the respective pair of rural and urban price of pawpaw and leafy fluted pumpkin revealed significant positive and symmetric relationships. The result implies the existence of symmetric price information flows on pawpaw and leafy fluted pumpkin in the rural and urban markets of the state. The bivariate Granger causality test revealed bi-directional relationships between the rural and urban price of pawpaw and leafy fluted pumpkin in the State. This further substantiates the strong co-movement of prices of pawpaw and leafy fluted pumpkin in the rural and urban markets and strong evidence of market integration. The equation for the law of one price revealed the presence of significant long run market

**Corresponding author: Email: brownsonakpan10@gmail.com;*

integration between the rural and urban price of pawpaw and leafy fluted pumpkin in the study area. Based on the findings, it is recommended that, the Akwa Ibom State government should continue to provide marketing infrastructures in the rural areas to improve the symmetric nature of information among pawpaw and leafy fluted pumpkin markets in the state. The government of Akwa Ibom State should established market information centers and awareness programmes on mass media to facilitate efficient communication and flow of information among pawpaw and leafy fluted pumpkin producers and consumers in the state.

Keywords: Market; pawpaw; leafy fluted pumpkin; price; integration; Akwa Ibom; Nigeria.

1. INTRODUCTION

Leafy fluted pumpkin and pawpaw are among the most consumed vegetables and fruits respectively in Nigeria [1]. Fluted pumpkin (*Telfairia occidentalis)* is a tropical vine grown in West Africa that produces edible seeds and leaves [2]. The leaf is noted for its high nutritional, medicinal and industrial values [3]. Tindal [4] reported that the fluted pumpkin leaf is rich in protein 29%, fat 18%, minerals and vitamins 20%. Also, Badifu and Ogunsua, [5] in Nigeria reported that, the leafy fluted pumpkin contained about 20.5g proteins, 45g fat, 23g carbohydrate, 2.2g fiber and 4.8g total ash. The leaf is also rich in Magnesium, iron and fibers and is used as food supplements [6] and [7]. Pawpaw (*Carica papaya),* on the other hand, is a fruit that consists of mostly water, carbohydrate, low calories, vitamins (A and C) and minerals (potassium) [8]. Several reports have shown that adequate intake of fruits and vegetables form an important part of a healthy diet. According to the World Health Organization (WHO) reports in 2005, adequate fruit and vegetable intake entails a consumption of at least 400g of fruits and vegetables per day, per capita (an equivalent of 146kg per capita per year). The report also pointed out that vegetable and fruit consumption was low in Sub-Saharan Africa countries (about 27 to 114kg/capita/year). The average quantity of vegetable and fruits per annum consumed in the region was below the WHO/FAO recommendation benchmark [9]. The low consumption of fruits and vegetables constitute a risk factor for [10]. Scientific evidence indicates that frequent consumption of fruits and vegetables can prevent oesophageal, stomach, pancreatic, bladder and cervical cancers and that a diet high in fruits and vegetables could prevent 20% of most types of cancers [11].

Pawpaw and leafy fluted pumpkin are characterized by problems of seasonality, bulkiness and high perishability. The persistence of these problems affects production, marketing and consumption of these agricultural commodities. Due to the nature of pawpaw and leafy fluted pumpkin, proper handling is a serious challenge to majority of farmers in Nigeria. Poor infrastructures such as good road network, storage facilities and electricity constitute major constraints to pawpaw and leafy vegetable production, consumption and even value addition in Nigeria [12]. As the result of these problems associated with pawpaw and leafy fluted pumpkin consumption; there are price variations among regions, rural and urban areas in the country. Many researches in Nigeria have linked price variations in agricultural commodities to several factors including variances in bargaining power among consumers, cyclical income fluctuations among sellers and consumers, seasonality of production, natural shocks such as flood, pests, diseases, and inappropriate response by farmers to price signals [13,14,15,16]. Instability in agricultural 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. It could also increase poverty level among low income earners in the society [17].

Spatial market price linkages are often interpreted as providing insights into the efficiency of infrastructures of markets. This is especially true in developing economy or society, where infrastructure issues such as road systems, market development, transportation, and so forth are pertinent issues [18]. In separated markets; when there is significant price difference between homogenous goods, such that the differences exceeded the transfer cost; the arbitrage activities are promoted. This is a situation when spatial markets are not integrated. On the other hand, two markets are integrated when there is a significant long-run relationship between prices of goods due to the smooth transmission of price signals and information across the two markets [19,15]. Market integration could be perfect if price changes in one market are fully and instantaneously reflected in the alternative markets [20]. Based on the important of pawpaw and leafy fluted pumpkin in the dietary need of Nigerians, it is important to understand the direction and magnitude of price transmission and market integration between the rural and urban markets in a state like Akwa Ibom. This will provide indispensable input to policy makers in the state to formulate workable policies for some components of the crop sub-sector and the agricultural sector as a whole. It will also promote the achievement of the self food sufficiency drive and help in minimizing the menace of poverty among citizenry in the state. Therefore, such information can help government at all tiers to decide the extent to which intervention policy on the price transmission and integration can be considered as efficient across different areas in their domains.

There are several empirical investigations on agricultural price transmission and market integration of food stuffs in Nigeria. Amusa [21] analyzed the trend in agricultural food prices in Nigeria and 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. Also, Okoh *and* Egbon [19] 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 drives the rural market price. In western Nigeria, Adeoye, Dontsop Nguezet, Badmus and Amao [22] examined the price transmission and market integration of banana and plantain in Oyo state, Nigeria. Six market links rejected their respective null hypothesis of no Granger causality at 5% significant level. However, only two market links exhibited bi-directional Granger causality or simultaneous feedback relationship. The remaining four market links exhibited significant uni-directional Granger causality relationships. The result revealed that, the urban plantain market occupies the leadership position in the commodity price formation and transmission in the markets investigated. In addition, Ojiako et al., [23] studied the spatial integration and price transmission in selected cassava products' (Lafun) markets in Nigeria. The result revealed the presence of the long-run equilibrium following exogenous shocks in the market. In addition, 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 urban market, the effect of which was computed as 95.6% using the forecast error variance decompositions. The study further discovered that, the effects of the rural prices' shock on urban price were very negligible at 3.2% after 10 weeks. The implication is that the rural market was the dominant market for determining the price of *lafun* in the short-run.

In the South-South region, Akpan et al., [15] 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 has constant exponential growth rate of 0.59% which suggests efficient co-movement for rural and urban prices of local and foreign rice in the study area. 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.

From the reviewed literature, it is obvious that, issues related to fruit and vegetable price transmission and market integration studies had not been investigated widely in Nigeria. Hence, this study is designed to specially provide dynamic information on pawpaw and leafy *Telfairia* or fluted pumpkin marketing in Akwa Ibom State, Nigeria. To achieve this broad objective of the study, the following specific objectives were pursued:

- To examine the trends of the monthly prices (₦/Kg) of pawpaw and leafy *Telfairia* in the rural and the urban markets of the study area.
- To assess the nature of price transmission of pawpaw and leafy *Telfairia* in the rural and urban market of the study area, and
- To examine the degree of the long and short market integration of pawpaw and leafy *Telfairia* in the study area.

1.1 Research Hypotheses

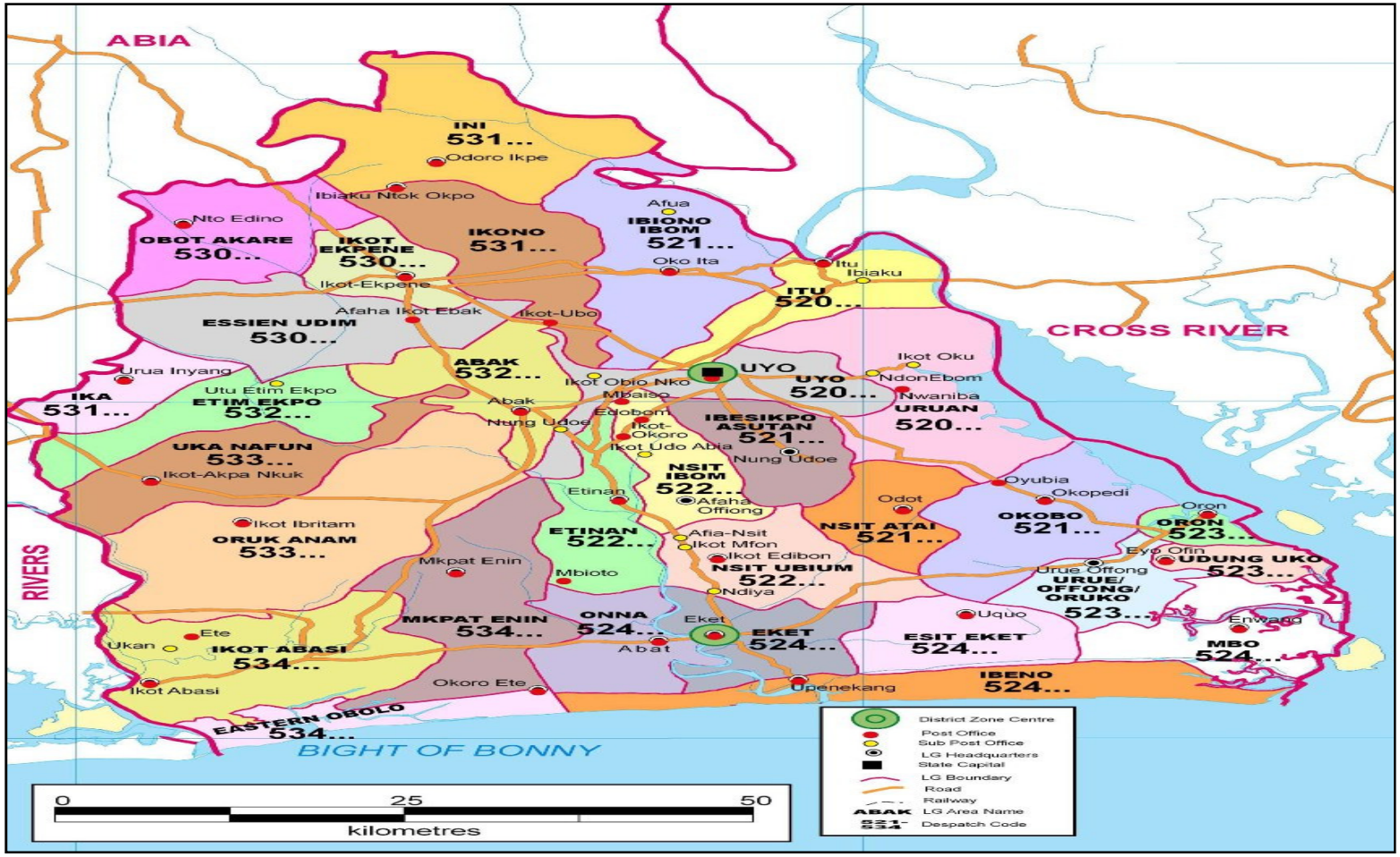
The following null hypotheses were tested for, in this study.

H**o:** Price trend in pawpaw and leafy Telfairia do not differ in rural and urban markets in Akwa Ibom State.
Ho: Price transmission in pawpaw and leafy Telfairia in the rural and urban markets is not symmetric in Akwa Ibom State.
Ho: There are no long run market integration relationships between prices of pawpaw and leafy Telfairia in the rural and urban markets in the study area.

2. RESEARCH METHODOLOGY

2.1 Study Area

The study was conducted in Akwa Ibom State located in the coastal South-South region of Nigeria. The state is located between latitudes 4º32^1 and 5º33^1 north and longitudes 7º25^1 and 8º25^1 east. It has a total land area of areas of 7,246km^2. The mean annual temperature of the state lies between 26ºC and 29ºC and average sunshine of about 1,450 hours per year. The mean annual rainfall ranges from 2,000mm to 3,000mm, depending on the area. Akwa Ibom State has a population of about 3,902,051 [24]. The state is basically an agrarian society where crops like maize, okra, fluted pumpkin, cassava, pineapple, tomato, pawpaw, yam and rice are cultivated in large quantities. The map of the state is shown below.



Source: Official Website of Akwa Ibom State 2014

2.2 Source of Data

Secondary or time series data were used in this study. The data were obtained from the quarterly reports of the Akwa Ibom State Agricultural Development Programme (AKADEP) [25]. It consisted of the average monthly retailed price pawpaw and leafy fluted pumpkin measured in Naira per Kilogram from sampled markets in the rural and urban areas of Akwa Ibom State. The study period covered January 2005 to September 2013. A total of 105 weeks' retailed average monthly prices (₦/Kg) of pawpaw and leafy fluted pumpkin from rural and urban markets were used in the study.

2.3 Analytical Techniques

The study applied several of statistical and econometric techniques to test for the relationship between rural and urban prices of pawpaw and leafy fluted pumpkin in the study area. The tests applied include; the trend analysis, bi-variate correlation analysis and Granger causality tests. Each of the tests is explained as shown below:

2.4 The Trend Analysis of Prices of Pawpaw fruit and Leafy *Telfairia* (Fluted Pumpkin leaf) in the Rural and Urban Markets of Akwa Ibom State in Nigeria

To investigate the nature of growth rate in prices of pawpaw and leafy *Telfairia* (fluted pumpkin) in the study area, the exponential growth rate equation was specified as thus:

$$P_t = b_o e^{bt} e^{ut} \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots \ldots (1)$$

$$log_e P_t = b_0 + b_1 t + U_t \ldots \ldots \ldots \ldots \ldots \ldots \ldots . \ldots \ldots \ldots . \ldots \ldots \ldots \ldots \ldots \ldots (2)$$

Where exponential growth rate (r) is defined as $(e^{b1} - 1) * 100$; where "e" is 2.7183. The linear quadratic trend equation was also used to test for the effect of increasing time on prices of pawpaw and leafy *Telfairia* in the rural and urban markets of the study area. The linear quadratic trend equation was specified as thus:

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

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

$PP_{rt} = Average\ monthly\ Price\ of\ pawpaw\ in\ rural\ market\ in\ naira/Kg$
$PP_{ut} = Average\ monthly\ Price\ ofpawpaw\ in\ Urban\ market\ in\ naira/Kg$
$LT_{rt} = Average\ monthly\ Price\ of\ leafy\ Telfairia\ in\ rural\ market\ in\ naira/Kg$
$LT_{ut} = Average\ monthly\ Price\ of\ leafy\ Telfairia\ in\ urban\ market\ in\ naira/Kg$

T = Time Trend (1, 2… 105)

The exponential growth rate equation was used in this study to investigate the growth in monthly prices of pawpaw and leafy *Telfairia* (fluted pumpkin) because, several literature have supported continuous inflated prices of agricultural commodities for some years in Nigeria [26,27,11,28]

2.5 Pearson Correlation Matrix of Prices of pawpaw and leafy *Telfairia* in the Rural and Urban Markets of Akwa Ibom State in Nigeria

To test for the symmetric and linear relationship between rural and urban prices of pawpaw and leafy *Telfairia* in the study area, the Pearson correlation coefficients was employed. The formula is described below:

$$PP_r = \frac{n\sum PP_{rt}PP_{ut} - (\sum PP_{rt})(\sum PP_{ut})}{\sqrt{\{n\sum PP_{rt}^2 - (\sum PP)^2\}\{\sum PP_{ut}^2 - (\sum PP_{ut})^2\}}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

The "PPr" is the correlation coefficient between the urban and rural market prices of pawpaw and leafy *Telfairia* in the study area. A significant relationship between the rural and urban price variable suggests efficient price transmission, symmetric price movement and or the presence of high probability for market integration between the two markets; while insignificant association suggests otherwise.

2.6 Bilateral Granger Causality Test on Prices of pawpaw and leafy fluted Pumpkin in the Rural and Urban Markets of Akwa Ibom State in Nigeria

The Granger causality test is used to determine whether one time series is useful in forecasting another. For instance, 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 the future values of *Y* [29]. 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 determine the number of lags (and to control for serial correlations) in a model, the Akaike, Schwarz or Hannan-Quinn information criteria are generally applied [30]. In this study, the bilateral Granger Causality tests were conducted on the average monthly market prices of pawpaw and leafy fluted pumpkin in the urban and rural areas of Akwa Ibom State, southern Nigeria. The primary model in Vector Autoregressive Regression forms are represented as in equations 5 to 8.

$$\left\{ LnPP_{rt} = \beta_0 + \beta_1 \sum_{i=1}^{n} LnPP_{rt-1} + \beta_2 \sum_{i=1}^{n} \Delta LnPP_{ut-1} + \varepsilon_{1t} \ldots\ldots\ldots (5) \right\}$$

$$\left\{ LnPP_{ut} = \delta_0 + \delta_1 \sum_{i=1}^{n} LnPP_{ut-1} + \delta_2 \sum_{i=1}^{n} LnPP_{rt-1} + \varepsilon_{2t} \ldots\ldots\ldots\ldots (6) \right\}$$

$$\left\{ LnLT_{rt} = \gamma_0 + \gamma_1 \sum_{i=1}^{n} LnLT_{rt-1} + \gamma_2 \sum_{i=1}^{n} LnLT_{ut-1} + \varepsilon_{3t} \ldots\ldots\ldots\ldots (7) \right\}$$

$$\left\{ LnLT_{ut} = \alpha_0 + \alpha_1 \sum_{i=1}^{n} LnLT_{ut-1} + \alpha_2 \sum_{i=1}^{n} LnLT_{rt-1} + \varepsilon_{4t} \ldots\ldots\ldots\ldots (8) \right\}$$

The above specification implied that, there is bilateral Granger causality from urban markets to rural market for pawpaw fruit, if $\beta_2 \neq 0$ and $\delta_2 = 0$. 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 [31], the weak exogeneity occurs when the marginal distribution of $for\ instance, P_{1t-1}$ 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 bilateral Granger-causality from the other variable. If we have 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 [32]. Similarly, there is Granger causality from the rural market price to urban market price of fresh tomato 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 the two variables if $\beta_2 = 0$ and $\boldsymbol{\delta_2} = 0$. The same interpretations follow for equations 7 and 8 for the leafy *Telfairia.* The variables are as defined previously in equation (3). A bi-directional Granger causality test indicates the presence of efficient price transmission between prices of rural and urban markets for the pawpaw and leafy fluted pumpkin in the study area.

2.7 Estimates of the Law of one price for Prices of Pawpaw and Leafy Fluted Pumpkin in Rural and Urban Areas in Akwa Ibom State in Nigeria

If the geographically separated markets are integrated, then there exists an equilibrium long run relationship among these markets [20,33,34]. If two prices ($PP_{rt}\ and\ PP_{ut}$) are perfectly integrated, then $\gamma_1 = 1\ in\ equation\ 9$. In this case, price changes in rural market ($\boldsymbol{PP_{rt}}$) are fully reflected in the urban ($\boldsymbol{PP_{ut}}$) market. When $\gamma_1 \neq 1\ (i.e.\gamma_1 < 1\ or\ \gamma_1 > 1)$, then the degree of 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 price equation for pawpaw and Leafy fluted pumpkin is given below:

$$\boldsymbol{LnPP_{rt} = \gamma_0 + \gamma_1 \sum_{i=1}^{n} LnPP_{ut} + U_{1t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{9})$$

$$\boldsymbol{LnLT_{rt} = \varphi_0 + \varphi_1 \sum_{i=1}^{n} LnLT_{ut} + U_{2t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (\mathbf{10})$$

Also, the urban price equation of pawpaw and leafy fluted pumpkin were specified in the similar manner as described above.

3. RESULTS AND DISCUSSIONS

3.1 Augmented Dicker Fuller Unit Root Test Results

The stationary status of prices of pawpaw and leafy fluted pumpkin was examined by the unit root tests. The Augmented Dicker Fuller (ADF) unit root test was used to ascertain the stationary of the specified price variables. The result of the tests is presented in Table 1. The result showed that, prices of pawpaw and leafy fluted pumpkin in the rural and urban markets were stationary at levels when compared with 1% critical value.

Table 1. Result of the Augmented Dicker Fuller unit root test for prices of pawpaw and leafy fluted pumpkin used in the analysis

Logged Variables	Augmented Dicker Fuller Test for unit root					
	With Constant			Constant and Trend		
	Level	1st diff.	OT	Level	1st diff.	OT
$\boldsymbol{Ln}PP_{rt}$	-4.169***	—	1(0)	- 6.686***	—	1(0)
$\boldsymbol{Ln}PP_{ut}$	-3.998***	—	1(0)	-6.542***	—	1(0)
$\boldsymbol{Ln}LT_{rt}$	-4.893***	—	1(0)	-7.424***	—	1(0)
$\boldsymbol{Ln}LT_{ut}$	-3.630***	—	1(0)	-5.940***	—	1(0)
1% (CV)	-3.49	-3.50		-4.05		

*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 pawpaw and leafy fluted pumpkin can be specified at their levels without the risk of obtaining spurious regression. Also, the result indicates that, the co-integration and Error correction test will be inappropriate to apply to the data set. The result obtained for the specified variables is similar to the research results reported by several researchers on different food stuffs in Nigeria. They include; Okoh *and* Egbon [19,23,15].

3.2 Descriptive Analysis of monthly Prices of pawpaw and leafy Telfairia (Fluted pumpkin) in Akwa Ibom State (From January 2005 to June 2013)

The descriptive statistics of the price variables used in the analyses is shown in Table 2. The average price of pawpaw was ₦137.43/kg and ₦145.81/kg in the rural and urban markets respectively in the study area. Also, the average price of leafy pumpkin stood at ₦70.09/kg and ₦78.24/kg in rural and urban markets respectively. These findings revealed that, there might be significant deviations or differences between the rural and urban price of pawpaw and leafy Telfairia (fluted pumpkin) in the study area. The paired t-test estimated for the rural and urban price of pawpaw and leafy fluted pumpkin revealed that, the calculated t-test value was 5.888 and 3.044 (significant at 1% probability level) for the respective price pair. The calculated standard deviations of 62.095 and 60.672 for the price of pawpaw in the rural and urban markets respectively indicate that, changes in both prices assume similar patterns during the study period. Similar result was discovered for the fluted pumpkin. In addition, the coefficient of variability in price of pawpaw in the rural and urban markets was 45.20% and 41.60% respectively. For leafy fluted pumpkin, it stood at 41.70% and 33.20% for the rural and urban markets respectively. The finding showed that, the rural prices of pawpaw and leafy *Telfairia* exhibited higher variations compared to their respective urban price. Furthermore, the average linear growth rate in the price of pawpaw in the rural and urban markets were 6.15% and 3.90% respectively. Similarly, the price of leafy fluted pumpkin grew at the rate of 10.11% and 4.48% in the rural and urban markets respectively.

The exponential trend equations for each of the price variables used in equation 3 is presented in Table 3. The estimated regression results for each of the price variables is followed by the calculated exponential growth rate and the conclusion derived from the respective long run linear quadratic trend equation. The result revealed that, the exponential trends in price of pawpaw and leafy *Telfairia* in rural and urban markets showed positive significant relationship with time in the study area. This implies that, changes in price of pawpaw and leafy *Telfairia* in the rural and urban markets is influenced by time variable. Prices of pawpaw in the rural and urban market have exponential growth rates of 0.96% and 0.75% respectively. In the similar way, about 1.04% and 0.99% exponential growth rate was

identified in the rural and urban prices of leafy *Telfairia*. These findings suggest that, there are noticeably dispersions between the rural and urban prices of pawpaw and leafy *Telfairia* in the rural and urban markets of the study area. The result suggests that, there is possibility of market integration between the rural and urban prices of pawpaw and leafy *Telfairia* in the study area. The nature of the linear quadratic growth in each price variable investigated revealed that, over time the price of pawpaw and leafy *Telfairia i*n the rural and urban markets showed significant marginal increase. This implies that, prices of pawpaw and leafy *Telfairia in* the rural and urban markets witnessed significant marginal increase over increase period of time. These results are in agreement with the research report of Amusa, [21] who asserted that, agricultural commodity prices experienced increase and fluctuations over time in Nigeria. Akpan et al., [15] also attested to this result on grain food stuffs in the southern Nigeria.

Table 2. Descriptive Statistics of pawpaw and leafy Telfairia used in the study

Parameters	Pawpaw Price		Leafy fluted pumpkin Price	
	Rural Market (₦/Kg)	Urban Market (₦/Kg)	Rural Market (₦/Kg)	Urban Market (₦/Kg)
Mean	137.43	145.81	70.090	78.238
Median	119.08	130.54	66.470	74.870
Minimum	19.23	63.00	29.820	44.000
Maximum	310.92	329.05	156.10	156.00
Standard deviation	62.095	60.672	29.241	25.985
Coefficient of Variation	0.452	0.416	0.417	0.332
Skewness	0.796	0.850	0.896	0.859
Kurtosis	-0.039	0.028	0.276	-0.074
Average Growth rate (%)	6.151	3.900	10.110	4.479

Source: Akwa Ibom Agricultural Development Programme (AKDEP), 2013. Table is computed by authors, and prices are expressed in nominal terms

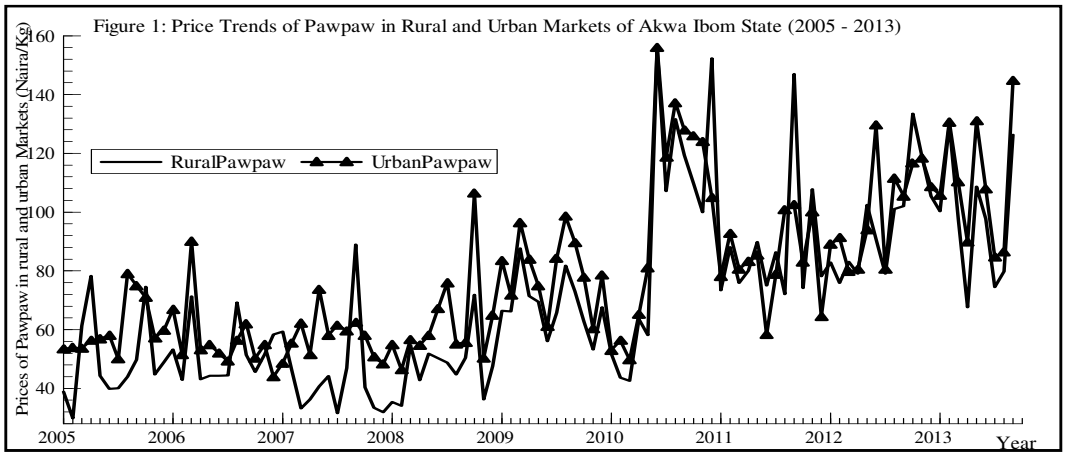
3.3 Exponential Trend Analysis of Prices of pawpaw and leafy *Telfairia* in Rural and Urban Markets of Akwa Ibom State

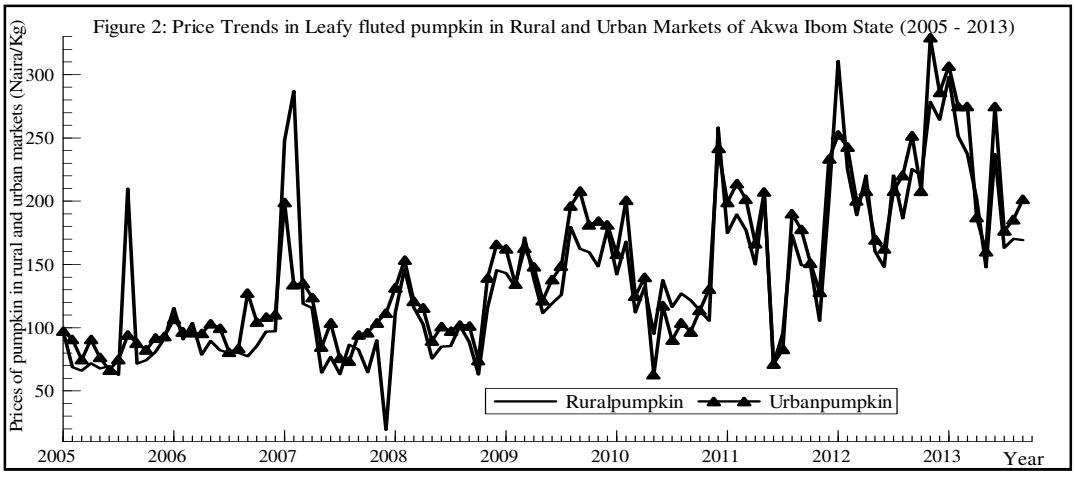
Table 3. Exponential Trend and linear quadratic trend estimates of Monthly Average pawpaw and leafy Telfairia in Rural and Urban Markets in Akwa Ibom State (2005 to 2013)

Variables	$LnPP_{rt}$	$LnPP_{ut}$	$LnLT_{rt}$	$LnLT_{ut}$
Constant	3.661(66.28)***	3.916(90.63)***	4.274(63.18)***	4.382(82.54)***
Time	0.009(10.59)***	0.007(10.48)***	0.010(9.31)***	0.009(11.27)***
F- cal.	112.080***	109.915***	86.641***	126.994***
R-square	0.521	0.516	0.457	0.552
Exponential GR (%)	0.962	0.745	1.037	0.985
Nature of Growth Rate				
Constant	42.736(6.80)***	54.127(9.73)***	87.290(6.37)***	88.024(7.34)***
Time (b_1)	0.225(0.82)	0.185(0.77)	0.144(0.24)	0.333(0.64)
Time (b_2)	0.004(1.66)*	0.004(1.73)*	0.011(2.09)**	0.011(2.21)**
F- cal.	49.359***	50.124***	44.000***	67.399***
R-square	0.492	0.496	0.463	0.569
Inference	significant GR	significant GR	Significant GR	Significant 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 graphically representation of the linear price trend in pawpaw and leafy Telfairia from January 2005 to September 2013, is shown in Fig. 1 and 2 respectively. The price trends show undulated fluctuations throughout the study period. In Fig. 1, the rural and urban price of pawpaw seems to move together in most part of the year. However, both prices exhibited similar pattern of fluctuations throughout the study period. The result implies that, the rural and urban prices of pawpaw move together in most periods during investigation. Similarly, in Fig. 2, the linear trend in price of leafy Telfairia in the rural and urban markets of the study area revealed undulated fluctuations during the period of investigation. The pattern of fluctuations in both prices was similar. However, a sharp dispersion between the rural and urban of leafy Telfairia price occurs in February, 2007. It was discovered that, prices of pawpaw and leafy Telfairia assume similar pattern of fluctuations in most part of the period under consideration. Hence, following this nature of fluctuations in the price of pawpaw and leafy Telfairia in the rural and urban markets of the study area; it is suggested that, there is a strong evidence of symmetric price transmission mechanism or market integration between the two prices.





3.4 Pearson correlation matrix of Monthly Prices of pawpaw and leafy Telfairia (Expressed in ₦/Kg) in Rural and Urban Markets in Akwa Ibom State, Southern Nigeria

The linear and symmetric relationship between the rural and urban average monthly market price of pawpaw and leafy *Telfairia* in Akwa Ibom State was established by the use of Pearson correlation coefficients. Table 4 presents the correlation matrix of the rural and urban prices of pawpaw and leafy Telfairia from January 2005 to September 2013 in Akwa Ibom State, Southern Nigeria. The result indicates that, prices of pawpaw and leafy Telfairia in the rural market have positive significant (at 1% probability level) linear relationship with their corresponding prices in the urban markets. This means that, the price of pawpaw in the rural market has a strong linear relationship with its own price in urban market in the study area. The same result was also obtained for the leafy fluted pumpkin market in the study area. These results further provide strong support for the existence of price integration and efficient price transmission mechanism between the rural and urban markets for pawpaw and leafy *Telfairia* in the study area. This result implies that, factors that influence price of pawpaw and leafy *Telfairia* marketing in the rural markets are likely similar to those presence in the urban markets in the study area.

Table 4. Pearson correlation matrix for prices of pawpaw and leafy Telfairia in Rural and Urban Markets in Akwa Ibom State (2005 - 2013)

Variables	PP_{rt}	PP_{ut}	FT_{rt}	FT_{ut}
PP_{rt}	1.000	0.875 ***	0.518***	0.518***
PP_{ut}		1.000	0.473***	0.474***
LT_{rt}			1.000	0.895***
LT_{ut}				1.000

Note: variables are as expressed in equation 3. Asterisk means significant at 5% probability level. 5% critical value (two-tailed)=0.1918 for n=105

3.5 Bilateral Granger Causality Test for Prices of Pawpaw and leafy Telfairia in the Rural and Urban Markets of Akwa Ibom State (2005 - 2013)

The causality relationship between the rural and urban prices of pawpaw and leafy Telfairia was tested in the study area. The result of the analysis is presented in Table 6. The result in Table 5 shows the optimal lag period used in the 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 5. The optimal Lag length for the causality equation

Lag	Loglikelihood	P(LR)	AIC	BIC	HQC
1	30.813	-	-0.408*	-0.151*	-0.304*
2	31.219	0.937	-0.338	0.023	-0.192
3	35.372	0.081	-0.341	0.123	-0.153

Source: From data analysis

The corresponding lag length indicates the best lag length for generating a more parsimonious causality equation for the specify price 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 bilateral Granger causality estimates are presented in Table 6.

Table 6. The vector autoregressive regression Granger causality estimates

Hypotheses	Lag	Sample size	F-Statistic	Prob.	Decision
$LnPP_{rt}$ does not Granger Cause	1	104	45.356	0.000***	Rejected
$LnPP_{ut}$	1	104	45.004	0.000***	Rejected
$LnPP_{ut}$ does not Granger Cause $LnPP_{rt}$					
$LnLT_{rt}$ does not Granger Cause	1	104	72.641	0.000***	Rejected
$LnLT_{ut}$	1	104	46.087	0.000***	Rejected
$LnLT_{ut}$ does not Granger Cause $LnLT_{rt}$					

Note: Variables are as defined in equation 3

The result presented in Table 6 revealed that, bi-directional Granger causality associations exist between the urban and rural price of pawpaw and leafy Telfairia from January 2005 to September 2013 in the study area. This result means that, the rural price of pawpaw and leafy *Telfairia i*s strongly endogenous to its respective urban price. The result also means that, the Granger causality runs from urban market to the rural market and vice versa. Alternatively, the result implies that, the urban price of pawpaw and leafy Telfairia impacted positively on their respective rural prices; and in the same manner the rural price of pawpaw and leafy *Telfairia* influence their respective urban prices. In the related way, the previous price of pawpaw and leafy Telfairia in urban market significantly predicted the current respective price in the rural market in the study area. The presence of the bi-directional Granger Causality between the rural and urban price of pawpaw and leafy Telfairia indicated that, there is efficient price transmission mechanism and strong market integration evidence between the two markets in the study area. Following this result, the flow of markets information between the rural and urban markets concerning the pawpaw and leafy Telfairia could be described as symmetric.

The result further suggested that, the rural and urban prices of pawpaw and leafy Telfairia might be tight together in the long run and the effect of transfer cost not significantly felt by participants. Based on the magnitude of the diagnostic statistics, it appears that, both rural and urban market play significant but equal role in the marketing of pawpaw in the state. There is no clear lead or driving market between the rural and urban market in the marketing chain of pawpaw in the state. This result can be attributed to the fact that, pawpaw is highly perishable, as such farmers must have to dispose it at any cost to avoid spoilage. The result for the leafy fluted pumpkin shows that, the rural market is the stimulant or the lead market in this commodity marketing in the study area. This perhaps suggests the increasing importance of domestic production of leafy *Telfairia* in the study area. The overall bilateral Granger causality test for prices of pawpaw and leafy Telfairia suggests the presence of high degree of market integration, efficient price transmission and strong endogeneity characteristic in prices of these commodities in the rural and urban areas. This result corroborates reports of Okoh and Egbon [19] and Adeoye et al., [22] for different food stuffs in western Nigeria. Akpan et al., [15] also confirm the similar relationship in grains in southern Nigeria.

3.6 Regression Estimates for the Law of one Price (LOP) for Prices of pawpaw and Leafy Telfairia in the Rural and Urban Markets of Akwa Ibom State, Southern Nigeria

The result in Table 7 and Table 8 present the regression estimates to test the law of one price in the pawpaw and leafy Telfairia markets in the study area. Results in Table 7 contain the rural and urban price equation estimates for pawpaw in the study area. The R-squares for the rural price equation of pawpaw is 0.742. This implies that, about 74% of the total variability in the rural price of pawpaw is explained by its respective urban price. The result also applied to the urban price equation of pawpaw. The F-statistics for the two equations is 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 pawpaw indicated that, the price transmission between the rural and urban markets exhibited high and near perfect long run integration. This is because; the integration coefficient (or elastic coefficient) was around unity (i.e. 1.106). These results give a strong evidence of long run price or market integration between the rural and urban market prices of pawpaw in the study area.

Table 7. Law of one price regression estimates for prices of pawpaw in the Rural and Urban markets of Akwa Ibom State (2005 – 2013)

Variable	$LnPP_{rt} = f(LnPP_{ut})$ (Pawpaw)	Variable	$LnPP_{ut} = f(LnPP_{rt})$ (Pawpaw)
Constant	-0.599 (-2.16)**	Constant	1.515 (9.28)***
$LnPP_{ut}$	1.106 (17.20)***	$LnPP_{rt}$	0.670 (17.20)***
F-cal	295.859***	F-cal	295.859***
R^2	0.742	R^2	0.742
DW- test	1.576	DW- test	1.569

*Note: Values in bracket represent t-values. The asterisk ** and *** represents 5% and 1% significance level respectively. Variables are as defined in equation 3*

The result for the urban price equation of pawpaw also shows a strong and significant indication of the law of one price. However, the coefficient of the long run market integration (inelastic coefficient) was far from unity. This means that, the long run market integration coefficient for the urban price equation of pawpaw is weaker than the rural price equation. The magnitude of market integration coefficient for pawpaw suggests that, the urban price impact on the rural price is more efficient relative to the rural price impact on urban price in the study area. Hence, the market integration in pawpaw is stronger when market information flow from urban to rural markets compared to the reverse case in the study area.

Similarly, results in Table 8 contain the rural and urban price equation estimates for the leafy fluted pumpkin in the study area. The R-square value is 0.73, and it implies that, about 73% of the total variability in the rural price of leafy fluted pumpkin is explained by its respective urban price. The same result applied to the urban price equation of leafy fluted pumpkin. The F-statistics for both equations is significant at 1% probability level; thus confirming the significant of the estimated R-squares. The estimated rural price equation of leafy fluted pumpkin indicated that, the price transmission between the rural and urban markets exhibited strong significant long run market integration relationship. The integration coefficient (or inelastic coefficient) was approximately unity (i.e. 0.986). These results give a good evidence of a long run price or market integration between the rural and urban market price of leafy fluted pumpkin in the state. The result for the urban price equation of the leafy

fluted pumpkin also revealed a significant long run market integration coefficient. However, it long run market integration (inelastic coefficient) coefficient was far from unity.

Table 8. Law of one price regression estimates for prices of leafy Telfairia in the Rural and Urban markets of Akwa Ibom State (2005 – 2013)

Variable	$LnLT_{rt} = f(LnLT_{ut})$ (leafy fluted pumpkin)	Variable	$LnLT_{ut} = f(LnLT_{rt})$ (leafy fluted pumpkin)
Constant	-0.012(-0.04)	Constant	1.351(6.26)***
$LnLT_{ut}$	0.986(16.53)***	$LnLT_{rt}$	0.736(16.53)***
F-cal	273.332***	F-cal	273.332***
R^2	0.726	R^2	0.726
DW- test	1.755	DW-test	1.455

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

3.7 Discussion

The rural and urban price equations for pawpaw however confirm the presence of significant market integration between the urban and rural price; but it failed to uphold instantaneous response of the urban price to rural price shock. This result indicates that, there might be some mounted externality costs in the marketing of pawpaw in the rural market of the study area. Comparing the two price equations for pawpaw, the long run market integration coefficient for the rural price equation is stronger than the urban price equation. This is because the market integration coefficient in the rural price equation is closer to unity than the urban counterpart. Based on the magnitude of the market integration coefficient in the rural and urban price equation of pawpaw, it is suggested that, the urban price impact on the rural price is more and efficient relative to the reverse situation in the study area. Hence, the long run market integration in pawpaw is stronger when market information or activities flow from the urban market to the rural market compared to the opposite case. The result provided additional evidence that, the urban market is the driver or the lead market in the marketing of pawpaw in Akwa Ibom State.

The empirical results for the rural and urban price equation of leafy fluted pumpkin revealed that, the coefficient of market integration were significant. This confirms the existence of high degree of long run market integration between the rural and urban price of leafy fluted pumpkin in the study area. The market integration coefficient in the rural price equation was approximately unity. This implies that, a shock imposed by the urban price of leafy fluted pumpkin is instantaneously transmitted to its corresponding rural price. This is conceivable when considering the flow of market information from urban to rural market. Also, the degree of market integration in the urban price equation of leafy fluted pumpkin was far from the threshold mark of unity. Although this also confers high degree of long run market integration, but is not as efficient as compare to the rural price equation. This result is tenable when market activities flow from rural to urban areas. It therefore implies that, when leafy fluted pumpkin marketing activities is stimulated by the rural market, the degree of market price transmission is slower or less efficient than the reverse case in the study area.

Based on the finding, it is suggested that, there are some levels of inefficiency in pawpaw and leafy fluted pumpkin market information transmission in the rural markets of the state. This result could be connected to the poor or inefficient marketing and social infrastructures in the rural areas of the state where most of the pawpaw and leafy fluted pumpkin are produced. Following the result obtained from the rural and urban price analysis of pawpaw

and leafy fluted pumpkin in the study area; it is established that, in the long run, the price of pawpaw and leafy fluted pumpkin in the rural markets will synchronize faster with that of the urban market if marketing shock emanated from the urban areas. On the other hand, if the marketing shock came from the rural area, the price transmission of pawpaw and leafy fluted pumpkin will not attain high level of efficiency as compared to the reverse case. Similar results on the long run relationships on agricultural commodities price transmission and market integration have been established by Okoh *and* Egbon [19]; Ojiako et al., [23] and Akpan et al. [15].

4. Summary and Recommendations

The study used statistical and econometric techniques to analyze the dynamic of price transmission between the rural and urban prices of pawpaw and leafy fluted pumpkin in Akwa Ibom State, Southern Nigeria. Results revealed that, prices of pawpaw and leafy fluted pumpkin in the rural and urban markets have positive relationship with time and exponential growth rates that is less than unity in pawpaw, but greater than unity in the rural price of leafy fluted pumpkin. The graphical analyses substantiate the trend equation results. The result of the trend analysis suggested the prevalence of good and efficient price transmission mechanism between the rural and urban market of pawpaw and leafy fluted pumpkin in the study area. Also, the Pearson correlation coefficient matrix revealed that, the rural price of pawpaw and leafy fluted pumpkin has linear symmetric relationships with their corresponding urban prices in the study area. The relationship was stronger in leafy fluted pumpkin than in pawpaw market. The result connotes the existence of the symmetric market information flow between the rural and urban markets for pawpaw and leafy fluted pumpkin in the state. The Granger causality test revealed bi-directional relationship between the rural and urban price of pawpaw and leafy fluted pumpkin in the study area. This suggested that, the price transmission mechanism between the rural and urban markets for pawpaw and leafy fluted pumpkin is efficient; and has high tendency for market integration as well as strong endogeneity properties.

The result for the test of the law of one price between the rural and urban price of pawpaw and leafy fluted pumpkin revealed the presence of the long run market integration relationship between the rural and urban prices of pawpaw and leafy fluted pumpkin and also upheld the hypothesis of the efficient or fast price transmission between the two markets in the study area. The results also attested to the presence of varied long run market integrations between the rural and urban market of pawpaw and leafy fluted pumpkin depending on the direction of flow of the market information or activities. This means that, the rural and urban price equation of pawpaw and leafy fluted pumpkin exhibited vary degrees of long run market integration as well as convergence to the law of one price.

Based on the discoveries of this study, it is recommended that, the Akwa Ibom State government should continue to make available marketing infrastructures especially in the rural areas to improve the symmetric nature of information among pawpaw and leafy fluted pumpkin markets in the state. Effort should also be channeled by all stake holders such as governments, trade unions, market unions and other organizations to reduce excessive externality costs (i.e. storage cost, transportation cost, toll gate, law enforcement charges) associated with the marketing of pawpaw and leafy fluted pumpkin. This attempt will help to reduce the total variable cost and bring about insignificant price differential between the rural and urban markets in the state. The government of Akwa Ibom State should established market information centers and awareness programmes on mass media (such as radio,

television and newspaper), to facilitate efficient communication and flow of information among pawpaw and leafy fluted pumpkin producers and consumers in the state.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ndor ES, Dauda N, MN. Garba. Growth and Yield Performances of Fluted Pumpkin (*Telfairia occidentalis* Hook F.) under Organic and Inorganic Fertilizer on Ultisols of North Central Nigeria. International Journal of Plant & Soil Science. 2013;2(2):212-221.
2. Dalziel JM. The useful plants of West Tropical Africa. Crown agents for the colonies. West Minsters, London. S.W. 1937;64-65.
3. Aletor O, Oshodi AA, Ipinmoroti K. Chemical composition of common leafy vegetables and functional properties of their leaf protein concentrate. Food Chemistry. 2002;78:63-68.
4. Tindal HD. Vegetables in the Tropics: Macmillan Education Ltd. Houndmills, Hampshire. 1986;533.
5. Badifu GI. Ogunsua AO. Chemical composition of kernels from some species of cucurbitacea grown in Nigeria. Plant Food Human Nutrition. 1991;41:35-44.
6. Ifeoma ON, Akoroda M, Odiaka EC. Diversity and production methods of fluted pumpkin (*Telfairia occidentalis* Hook F.); Experience with vegetable farmers in Makurdi, Nigeria. African Journal of Biotechnology. 2008;7(8);944-954.
7. Okoli BE. Morphological and cytological studies in *Telfairia* Hook (*Cucurbitaceae)* Feddes Repertorium. 1987;98:9-10.
8. Oloyede OI. Chemical profile of unripe pulp of Carica papaya. Pakistan Journal of Nutrition. 2005;4,379-381.
9. World Health Organization (WHO). Dietary intake of fruits and vegetables and risk of diabetes mellitus and cardiovascular diseases, WHO report Geneva; 2005.
10. Van Duyn M, Pivonka AE. Overview of the health benefits of fruit and vegetable consumption for the dietetics professional. J Am Diet Assoc. 2000;99(10):1241.
11. Famine Early Warning Systems Network (FEWSNET). Nigeria Food Security Outlook March to September; 2008.
12. Idah PA, Ajisegiri SA, Yisa MG. Fruits and Vegetables Handling and Transportation in Nigeria AU J.T. 2007;10(3):175-183.
13. Gilbert C. Commodity risk management for developing countries: paper prepared for the third meeting of the international task force (ITF) held in Geneva 23-24 June; 1999.
14. Adebusuyi BS. Stabilization of commodity market of interest to Africa: Paper presented at the workshop on constraints to growth in sub-Saharan Africa, held in Pretoria South Africa; 2004.
15. Akpan, SB, Inimfon VP, Samuel JU. Analysis of Monthly Price Transmission of Local and Foreign Rice in Rural and Urban Markets in Akwa Ibom State, Nigeria (2005 to 2013). International Journal of Agriculture and Forestry. 2014;4(1):6-18.
16. Akpan SB, Ini-mfon V, Samuel J, Udoro JU. Monthly Price Analysis of Cassava Derivatives in Rural and Urban Markets in Akwa Ibom State, Southern Nigeria. Agricultural Science. 2014;2(1):48-68.

17. Polaski S. Rising Food Prices, Poverty and Doha Round. Carnegie Endowment for International Peace; 2008.
18. Goodwin BK. Spatial and Vertical Price Transmission in Meat Markets. A Paper prepared for workshop on Market Integration and Vertical and Spatial Price Transmission in Agricultural Markets, University of Kentucky, April 21; 2005.
19. Okoh RN, Egbon PC. The Integration of Nigeria's Rural and Urban Food stuffs Markets. AERC Research Paper 151, Africa Economic Research Consortium, Airobi; 2005.
20. Goodwin BK, Schroeder TC. Cointegration tests and spatial price linkages in regional cattle markets. American Journal of Agricultural Economics. 1991;73(2):452-464.
21. Amusa AM. Trend Analysis of Agricultural Food Prices in Nigeria. (1985-1995) (ACase Study of Ibadan). Unpublished M. Sc Project, Department of Agricultural Economics University of Ibadan, Ibadan, Nigeria; 1997.
22. Adeoye IB, Dontsop Nguezet PM, Badmus MA, Amao IO. Price Transmission and Market Integration of Banana and Plantain in Oyo state, Nigeria. ARPN Journal of Agricultural and Biological Science. 2011;(6)5:18-24.
23. Ojiako IA, IA Chuma E, Godwin N, Nkang ANM. Spatial Integration and Price Transmission in Selected Cassava Products' Markets in Nigeria: A Case of Lafun. World Applied Sciences Journal. 2012;18 (9):1209-1219.
24. National Population Council (NPC) of Nigeria, Population Census Data; 2006.
25. Akwa Ibom State Agricultural Development Programme (AKADEP), quarterly physical progress reports of various issues from January 2005 to June; 2013.
26. Akpan SB. Relative Price Variability and Inflation: A case study of Grain subsector in Nigeria. Unpublished Master Degree Thesis; University of Uyo; 2007.
27. Adenegan KO, IB Adeoye. Price Analysis of Tomato in Rural and Urban Retail Markets of Oyo State. International Journal of Agricultural Economics & Rural Development. 2011;4(2):90–96.
28. Odozi JC, Bolarin TO. Governance options for price instability: A review of the food grain commodity in Nigeria. Journal of Development and Agricultural Economics. 2012;4(4):93-100.
29. Granger CW. J. Investigating causal relations by econometric models and Cross-spectral methods. Econometrica. 1969;37:424-438.
30. Baumöhl E. and Tomáš Výrost. Stock Market Integration: Granger Causality Testing with Respect to Non-synchronous Trading Effects. Finance aúvěr *Czech* Journal of Economics and Finance. 2010;60(5):414-425.
31. Hendry DF. 'The Role of Prediction in Evaluating Econometric Models', Proceedings of the Royal Society of London. 1986;407:25–34.
32. Chirwa EW. Food Marketing Reforms and Integration of Maize and Rice Markets in Malawi. University of Malawi. Working Paper, No. WC/05/99; 1999.
33. Sexton RJ, CL Kling HF. Carman. Market integration, efficiency of arbitrage, and imperfect competition: Methodology and application to U.S. celery. American Journal of Agricultural Economics. 1991;73(3):568-580.
34. Gonzalez-Rivera G, Helfand S. The Extent, Pattern and Degree of Market Integration: A Multivariate Approach for the Brazilian Rice Market. American Journal of Agriculture Economics. 2001;83(3):576-92.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sciencedomain.org/review-history.php?iid=539&id=2&aid=5003