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Maize Prices and Market Integration in Selected Markets in Gombe State, Nigeria

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ABSTRACT
This study was designed to analyze price of maize and market integration in rural and urban maize markets in Nigeria using evidence from Gombe State. . Secondary data on maize price spanning 2010 –2015 were sourced from Gombe State Agricultural Development Programme . The data were analyzed using Augmented Dicker Fuller (ADF) test and Indices of market concentration were also used to measure the degree of market integration. Unit Root Test showed that rural and urban prices were stationary at first differencing and were integrated of the order zero, 1(0). Maize markets in the study area were integrated but the level of integration was low. The results also revealed that prices of maize were stationary at their level. Urban maize market does not granger cause rural maize market (P > 0.05), while rural maize market granger cause urban tomato market (P< 0.05). None of the market links exhibited bi -directional granger causality or simultaneous feedback relationship. The Index of market connection (IMC) indicates that the markets exhibit low short run market integration. It is recommended that there should be efficient flow of information, good access road and infrastructural development to improve market performance.
Keywords: Maize, Urban and Rural Market, Gombe State, price transmission and co-integration

1.0 INTRODUCTION

Efficient agricultural marketing is essential for the satisfaction of producers and consumers, as well as production and consumption. Agricultural marketing assumes greater importance in an economy when excess production from farms are disposed of in order to earn income with which farmers can purchase goods and services not produced by them (Adenegan, Adeoye and Ibidapo, 2012). Prices are the most readily available and reliable information that guide farmers' planting decisions in Nigeria. A farmer's planting decisions depend on anticipated profits which in fact depend on anticipated prices of planted crops. This has made prices an important tool in the economic analysis of markets (Odozi and Bolarin, 2012).

Market price is a major endogenous determinant of supply and demand for agricultural product. Prices are signals that direct and coordinate not only the production and consumption decisions but also the marketing decisions over time, form, and space (Akpan, Ini-mfon and Udoka, 2014). The magnitude of market or retailed price of rice serves as a signal to relative scarcity or abundance of the commodity at a particular time and place. Price differential among markets also serve as incentive to allocate resources among spatial markets. Consequently, prices of agricultural products varies from month to month; region to region and even from day to day, due to problems associated with seasonality, poor storage, consumer preference and marketing cost among others(Ghosh, 2011).

Agricultural commodity price fluctuations and deviations among markets are normal phenomena across Nigeria. Many consumers do not have price information on agricultural commodities in various retail markets in Nigeria which might be responsible for exploitation due to insufficient price statistics. Spatial Market Integration refers to co movements of prices, and more generally, to the smooth transmission of price signals and information across spatially separated markets (Obayelu, & Salau, 2010). Links among spatially separated market will lead to efficient price formation and market integration could be perfect if price changes in one market are fully reflected in the alternative markets (Debaniyu, 2013). Previous studies in the marketing and pricing of staple food stuffs in different parts of Nigeria have concluded that the marketing and price information transmission

mechanism are inefficient although there are many buyers and sellers in the market(Jonah, Nnamdi, Folarin and Adewumi, 2014).

Maize is one of the staples widely grown in Nigeria and has its significance as a source of large number of industrial products besides its uses as human food and animal feed. It is an important source of carbohydrate, protein, iron, vitamin and minerals. Maize produced in Nigeria was 7.6 million tons in 2012/2013 of which 1.7 million tons were used for feed production (USDA Foreign Agricultural Science, 2013).

Despite the importance of prices in the allocation of resources, it is not too clear what role prices play in the allocation of resources in Nigeria's agriculture and in particular the marketing of maize. Furthermore, the factors that explain maize price levels and variations in time and space are generally unclear. In addition, the relationship between the maize prices both at the farm gate and retail levels is also not clear. Moreover, the connection between maize prices both at the rural and urban markets remains to be explored. Some of these issues constitute the focus of this study. There is a rising demand in prices of maize grain owing to its use as an important raw material in the animal feed, food and beverage industries. To this end, there is need to examine the market integration of the various maize markets. The main objective of the study is to examine the extent of market integration between the rural and urban prices for maize and determine the efficiency of information flow or price transmission between rural and urban markets in Gombe State.

2.0 RESEARCH METHODOLOGY

2.1. Study Area and Data Source

The study was conducted in Gombe State is one of the 36 states of the Federal Republic of Nigeria with 11 Local Government Areas, located in the centre of the north east of the country on latitude 9"30' and 12"30'N, Longitude 8"5'and 11"45'E. It is bordering Borno, Yobe, Adamawa, Taraba, and Bauchi states. The State occupies a total land area of about 20,265sqkm. The State climate is generally warm, with temperatures not exceeding 300c during the months of March-May considered to be the hottest months. It is mostly an agrarian state and the major crops grown are Maize, Sorghum, Millet, Cowpea etc. The major languages spoken are Hausa, Fulfulde, Tangale, Tera, Waja, and Kanuri

3.0 Methods of Data Analysis

The analytical methods used are unit root test, co integration and granger causality test.

3.1 Test of Stationarity - This was carried out to check for stationarity of the variables or price series using Augmented Dickey fuller test. A price series is stationary if its mean and variance are constant over time. Long time will take up to 30 years. Non stationary stochastic series have varying mean or time varying variance. The price series in this study were first tested for stationarity. The purpose was to overcome the problems of spurious regression. The augmented Dickey Fuller (ADF) was adopted to test for stationarity. This involves running a regression of the form:

$$\Delta P_{it} = \delta P_{t-1} + \sum_{i=1}^{P} \beta 1 \Delta P_{t-} \text{ ----------1}$$

Δ= first difference operator,

∂=0 implies the existence of a unit root in P_{it} or that the price series is non-stationary

i = commodity price series, i.e. maize,

t = time indicator,

e_{it} is the error term .

The process is considered stationary if $/\delta/ < 1$ thus testing for stationarity is equivalent with testing for unit roots ($(\delta) < 1$ Therefore:

H_o: $\delta = 0$ the price series is non stationary or existence of unit root

H_1 : $\delta < 0$ the price series is stationary

3.2 Test of Co integration - Johansen Tests were carried out using a linear deterministic trend in order to know the number of co integrating vectors. The Johansen testing procedures have the

advantage that they allows for the existence of more than one co integrating relationship (vector) and the speed of adjustment towards the long-term equilibrium is easily determined (Bakucs and Ferto, 2005).

The model is presented thus:

$$\Delta X_t = \mu_t + \sum_{ii=1}^{K} \Gamma X_{t-1} + \Pi X_{t-k} + \xi_t \quad \text{----------2}$$

Where:

Xt = an n x 1 vector containing the series of interest (tomatoes spatial price series),

Γ and Π = matrices of parameters, K = number of lags, and should be adequately large enough both to capture the short-run dynamics of the underlying VAR and to produce normally distributed white noise residuals,

ε_t = vector of white noise errors.

The Johansen test will give an insight into the number of estimation equations to be fitted. The presence of one co-integration relationship is necessary for the analysis of long run relationship of the prices to be plausible.

3.3 Granger Causality Tests – The Granger causality test was carried out to determine the direction of causality. When two price series are co-integrated and stationary, one may proceed to carry out the granger causality test. This is because one granger causal relationship must exist in a group of co integrated series (Chirwa, 2000). When Granger causality run one way (uni- directional), the market, which Granger-causes the other is tagged the exogenous market. Exogeneity can be weak or strong. Hendry (1986) observed that weak exogeneity occurs when the marginal distribution of $P_{i\,(t-1)}$ and $P_{j(t-1)}$ was significant, while strong exogeneity occurs when there is no significant Granger-causality from the other variable. It could also be bi-directional which indicates that both series influence each other (X causes Y, and Y also causes X). The Granger model used in this study can be represented by:

$$\Delta P_{it} = \sum_{i=1}^{m} a_j \Delta P_{j(t-1)} + \xi_i \quad \text{----------3}$$

Where m and n are the numbers of lags determined by a suitable information criterion.

Rejection of the null hypothesis indicates that prices in market, j Granger-cause prices in market i.

3.4 Index of Market Concentration Analysis

Index of Market concentration (IMC) is used to measure price relationship between integrated markets and following formula was used to calculate IMC:

$P_t = \beta_0 + \beta_1 P_{t-1} + \beta_2(R_t - R_{t-1}) + \beta_3 R_{t-1} + e_t$

Where:

R_t = Urban or reference price

P_t = Rural price

R_{t-1}= Lagged price for urban markets.

$R_t - R_{t-1}$ = Difference between urban price and its lag

e_t = error term or unexplained term.

B_0 = constant price

B_1 = coefficient of rural lagged price

B_2=coefficient of $R_t - R_{t-1}$

B_3 = coefficient or urban lagged price

$IMC = \beta_1/\beta_3$ where $0 \leq IMC \leq \infty$

where

IMC < 1 implies high short run market integration

IMC > 1 implies low short run market integration

IMC = ∞ implies no market integration

IMC = 1 high or short run market integration.

4.0 RESULTS AND DISCUSSION

4.1 Stationarity test of Maize prices in Gombe State

The result (Table 1) shows the stationarity test for maize using ADF procedure. The results indicate that all the variables are stationary at their level. Therefore, the null hypotheses of non-stationary were rejected for all the variables at their level. This did not conform to the findings of Alexander and Wyeth (1994), Chirwa (2000), Yusuff *et al* (2006) that commodity prices are stationary at the order of first difference. Thus, the test of co integration could be applied as all the maize price data series were integrated of the same order, i.e. I(1) and did not have unit root.

Table 1: ADF test results for rural and urban prices of Maize

Variable	ADF at levels	ADF at first difference	Remarks
Rural Price	-3.79**	-9.43***	Stationary at level
Urban Price	-5.37***	-12.67***	Stationary at level

** Sig at 5% *** Significant at 1%.

4.2 Co integration and Granger Casualty Test for Maize

In Table 2, the maximum Eigen value test shows that the two maize market pairs investigated are co-integrated at 1% level of significance. The trace test shows that the maize market pairs are co-integrated at 1% level of significance. Therefore using the trace statistics, it could be inferred that the maize markets investigated are co-integrated of the order (1, 1). This is the proportion of maize market pairs which prices are tied together in the long run.

Table 2: Johansen tests for co integration for rural prices and urban prices of Maize

Rural and urban prices	Trace test	Max test
r = 0	44.72***	16.53***
r=≤1	17.84***	3.81***

***Sig at 1%

4.3 Granger causality test for Maize in Nigeria

Two maize market links were investigated for evidence of granger causality and the result is shown in table 3. From the result of the analysis, urban maize market price does not determine the rural maize market price. Although, rural maize market price determines the urban maize market price, none of the market links exhibited bi directional granger causality or simultaneous feedback relationship.

Table 3: Granger causality test results for Rural and urban prices of Maize

Variable	F-statistic	Probability
Urban does not granger cause rural	0.25841	0.67476
Rural does not granger cause urban	6.38177	0.00276***

***Sig at 1%

4.4 The indices of market concentration (IMC)

For maize prices in the rural and urban markets, the IMC obtained were 0.62. The IMC for these market pairs was less than one thus indicating high short run market integration. The result shows that price changes in the rural market does cause immediate change in the prices in the urban market.

4.5 CONCLUSION

The study examined price behavior in maize rural and urban markets in Gombe State, Nigeria. The trend analysis showed that the prices of maize in the markets studied moved in an upward trend from April to August of each year. This is due to the fact that prices were higher in those months compared

to other months of the year. The stationary test indicated that the prices were stationary at level form. The result of the granger causality test confirmed that rural prices of maize determine the urban prices in Gombe State.

4.6 POLICY RECOMMENDATIONS

Based on the results of the study, the following are recommended;

- There should be provision of market information centers to enhance adequate communication and flow of information between markets.
- The transportation system should be improved to ensure evacuation from the surplus market to the deficit/shortage market.
- Farmers should be provided with more price information in order to take advantage of spatial price differences.
- Also rural infrastructure that enhances competition among traders should be provided as this minimizes post-harvest losses and advantages of spatial price linkages can be achieved.

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