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ECONOMETRIC INVESTIGATION OF PRICE DIFFERENTIALS OF FRESH TOMATO AMONG SOME MAJOR RURAL AND URBAN RETAIL MARKETS IN KANO STATE, NIGERIA

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ABSTRACT

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The study investigated the price differentials of fresh tomato among some major rural and urban retail markets of Kano State, Nigeria. A total of 149 respondents were randomly selected from the four markets selected purposively due to the high concentration of retail marketers. Information was collected using structured questionnaire. Descriptive statistics, Time Series Decomposition, and Co-Integration were used for the analysis. Descriptive statistics revealed that 64% of fresh tomato retail marketers were within their productive age bracket having a mean marketing experience of 15 years. On the average 10 household members were dependents on a retail marketer and 87.2% of retail marketers attended at least primary school. The results of the Co-Integration techniques revealed that majority of the markets pairs were Co-Integrated. The study recommends that fresh tomato retail marketers need to improve their education status and the more experienced retailers should share their experiences, knowledge and ideas with younger ones for more profit and sustainability.

INTRODUCTION

Tomato (*Solanum lycopersicum*) is among the major vegetable crops grown in most parts of the world contributing significantly to the income and nutritive security of majority of the households as it accounts for about 18% of the average daily food consumption. It is however being viewed as a cash crop and among the priority vegetable crop listed in the current policy and strategy document, that is reviewed Agricultural Transformation agenda (Ayoola, 2016). It is widely cultivated by small scale farmer because of its special attributes; economically attractive, short duration and high yield (Weimberger & Lumpkin, 2007).

The demand for tomato in Nigeria is currently estimated at 2.3 million metric tons per annum and a total arable land of about 1,000, 000ha under tomato production, yielding an estimated output of about 1.8 million metric tons per annum (Ugonna et al., 2017). This placed Nigeria 16th on the global production and second largest in Africa (Adeolu&Taiwo, 2017). However, 50% of tomato produced is lost due to postharvest losses which are not unconnected with the poor food supply chain management, lack of good storage facilities and poorly developed marketing channels leading to excess demand gap (Central Bank of Nigeria, CBN, 2014).

In the same vein, Federal Ministry of Agriculture and Rural Development (FMA&RD) 2014 reported that about 105, 000 metric tons of tomato paste valued at about 16 billion naira is imported annually to bridge the demand gap.

Tomato consumption trend in Nigeria shows that between January and April supply of fresh tomato is high and the price could be as low as ₦760 (\$2) per basket thus consumers rarely use other tomato products. However, from April to September supply of fresh tomato drastically declines representing the off season during which consumers turn to other forms such as imported tomato paste. These changes result in fluctuation of prices of tomato products and affect consumption pattern. During this period, price of fresh tomato could shoot to as high as >=₦38, 000 (\$100) per basket.

The above scenario has been phenomenal for long but the worse scenario was in 2016, when the price of tomato skyrocketed by 400% within three months (May to July), as *Tuta Absoluta* destroyed the annual harvest, affecting tomato farms across Kaduna, Kano, Katsina, Jigawa and Plateau States of Nigeria (FMA & RD, 2015). Despite the fact that Nigeria was the 16th largest producer of tomato in the world and largest in Sub-Saharan Africa, the traders were compelled to import tomato from neighboring Chad, Burkina-Faso and Cameroon. It is in light of this incidence that the traders at the rural market started realizing that they are being offered a low price by the middlemen and these middlemen charged high price to the urban retail marketers. The middlemen explained that the price they charged urban retail marketers encompasses transportation cost and risk.

More so, unplanned production resulting to unplanned supply also affects the physical flow of goods and services leading to a significant price difference between markets.. This highlighted some of the gaps that the article partially filled. The aim is to investigate the Price Differentials of fresh Tomato among Some Major Rural and Urban Retail Markets in Kano State in order to provide more information and better policy prescription for policy makers.

METHODOLOGY

Description of the Study Area

Kano State is made up of forty four (44) Local Government Areas covering a total land area of 20,760 km². The State is located within latitude 11°30'N to 11°50'N and longitude 8°30'E to 8°50'E. The state is bordered to the north and northwest by Katsina State, to the east and northeast by Jigawa State, to the south by Bauchi State and the southwest by Kaduna State. According to 2006 provisional population figure, Kano State has a population of 12, 170, 636 inhabitants, by the year 2016 at an annual growth rate of 3.3%, who are mainly Hausa and Fulani by tribe (NPC, 2006). Other ethnic groups inhabiting the State include all major and minor tribes of Nigeria such as Yoruba, Igbo, Nupe, Kanuri, Tiv, Ebir, as well as other races from the Middle East especially Yemen, Lebanon and Syria (KNSG, 2004). Agricultural land is put at 1,754, 200ha while forest and grazing land has 75,000ha. This implies that teaming population created demand for many agricultural commodities including tomato and it is also apparent that ethnicity and tribe were not a barrier to consumption of tomato. Moreover, 80% of the inhabitants of the State are farmers cultivating cereals, legumes, vegetable crops (including tomato) and beekeeping (KNSG, 2004).

Rain fed and dry season farming apart from trading, fishing, livestock rearing and embroidery are the major economic activities of the State. The climate of Kano is mainly the tropical wet and dry seasons. The rainfall pattern is unimodal with the highest peak during the month of August. The average rainfall is 600mm. the temperature is averagely warm all year round at 27°C ± 7°C (Olofin & Tanko, 2002). This provide a conducive environment for tomato production in Kano State especially during dry season Kano State is the second largest industrial center in Nigeria and the largest in Northern Nigeria with textile, tanning, footwear, cosmetics, plastics, enamelware, pharmaceuticals, ceramics, furniture and other industries. Others include soft drinks, food and beverages, dairy products, vegetables and animal feeds (Olofin, 1985).

Sampling Techniques

Multistage sampling technique was adopted for the selection of tomato retail marketers in this study. .

The first stage was the purposive selection of four (4) Local Government Areas namely Wudil, Warawa from non-metropolitan and Tarauni, Nassarawa from metropolitan. Warawa and Wudil were purposively selected because they are non-major producing areas and that the producer price will have no masking effect on the retail price, and they were characterized by a continuous retail marketing of tomato year round. Nassarawa was purposively selected due to the presence of a major vegetable market at ‘Yan Kaba and it is a metropolitan LGA. Tarauni which is also a metropolitan LGA was characterized by high level of retail marketing activity of fresh tomato and most of the customers attending the market are of high economic class. Moreover, retail marketing of fresh tomato is being carried out year round in all the selected locations.

The second stage was the purposive selection of one market site from each of the selected Local Government Areas based on high concentration of tomato retail marketers coupled with their nodal characteristics namely; Wudil market from Wudil, Garidau Market from Warawa, ‘Yan Kaba market from Nassarawa and Tarauni market from Tarauni Local Government Area.

The third stage was the random selection of 149 retail marketers from a population of 297 respondents. Roasoft which is an online sample size calculator revealed that at 10% error margin and 90% confidence interval a minimum of 56 sample size is appropriate for a population of 297 respondents. However, the researcher selected 149 retail marketers to improve on the confidence level by randomly selecting 50% of fresh tomato retail marketers from the sample frame of each marketing site as shown in Table 1. The sample frames in the sampled market places were developed with aid of market leadership.

Table 1: Sample Distribution of Fresh Tomato Retail Marketers

Local Government Area	Market Site	Sample Frame	Sample size (50%)
Wudil	Wudil Market	87	44
Warawa	Garindau Market	69	35
Nasarawa	Yan Kaba Market	88	44
Tarauni	Tarauni Market	52	26
Total		297	149

Method of Data Collection

Cross sectional and time series data were used for the study. The cross sectional primary form of data were collected through the use of questionnaire which was administered to the sampled retail tomato marketers and the time series data were collected using a data collection form for a period of one year (May 2015-April 2016). The data were collected three times a week (morning, afternoon and evening) to obtain average weekly prices.

Analytical Tool

Descriptive Statistics

It involves the use of percentages, mean, standard deviation and frequency.

$$x = \frac{\sum x_i}{\sum f}, \delta = \sqrt{\left\{ \frac{\sum x^2}{n} - \left(\frac{\sum x}{n} \right)^2 \right\} / n - 1}$$

and % = $\frac{f}{\sum f} \times 100$

Where,

x- Observations, F-frequency, \sum -summation, δ =variance, n- Number of observations

Co-integration Technique

It allows the identification of both the degree of integration and its direction between the two markets (Francesco &Eleni, 1995).

First is the Augmented Dickey Fuller (ADF) test, then, the Engle Granger Two-Step procedure. If the Augmented Dickey Fuller test proves that the two price series are integrated and Cointegrated, then price changes in one market are useful to predict changes in the other market. The existence of Cointegration therefore, implies that there is some market integration and it helps to explain its direction.

And the major implication of this finding is that the partaking of respondents with tertiary education qualifications could be a turning point of fresh tomato retail marketing in the study area as they were observed to be very neat and organized which strategically promote their marketing activities.

This might also inspire another potential educated entrants to join the venture unlike before, when the people with formal educational qualifications normally resent. This is closely related to the findings of Wongnaa (2014) who reported that majority (46%) of the retail marketers in Benue State were at least primary school leavers.

Table 2: Qualitative Socioeconomic Characteristics of Fresh Tomato Retail Marketers

Socioeconomic Variable	Frequency	Percentage
Sex		
Male	145	97.3
Female	4	2.7
Total	149	100
Marital Status		
Single	18	12.1
Married	130	87.2
Widowed	1	0.7
Total	149	100
Educational Status		
Primary	41	27.5
Secondary	32	21.5
Tertiary	6	4
Informal	70	47
Total	149	100

Source: Field Survey, 2016

Qualitative Socioeconomic Characteristics of Fresh Tomato Retail Marketers

Result from Table 3 shows an average retail marketer in the study area as 39.6 years and so also retail marketer as young as 22 years and as old as 57 years were finding means of sustenance in tomato retailing. It is therefore worth noting that the participation of different age groups could be seen as an element that could aid sustainability through sharing of experiences and knowledge between them. It also ensures succession where younger ones succeed the older and tired entrepreneurs in the same marketing system. The study further revealed that the population of the youngest retail markers (64%) in the first three age groups that were either youths or adults within their productive age bracket is greater than that of the old (36%) in the last two age groups. This could mean that retail marketing of fresh tomato

may not suffer deflation of human resource in the long run (*ceteris paribus*). This is in line with the findings of Wongnaa (2014) who reported the majority (33%) of retail marketers in Benue State were within their productive age.

It further revealed that on the average the household in the study area have 10 members, minimum of 1member and maximum of 46 members. The study further revealed that the majority (24.2%) of fresh tomato retail marketers falls within the household category of 7-11 members; this might be due to the fact that polygamous marriage is highly pronounced in the study area, indicating high level of burden among the households. This agrees with the finding of Haruna et al., (2012) who reported that majority (46%) of the retail marketers in Bauchi Metropolis fall within the household category of 11-15 members.

it could also be deduced that most of the of the household groups increase down the age groups which may be due to expansion of the family size over the years, until at the fourth and fifth age groups when household members of some household groups decreases, this might be due to the fact that most of the members have become households affecting the size of the previous householder to whom they initially belonged. Moreover, the study further revealed that majority of the respondents (77.4%) that are within the age group 29-35 years fall within the household group of 12-15 members; this indicated that the polygamous marriage is more common among the respondents that fall under this age group

On the average the retail marketers in the study area have a retail marketing experience of 15 years and so also the retail marketer with years of experience of at most (minimum) 1 year and at least 25 years (maximum) operate together, this could ensure sustainability through sharing of experiences and knowledge between the marketers. The study further revealed that majority 26.2% of fresh tomato retail marketers fall within the experience age group of 11-15 years implying that majority of fresh tomato retail marketers were old in the business. This is closely related to the findings of Adeoye et al. (2009) who reported about (50%) of the retail marketers in Ughelli Local Government area of Delta State fell within the experience age group of 6-10 years.

Table 3: Quantitative Socioeconomic Characteristics of Fresh Tomato Retail Marketers

Socioeconomic Variable	Frequency	Percentage	Min	Max	Mean
Age (years)					
22.0 - 28.0	31	20.8	22	57	39.6
29.0 - 35.0	41	27.5			
36.0 - 42.0	23	15.4			
43.0 - 59.0	25	16.8			
50.0 - 57.0	29	19.5			
Total	149	100			
Household Size (number)					
1.0 - 3.0	34	22.8			10
4.0 - 8.0	27	18.1			
7.0 - 11.0	36	24.2			
10.0 -14.0	25	16.8			
15.0- 17	27	18.1			
Total	149	100			
Experience (years)					
1.0 - 5.0	32	21.5	2	25	15
6.0 - 10.0	30	20.1			
11.0 - 15.0	39	26.2			
16.0 - 20.0	20	13.4			
21.0- 25.0	28	18.8			
Total	149	100			

Source: Field Survey, 2016

Spatial Price Variability (Units Roots Test)

The spatial price linkages between selected markets were assessed using co-integration technique. First is the unit root test for the

Integration orders as explained below. The price series were tested for stationarity in order to avoid spurious regression between the price series.

In each situation when the $t\text{-ADF} > t_\alpha$ it implies the acceptance of null hypothesis of non-stationary that, the series is integrated of order one $I(1)$ and when the $t\text{-ADF} < t_\alpha$ it implies the acceptance of alternative hypothesis of stationarity that, the series is integrated of order zero $I(0)$.

a. Integration Test for Order Zero $I(0)$ on Price Series in Fresh Tomato Markets

The results of the units root test using augmented dickey fuller method for the null hypothesis that the fresh tomato price series in all the locations were integrated of order

one against the alternative that says they were integrated of order zero was presented in Table 4. From the results, it could be deduced that, the $t\text{-ADF}$ values of 1.189, 0.888, 0.951 and 0.764 for Yan Kaba, Tarauni, Wudil and Garindau markets respectively is greater than the critical t_α (-3.568), implying that, all the four price series at the level were not integrated of order zero and that the researcher rejected the alternative hypothesis for integration of order zero and accepted the null hypothesis.

Table 4: Results of Integration Test for Order Zero $I(0)$ on Price Series of Fresh Tomato Markets

Market	t-ADF	t_α	Remark
Yan Kaba	1.189**	-3.568	Non-Stationary
Tarauni	0.888**	-3.568	Non-Stationary
Wudil	0.951**	-3.568	Non-Stationary
Garindau	0.764**	-3.568	Non-Stationary

Source: Computed From Field Survey, 2016

** denotes rejection of alternative hypothesis of order zero at 95% significant level.

b. Integration Test for Order Zero $I(1)$ on Price Series of Fresh Tomato Markets

The results of the units root test using augmented dickey fuller method for the null hypothesis that the fresh tomato price series in all the locations were integrated of order two against the alternative that says they were integrated of order one was presented in Table 5. From the results, it could be deduced

that, the $t\text{-ADF}$ values of -5.538, -5.444, -5.951 and -5.946 for Yan Kaba, Tarauni, Wudil and Garindau markets respectively is less than the critical t_α (-3.568), implying that, all the four price series were stationary at first difference and that the researcher reject the null hypothesis of integration of order two and accepted the alternative hypothesis.

Table 5: Results of Integration Test for Order One $I(1)$ on Price Series of Fresh Tomato Markets

Market	t-ADF	t_α	Remark
Yan Kaba	-5.538**	-3.568	Stationary
Tarauni	-5.444**	-3.568	Stationary
Wudil	-5.951**	-3.568	Stationary
Garindau	-5.946 **	-3.568	Stationary

Source: Computed From Field Survey, 2016

** denotes rejection of null hypothesis of order two at 95% significant level

Having obtained the stable time series from first difference, the cointegration results was explained below;

c. Co-Integration Test of Fresh Tomato Retail Prices

Cointegration between markets means that the markets are spatially integrated and efficient and thus prices of the fresh tomato at different markets have a long run linear relationship. In each situation when the $t\text{-ADF} > t_\alpha$ it implies the acceptance of null hypothesis of no cointegration and when the $t\text{-ADF} < t_\alpha$ it implies the acceptance of alternative hypothesis of cointegration that, the series are cointegrated.

The result of the Engle-Granger Cointegration test is as presented in Table 6. The results revealed that the all the four price series were cointegrated at 5% and 10% level of significance with exception of Yankaba and Tarauni Markets. This implies that all of these markets that were cointegrated exhibited a linear relationship in the long run and that the price between the pair of markets will attain equilibrium in the future. This is in line with findings of Sunday (2014) who reported that

the retail price series of urban and rural markets of Akwa-Ibom state were cointegrated on the contrary, Yankaba and Tarauni markets that were not cointegrated despite the fact that all the two locations are from Metropolitan and Tarauni market received its supply from ‘Yankaba. This might be as a result of the supply cut-off between the pair of markets during tomato ebola virus outbreak, as a result of which each markets is looking for an alternative cheapest supply source at the grass root level. This agrees with the findings of Abba (2009) who reported that out of twelve pairs of market only one pair (Gujungu and Suleja) was found to be not cointegrated in his investigation on tomato price communication between pair of markets in some selected states. The major implication of this finding is that the price difference between Tarauni and Yankaba markets is in excess of transfer cost which might result in the inefficiency in the spatial price.

Table 6: Results of Cointegration Test of Fresh Tomato Retail Prices in Kano State

Y	Variables X	t-statistics	t-ADF		Decision
			5%	10%	
Yankaba Price	Tarauni Price	-1.984	-2.922	-2.599	Not Co-integrated
Yankaba Price	Wudil Price	-5.541**	-2.922	-2.599	Co-integrated
Garindau Price	Yankaba Price	-7.825**	-2.922	-2.599	Co-integrated
Tarauni Price	Wudil Price	-4.386**	-2.922	-2.599	Co-integrated
Tarauni Price	Garindau Price	-7.706**	-2.922	-2.599	Co-integrated
Wudil Price	Garindau Price	-5.838**	-2.922	-2.599	Co-integrated

Source: Computed From Field Survey, 2016

** denotes rejection of the null hypothesis of no co-integration

Constraints to Fresh Tomato Retail Marketing

Table 7 presents constraints affecting fresh tomato retail marketing. The results revealed that frequent price fluctuation that ranked first is the major (100%) problem affecting fresh tomato retail marketing may be due to the fact a basket of fresh tomato may worth ₦300 today and ₦30, 000 in few weeks indicating high level of price unpredictability, the least (1.4%) ranking problem was absence of cooperative societies, this might be as a result of the fact that majority of the

respondents were literate and were patronizing the activities of the associations that exist in the markets. This disagrees with findings of Abba (2009) who reported the major problems to be poor access to market information and bad road network among others in Hadejia LGA of Jigawa State and that of Haruna et. al. (2013) who reported that high cost of purchase price during the off season as the major problem among others was the major problem affecting tomato retail marketers in Katsina State.

Table 7: Results of Constraints Affecting Fresh Tomato Retail Marketing

Constraints	Frequency	Percentage	Rank
Frequent Price Fluctuation	70	100	1 st
Lack of Processing Facilities	63	90	2 nd
Lack of Storage Facilities	59	84.3	3 rd
Poor Market Information	31	44.3	4 th
Poor Transport Network	13	18.6	5 th
Absence of Cooperative Societies.	1	1.4	6 th

Source: Field Survey, 2016

Note- multiple responses captured

CONCLUSION AND RECOMMENDATION

Based on the findings of this study it could be concluded that the fresh tomato retail prices in most of the market site is virtually the same and the price difference between markets is not in excess of transportation cost. Thus, in the long run the price between spatially

different markets could exhibit a linear relationship.

The study recommends that fresh tomato retail marketers need to improve their education status and the more experienced retailers should share their experiences, knowledge and ideas with younger ones for more profit and sustainability

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