

ANALYSIS OF THE EFFECT OF INFLATION ON PRICES AND OUTPUT OF SELECTED AGRICULTURAL PRODUCE IN NIGERIA

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Abstract

Analysis of the effect of inflation on prices and output of selected agricultural produce in Nigeria (1992-2016) was carried out. Data for the study were collected from National Bureau of Statistics (NBS), Central Bank of Nigeria (CBN), World Bank and Benue Agricultural and Rural Development Authority (BNARDA), Inferential statistics such as Augmented Dickey Fuller (ADF) test, Co-integration analysis, Vector Auto-Regressive (VAR) were used. The ADF test was used to test for the presence of unit roots due to the time series nature of the data. All the variables attain stationary at first difference except inflation GDP deflator which attains stationary at level at 0.01 probability level which necessitated the application of Co-integration analysis. The Co-integration test shows that the trace test of 89.20910 is greater than 15.49471 for maize price, trace test of 9.180504 is greater than 3.841466 for rice price, trace test of 19.06995 is greater than 3.841466 for yam price and trace test of 8.343064 is greater than 3.84166 for cassava price indicate that co-integration exist between inflation and prices of selected agricultural produce at 0.05 level of significance. Since long run relation exist between inflation and prices of selected agricultural produce, VAR was used to model both long run and short run relationship between the variables, The result of VAR indicates that inflation has a positive significant effect on the prices of selected agricultural produce in that, the chi-square calculated of 10.37, 9.99, 12.66, 15.41 for maize price, rice price, yam price and cassava price which is greater than chi-square tabulated of 5.99 at 2 df shows that inflation has significant effect on prices of selected agricultural produce in the long run. The study based on its findings recommends that policies that will buffer the agricultural sector from effect of inflation in the long and short run should be enacted

Keywords: Analysis, Inflation, Prices, Agricultural Produce

INTRODUCTION

Agriculture as the second largest sector after oil, fell from 48percent of Gross national product (GDP) in 1970 to 20.6percent in 1980 and was only 23.3percent in 2005(CBN,2009). The sector's contribution to the growth of Nigeria economy in 2012 stood at 39.21 and 41.93percent improvement in the third quarter of 2013. This is because agricultural output continue to experience improved production in 2013.The sector recorded growth rate of 3.83percent in the fourth quarter of 2012 as against 5.68 percent in the fourth quarter of 2011.Output in the third quarter of 2013 stood at 5.08 percent, up from the 3.89 percent recorded in the corresponding period of 2012 and also higher than the 4.52 percent recorded during second quarter of 2013(NBS, 2013).

In 2015 agriculture grew by 4.1 percent and in 2016, the sector (which includes crop production, forestry, Animal husbandry and fishing) accounts for 24.43 percent of economic activity in Nigeria. Crop production take up to 87.73 percent, Livestock take up to 8.73 percent, Forestry take up to 1.09percent and fishing take up to 2.45percent of activities in the Agricultural sector. The Gross domestic product from agriculture in 2017 was 27.38 percent. The observed increase in agriculture in the past few years was sustained in the first half of 2010. The year-on-year food inflation comprising farm produce, processed and imported food maintained an upward trend all through the first half of 2015. It was 10.0percent at end- June 2015, compared with 9.8 and 9.2percent at end of June and end of December 2014 respectively. The 12-month moving average food inflation remained constant at 9.5percent throughout the first half of 2015, Same as end of June and end of December 2014. The gradual but steady rise in food inflation was attributed mainly to the fuel crisis experienced in the country throughout the country in the first half of 2015 due to the stand-off between the Federal Government and the oil makers over the non- payment of subsidy claims. The development led to hike in the prices of petroleum product and a significant rise in the cost of the transportation. Distribution constraints arising from security challenges especially on the North-Eastern part of the country and late commencement of the rainy season also contributed to food inflation (NBS 2015).

Inflation is defined as a sustained increase in the general level of prices for goods and services in an economy (CPI Inflation rate of 2.5% or higher). Inflation occurs when there is a decrease in the availability of demanded goods and services (McKenna, 1977; Evans/Harvey Mudd College, 2013). In the short run, the demand for these services can become greater than the supply of these services (McKenna, 1977; Casler, 1992). Due to this occurrence, suppliers will increase the prices of the goods and services. However, over time, the cost of the goods and services will increase beyond the purchasing power of the consumer (demander of goods/services). Due to this increase, the purchasing power of the demander will eventually decrease and the average standard of living will start to decline (McKenna, 1977; Casler, 1992).

Deflation is defined as the sustained decrease in the general level of prices for goods and services (CPI Inflation rate of < 0%). Deflation usually occurs because of a reduction in personal, or government spending, which can occur in periods of high or increasing unemployment (Shilling, 1999; Evans, 2013). The reduction in spending has the ability to decrease demand which in turn reduces the price for these goods and services. As a result, suppliers can no longer afford to supply items at the decreased price. These suppliers will start to reduce their supply and in turn lay off their employees. This has the potential to exasperate a situation where there is already high or growing unemployment (Shilling, 1999). As a result of these potential occurrences, the presence of deflation is associated with a poorly performing economy (Atkesonand Kehoe, 2004; Evans, 2013). Inflation is also a sustained increase in the general level of prices of goods and services (CBN, 2015). Food marketing sector has a significant impact on the nation's economy and this is further described below. On the positive side, the food marketing sector contribute significantly both to the gross national product and employment. According to the National Bureau of Statistics 2015, the year-on-year food inflation comprising farm produce, processed and imported food maintained an upward trend all through the first half of 2015. It was 10.0percent at end of June 2015, compared with 9.8percent and 9.2percent at end of June and end of December 2014 respectively.

The demand for agricultural produce, fluctuate widely from year to year due to inflation, deflation, activities of the middlemen, population, infrastructure and climatic fluctuations. This paper seeks to find a solution to the effects of inflation on the prices of selected agricultural produce in Nigeria by answering the following research questions;

- i. What is the trend of inflation in Nigeria (1992-2016)?
- ii. What are the long run effect of inflation on prices of agricultural produce?

METHODOLOGY

STUDY AREA

Nigeria is a federal constitutional republic comprising of 36 states and its Federal Capital Territory Abuja. Nigeria is located in West Africa on latitudes 5° to 10° North and between longitudes 2°2' and 14°30' East and with a land area of 923 769 Sq km. Nigeria shares boundary with The Republic of Benin in the West, Chad and Cameroon in the East, Niger in the North. Its coast in the South lies in the Gulf of Guinea in the Atlantic Ocean. Nigeria is referred to as the giant of Africa, it is the most populous nation, with an estimated population of about 131,859,731 inhabitants. The average annual growth rate according to the 2006 estimate was 2.38%. Nigeria's population is divided among 478 different ethnic groups, some numbering fewer than 10000 people. Of the different ethnic groups, ten (Hausa, Yoruba, Igbo, Fulani, Kanuri, Tiv, Edo, Nupe, Ibibio and Ijaw) account for nearly 80% of the population. Twenty-five percent (25%) of the population is in the former western region (12% of area), 21% in the former eastern region (9% of area) and 53% in the northern region (79% of area). The lowest population densities are in the northern regions, especially in Borno, Adamawa, Kebbi, Kwara, Taraba, Yobe and Zamfara States.

Nigeria has two major seasons which include rainy season between April and October and dry season from November to March. Nigeria is found in the region where the climate is seasonally damp and very humid. Nigeria is affected by four climate types which includes; tropical monsoon climate found in the southern part of the country with temperature of 26-28°C; tropical savannah climate or tropical wet and dry climate is extensive in area and covers most of the western Nigeria to central Nigeria beginning from the tropical rainforest climate boundary in southern Nigeria to the central part of Nigeria, where it exerts enormous influence on the region with a temperature of 18.45-36.9°C; and Alpine climate or highland climate or mountain climate are found on highland regions of Nigeria. Agriculture employs over 70% of the country's manpower (WIKIPEDIA, 2017). The country's main cash crops are cocoa, groundnut, shear butter, palm oil, cashew, timber, etc. Major food crops include; cassava, yam, millet, soybean, rice, sesame, etc.

DATA ANALYSIS TECHNIQUES

The research data obtained were analyzed using descriptive and inferential statistics. Descriptive statistics such as frequencies, graphs and percentages were used for objectives (i), and (ii), Inferential statistics such as Johansen co-integration test and Vector Auto-Regression model were used for objective (iii) after testing for unit root while T-test was used to test the hypothesis.

MODEL SPECIFICATION

The Unit Root Test: Augmented Dickey-Fuller (ADF) Test

A unit root test is a stochastic trend in time series sometimes called random walk with drift, if a

time series has a unit root, it shows a systematic pattern that is unpredictable or predictable and they indicate non-stationary or stationary. This is based on linear regression. Serial correlation can be issued in which case, the Augmented Dickey-Fuller (ADF) can be used. Set up an autoregressive model for y_t and test if $\theta(1) = 0$

Consider the AR (1) regression model

$$y_t = \theta y_{t-1} + \epsilon_t.$$

Alternatively, the model can be formulated as

$$\Delta y_t = (\theta - 1)y_{t-1} + \epsilon_t = \pi y_{t-1} + \epsilon_t$$

Where $\pi = \theta - 1 = \theta(1)$

The unit root hypothesis translates into

$$H_0: \pi = 0 \text{ against } H_A: \pi < 0$$

The Dickey-Fuller (DF) test is simply the t-test for H_0

Vector Auto-regressive Model (VAR)

VAR model is given below:

$$Y_t = a + A_1 Y_{t-1} + A_2 Y_{t-2} + \dots + A_p Y_{t-p} + \epsilon_t$$

Where

$Y_t = (Y_{1t}, Y_{2t}, \dots, Y_{nt})$: an $(n \times 1)$ vector of time series variables

a : an $(n \times 1)$ vector of intercepts

$A_i (i = 1, 2, \dots, p)$: $(n \times n)$ coefficient matrices

ϵ_t : an $(n \times 1)$ vector of unobservable i.i.d. zero mean error term (white noise)

RESULTS AND DISCUSSION

Descriptive (Trends) Analysis of Inflation, Prices and Output of Selected Agricultural Produce.

The graphs show the inflationary trend of the various prices and output.

TREND OF INFLATION GDP DEFLATOR

From the graph it is deduced that the inflation GDP deflator which is a measure of the level of prices of all new domestically produced final goods and services in an economy indicates that, it moves slowly from 1992 to 1993 and rises sharply in 1994 and dropped in 1996 oscillating up and down until it rises up in 2010 and dropped in 2011 maintaining a uniform curve till 2016.

This is as a result of high inflation relative to low output and employment. It is observed that the inflation GDP deflator is maximum 1994 and 2010. On the average GDP over the study period stood at ₦23.1601 and the standard deviation varies at 31.28162%.

TREND OF INFLATION CONSUMER PRICES

Inflation consumer prices, which is inflation as measured by the consumer price index reflects the annual percentage change in the cost of the average consumer of acquiring a basket of goods and services that maybe fixed or changed at specific time interval such as yearly.

It can be deduced from the graph as the inflation consumer prices rises uniformly from 1992 to 1993 and rises sharply in 1994 and drops in 1996, oscillating up and down until 2016. As a result, the low GDP and high inflation makes consumer prices unstable. The inflation consumer prices

reaches maximum in 1994 and minimum in 2007, the rises here could be as a result of demand pull or cost push inflation. On the average the inflation consumer prices stood at 19.61156% and the standard deviation which indicates how this variable varies over the years is 18.65501%.

TREND OF MAIZE OUTPUT

The output of maize rises from 1992 until 1994 and drops in 1995 oscillating up and down until 2000 after which it continued to rise higher and higher until 2005 and afterwards fluctuates up and down until 2013 from which it rises continuously till 2016. It attains maximum in 2015. On the average maize output stood at 6848887kg and the standard deviation which indicates how this variable varies over the years is 1825686kg.

TREND OF RICE OUTPUT

The output of rice fluctuates from 1992 until 2013 and afterwards rises continuously till 2016. It also attains maximum in 2015. On the average rice output stood at 3849341kg and the standard deviation which indicates how this variable varies over the years is 1100839kg.

TREND OF YAM OUTPUT

Output of yam rises uniformly from 1992 to 2005 afterwards it oscillates up and down until 2012 from which it rises continuously till 2016. It's attained maximum in 2015. On the average yam output stood at 30652752kg and the standard deviation which indicates how this variable varies over the years is 7328124kg.

TREND OF CASSAVA OUTPUT

Output of cassava also rises slowly from 1992 until 2005 from where it fluctuate up and down until 2012 and rises continuously till 2016. Its attain maximum in 2015. On the average cassava output stood at ₦39768599 and the standard deviation which indicates how this variable varies over the years is 9029305kg.

The fluctuations in the various outputs are as a result of factors such as lack of incentives, unfavorable climate, high cost of fertilizers e.t.c lead to decrease or low output, While the higher rises in output are due to favorable climate, agricultural practices, low cost of fertilizer, expansion of the area cultivated, implementation in schemes, initiatives and policies e.t.c.

Likewise the graphs showing the inflationary trend of the various prices of the selected agricultural produce over the years can be deduced as;

TREND OF MAIZE PRICE

The prices of maize moves slowly from 1992, oscillating up and down until it reaches its maximum in 2007, drops in 2008 and rises continuously from 2010 to 2016, as a result of high inflation in Nigeria. On the average maize price stood at 36333.59 Naira and the standard deviation which indicates how this variable varies over the years is 21104.21 Naira.

TREND OF RICE PRICE

Also the prices of rice moves slowly from 1992 fluctuating up and down until it reaches maximum in 2008 and drops in 2009 from where it rises continuously till 2016. On the average rice price stood

at 40398.64Naira and the standard deviation which indicates how this variable varies over the years is 19441.34 Naira.

TREND OF YAM PRICE

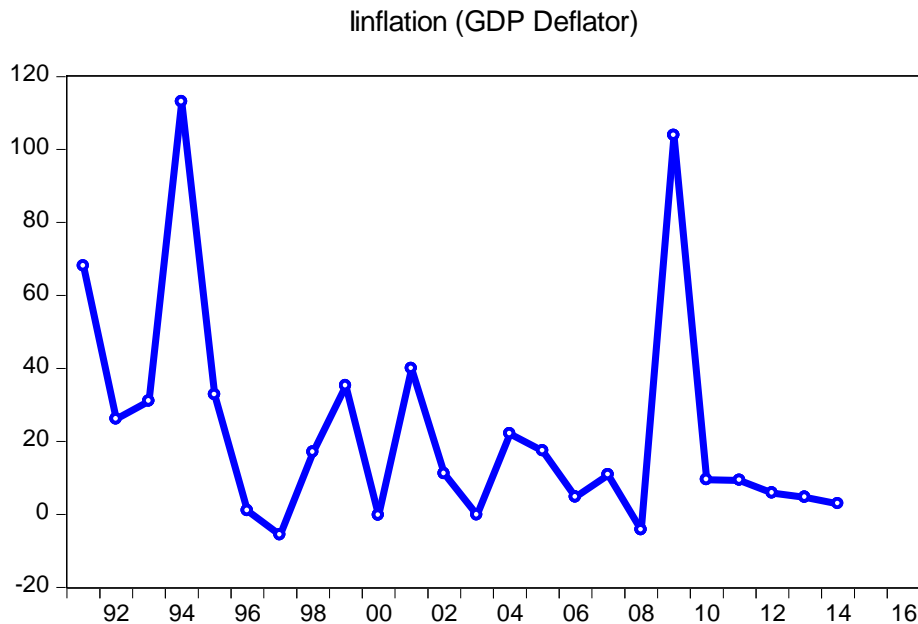
The prices of yam rises slowly from 1992 till 1999 where it fluctuate up and down and reaches maximum in 2007 and then drops in 2008 and from there rises continuously till 2016. On the average yam stood at 42981.64 Naira and the standard deviation which indicates how this variable varies over the years is 22870.66 Naira.

TREND OF CASSAVA PRICE

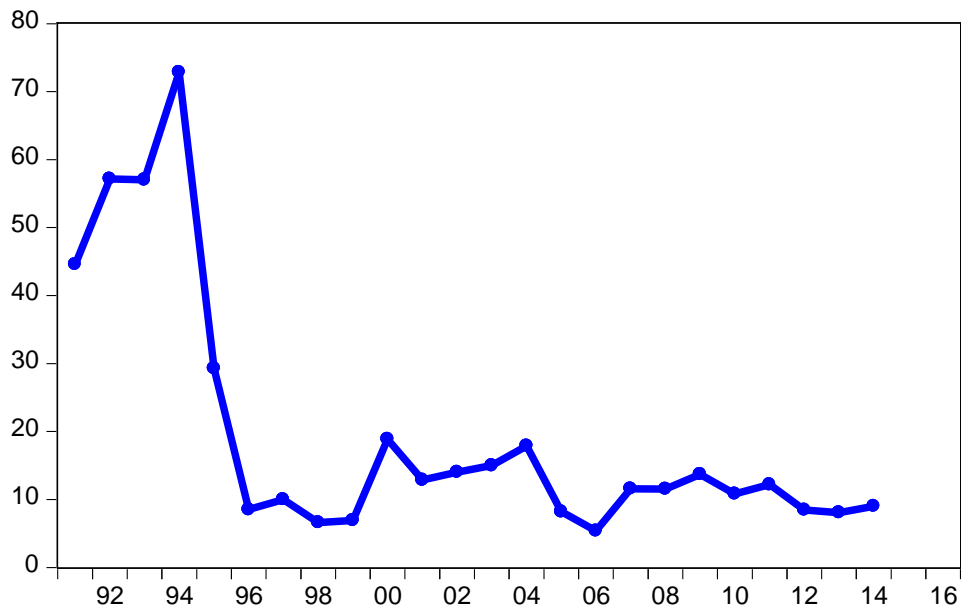
The prices of cassava rise slowly from 1992 oscillating up and down till it reaches maximum at 2007 and drops in 2008 and afterwards rises slowly till 2016. On the average cassava price stood at 17035.14 Naira and the standard deviation which indicates how this variable varies over the years is 8032.531 Naira.

The fluctuations in various prices are as a result of cost of agricultural inputs, fuel crises in the country, rise in the cost of transportation, distribution constraint arising from security challenges especially in the Northern-Eastern part of the country, increase in importation of food commodities and late commencement of the rainy season contributed to rise in prices while lower prices are as a result of weak demand, oversupply and glut in the market e.t.c. The continuous rising of these prices is as a result of inflation in the country and there was price hike between 2007 and 2008.

Figures: Graphs showing trends in prices and output of selected agricultural produce.

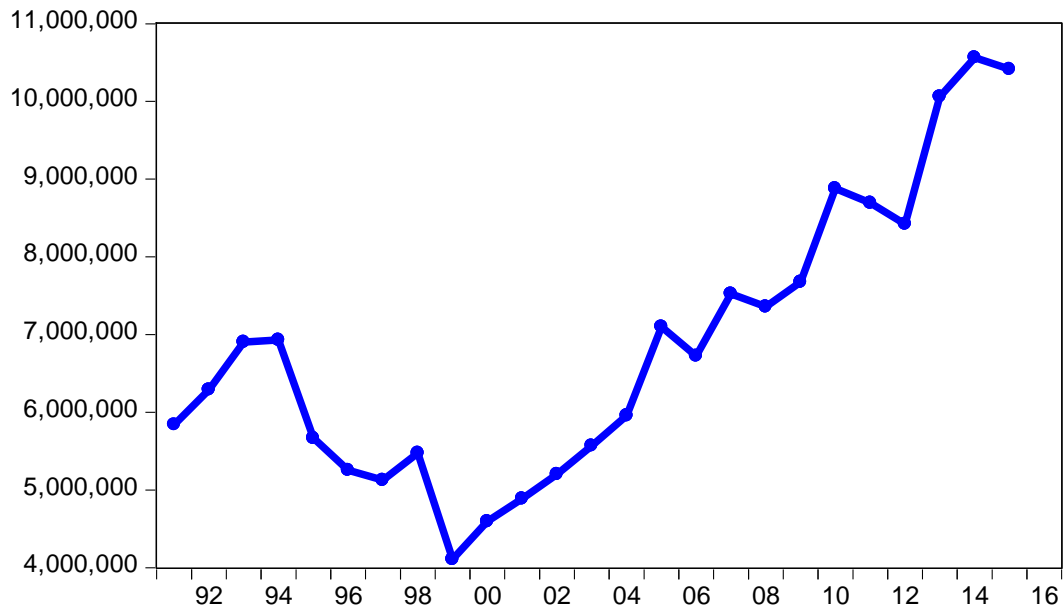


Inflation (Consumer prices)



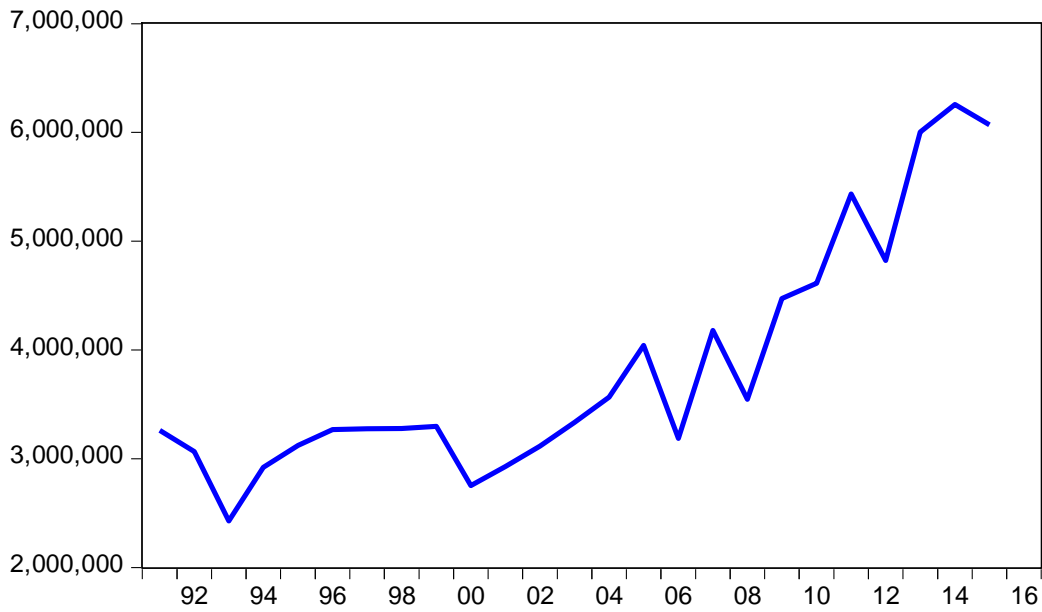
SPSS Output: 2020

Maize output



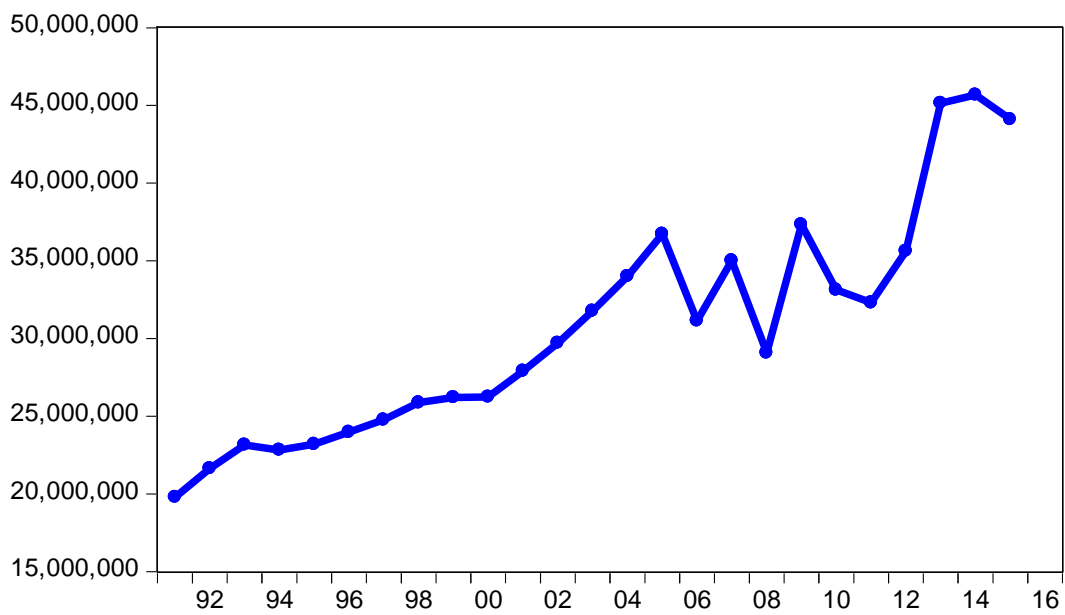
SPSS Output: 2020

Rice Output

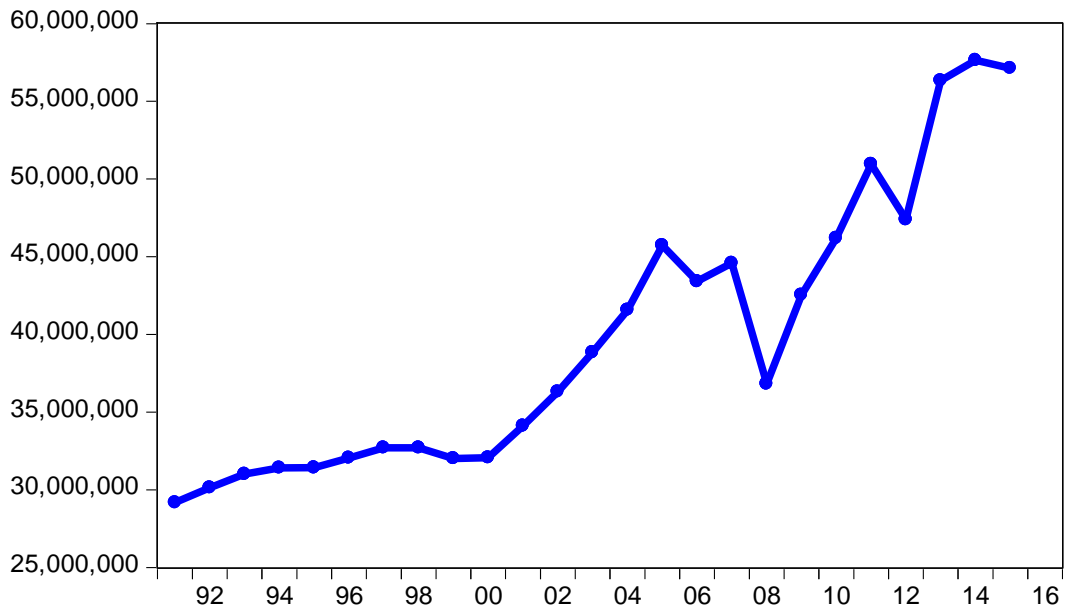


SPSS Output: 2020

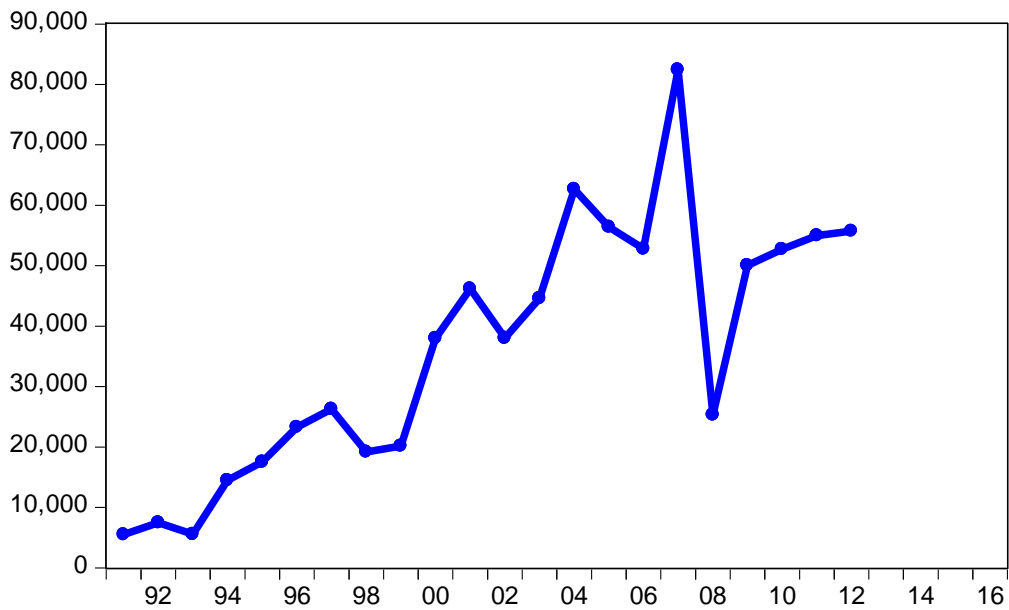
Yams Output



Cassava Output

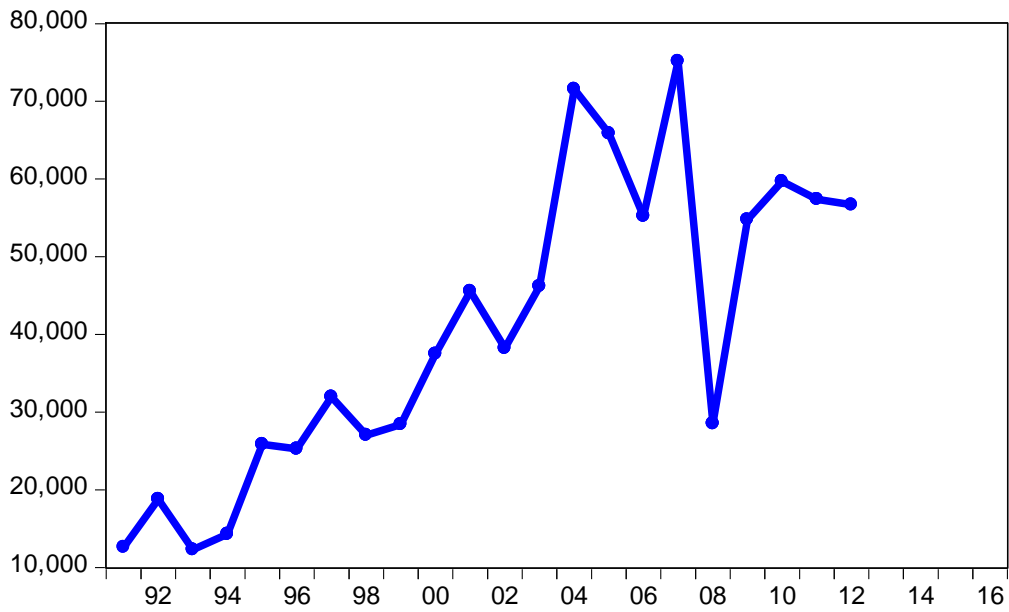


Maize prices



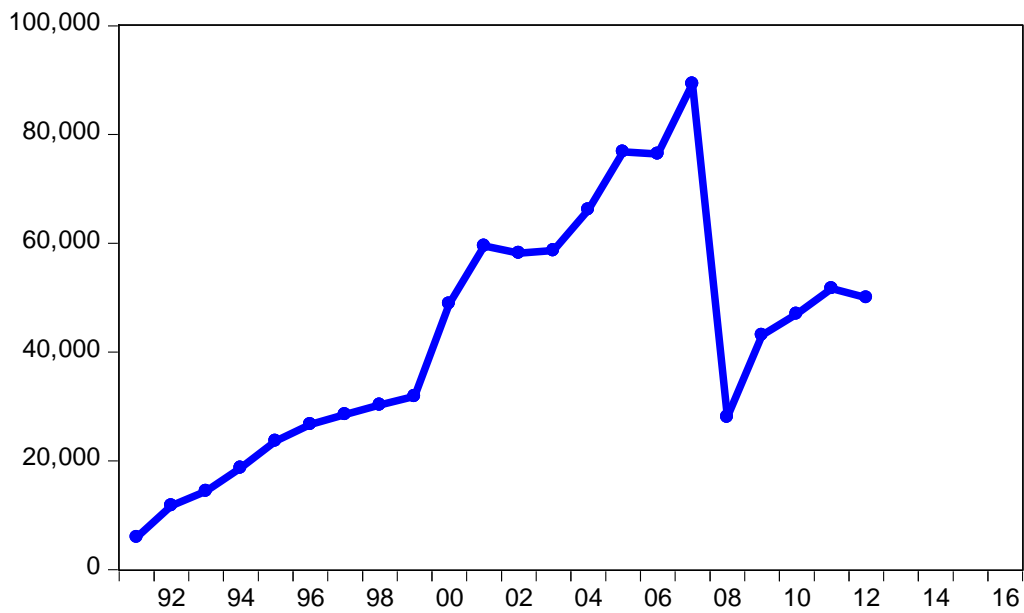
SPSS Output: 2020

Rice Prices



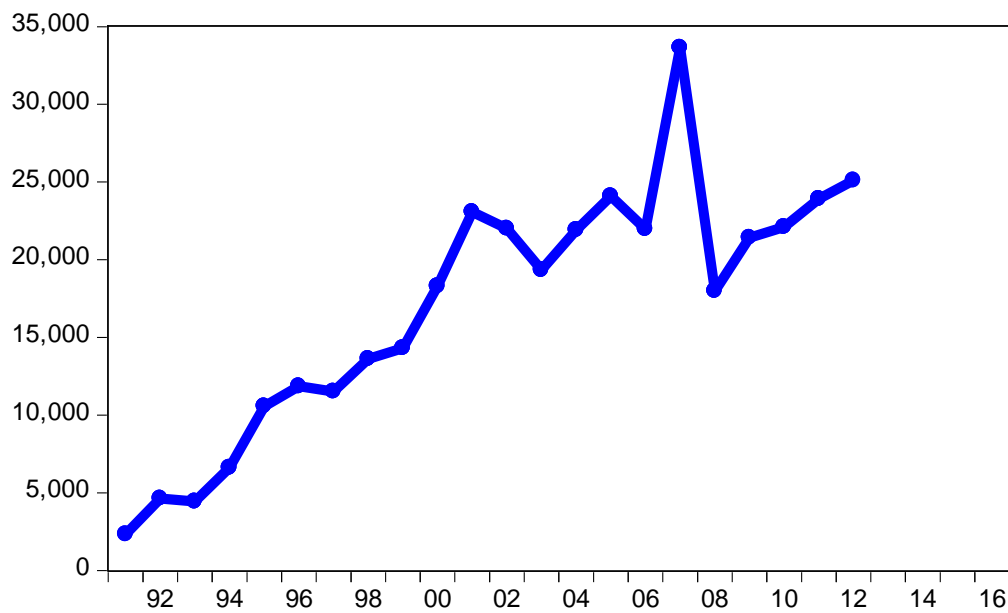
SPSS Output: 2020

Yams Prices



SPSS Output: 2020

cassava Prices



SPSS Output: 2020

UNIT ROOT TEST FOR INFLATION, OUTPUT AND PRICES OF AGRICULTURAL PRODUCE

Table 1 gives the unit test results for inflation, output of agricultural produce (maize, rice, yam and cassava) and price of agricultural produce (maize, rice, yam and cassava). The result of the Augmented Dickey-Fuller test indicates that all the series were found to become stationary at first difference over the years except GDP deflator. This implies that all the variables are non-stationary at level except inflation GDP deflator which is stationary at level since its probability is less than 10%.

Table 1: Augmented Dickey-Fuller (ADF) test for stationary

S/n	Variable	LEVEL		FIRST DIFFERENCE	
		T-Stat.	Prob.	T-Stat.	Prob.
1	Inflation GDP Deflator	-4.722484	0.0011		
2	Inflation consumer Prices	-1.799324	0.3714	-4.640989	0.0014
3	Maize output	0.109657	0.9597	-4.866028	0.0008
4	Rice output	1.206378	0.9971	-8.355414	0
5	Yam output	-0.919589	0.7641	-6.95861	0
6	Cassava output	-0.160378	0.9313	-6.121927	0
7	Maize prices	-1.456885	0.534	-5.555555	0.0003
8	Rice prices	-2.074813	0.2557	-7.486043	0
9	Yam prices	-2.053992	0.2635	-5.735955	0.0002
10	Cassava prices	-1.613388	0.4577	-7.727587	0

***Significant at $\leq 10\%$

Source: computed from field data, 2020.

RESULT OF CO-INTEGRATION RANK TEST FOR THE LONG RUN EFFECT OF INFLATION ON PRICES OF SELECTED AGRICULTURAL PRODUCE (MAIZE, RICE, YAM AND CASSAVA)

This Johansen Co-integration result is shown in Table 4 and the inflation was regressed on other variables based on the fact that its shared non-stationary at level and stationary at first difference with the other variables.

Further investigation into the series properties of the variables through the use of Johansen Co-integration test indicates that long run equilibrium exist among the variables, the decision rule is that the values of the trace statistics must be greater than critical value for the variables to co-integrate. Thus, based on the decision rule, for maize price and inflation, the trace statistics of 89.20910 is greater than the critical value of 15.49471 at 0.05 level of significance, therefore, co-integration exists.

On this basis, the null hypothesis of no hypothesized number of equation(s) is rejected and also the trace statistics of 6.255143 is greater than the critical value of 3.841466 at 0.05 level of significance respectively, therefore, co-integration exists, this agrees with the findings of (Ukoha 2008) on the effect of inflation on price variability which says that co-integration exist between inflation and relative price variability of food and cash crops and thus the trace test indicates 2 co-integrating equations at 0.05 level of significance.

Which means that inflation influence price and price also influence inflation in the long run, that is, there is full rank of co-integration and the implication is that in the long run stability exist in the relationship between inflation and prices of selected agricultural produce in the long run, therefore Vector Auto-regressive model (VAR) can be used to model the long run and short run relationship between the variables.

Table 2: Johansen Co-integration Rank Test of long run effect of inflation on prices of maize, rice, yam and cassava

VARIABLES	HYPOTHESIZED NO. OF CE(S)	EIGEN VALUE	TRACE STAT.	CRITICAL VALUE (0.05)	PROB**
Maize price	None*	0.984199	89.20910	15.49471	0
	At most 1*	0.268572	6.255143	3.841466	0.0124
Rice price	None*	0.949630	68.94772	15.49471	0
	At most 1*	0.368101	9.180504	3.841466	0.0024
Yam prices	None*	0.696732	42.93270	15.49471	0
	At most 1*	0.614609	19.06995	3.841466	0
Cassava price	None*	0.921704	59.28819	15.49471	0
	At most 1*	0.341080	8.343064	3.841466	0

Trace test indicates two (2) co-integrating equations at the 0.05 level for all the price relationship Computed from field data, 2020.

VECTOR AUTO-REGRESSIVE ESTIMATE FOR LONG RUN EFFECT OF INFLATION ON PRICES OF MAIZE, RICE, YAM AND CASSAVA.

Table 3 shows the result of the effect of inflation on prices of selected agricultural produce in the long run, from the table it indicates that the chi-square calculated of 10.37 for maize price is greater than the chi-square tabulated of 5.99 at 2 degree of freedom. For rice price the chi-square calculated

of 9.99 for is greater than the chi-square tabulated of 5.99 at 2 degree of freedom. For yam price the chi-square calculated of 12.66 is greater than the chi-square tabulated of 5.99 at 2 degree of freedom

For cassava price, the chi-square calculated of 15.41 is greater than the chi-square tabulated of 5.99 at 2 degree of freedom The null hypothesis is rejected as this indicates that inflation have a positive significant influence on prices of maize, rice, yam and cassava respectively in the long run. Which means that during inflationary period the prices of these variables increases in the long run as a result of increase in the cost of agricultural inputs, cost of transportation e.t.c., this is in agreement with the findings of Agada (2017) on the effect of inflation on prices and output of selected agricultural produce which analyses that inflation has a positive significant effect on prices of agricultural produce.