INFLATIONARY TREND, AGRICULTURAL PRODUCTIVITY AND ECONOMIC GROWTH IN NIGERIA: THE LINKS

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Abstract

This study investigates the links existing amongst inflationary trend, agricultural productivity and economic growth in Nigeria using time series data spanning from 1970 to 2011. Secondary data on inflation rate, index of the aggregate of agricultural production and real gross domestic product were sourced from the publications of Central Bank of Nigeria and the National Bureau of Statistics. Descriptive and inferential statistics particularly Granger causality test was employed for the analyses. The results indicated a unidirectional causality from inflationary trend to agricultural productivity, unidirectional causality from agricultural productivity to economic growth with no causality between inflationary trend and economic growth. These findings imply that the trend of inflation was significant in influencing agricultural productivity and agricultural productivity was significant in influencing economic growth. Based on these findings, it is recommended that the Central Bank of Nigeria should pay more attention in checking inflation and pursue policies that will ensure single digit inflation rate as inflation exerts significant influence on agricultural production. This is imperative so that the agricultural sector would continue to be pivotal to the growth of Nigeria's economy as well as poverty and hunger reduction among Nigerians.

Keywords: Inflation, Agriculture, Economic growth, Link

1. Introduction

Inflation has been apparent in Nigeria which was propelled in the 1960s through the "cheap money policy" adopted by the government to stimulate development after independence (Bayo, 2005). Nigeria has experienced all manners of inflationary episodes; from creeping to moderate and from high to galloping (Olubusoye and Oyaromade, 2008). Inflationary pressure in Nigeria was largely contained in 2010 and 2011, though the rate remained above the national and the West African Monetary Zone (WAMZ) single-digit inflation rate

target (CBN, 2011). However, the 12-month moving average headline inflation rate was 10.8 per cent in 2011, compared with 13.7 per cent at end-December 2010.

The agricultural sector is strategic to national economic development and contributes 42.1% of the GDP in 2009 (Eleri *et al.,* 2012). It remains a major source of food and raw material for agro-industrial processing and has strong links to employment, national income, market opportunities for industrial production and strong potentials for poverty reduction and health improvement. However, Nigeria's agriculture faces tremendous challenges with the rising food prices becoming more disturbing.

Food price inflation has risen in recent years (2000 – 2008) because of many factors; on and off farms throughout the world (Oppedahl, 2009). The future direction of world food prices will depend on whether research and development increases agricultural productivity faster than the growth in world food demand. Key sources and features of recent increases of food prices in developing countries have been identified as being the underinvestment in agricultural innovation and rural infrastructure, shift of land and crops towards biofuel feedstocks, natural disasters, high global energy prices, unequal distribution of resources, mismanagement of natural resource, population growth and competition for land and water (Alam and Shahiduzzaman, 2008)

Global food prices registered a new high in February 2011, rising by more than 30 per cent year-on-year, underpinned by large increases in the prices of cereals, edible oils, and meat (ADB, 2011). While the recent price increases were triggered largely by production shortfalls due to bad weather, structural and cyclical factors that were at play during the 2007–2008 planting season, food crisis continue to be relevant, especially in light of the strong recovery of many emerging economies from the global economic crisis. Inflation is undeniably one of the most leading and dynamic macroeconomic issues confronting almost all economies of the world and has become a leading topic of discussion in Nigerian families and press as its effects penetrate more deeply into nation's life due to prevailing increase in prices (Olatunji *et al*., 2010). The consumer price index for food over the years in Nigeria constituted a larger proportion of the composite consumer price index (CBN, 2010) and as noted by Oppedahl (2009), households in developing countries like Nigeria spend more on food relative to overall spending and therefore, food price inflation had played a bigger role in overall inflation.

Despite the critical position of inflation in the macroeconomic environment of Nigeria, research efforts have not hitherto addressed the links between the direction of inflation, agricultural productivity and economic growth over the years in Nigeria and therefore, this study was carried out to fill the identified gap in research by providing empirical evidence on the direction of causality between the inflationary trend, agricultural productivity and economic growth in Nigeria and draw up relevant policy implications.

2. Theoretical Framework and Literature Review

According to Keynesian theory, inflation can be caused by increase in demand and/or increase in cost (Jhingan, 2010). Demand-pull inflation is a situation where aggregate demand persistently exceeds aggregate supply when the economy is near or at full employment. Keynesian theory of cost-push inflation attributes the basic cause of inflation to supply side factors. This means that, rising production costs will lead to inflation.

Akpan and Udoh (2009) study on estimating grain relative price variability and inflation rate movement in different agricultural policy regimes in Nigeria found out that inflation had a positive significant effect on relative price variability of grains and that the SAP and post SAP agricultural policy regimes in the country brought about a positive significant shift in the coefficient of inflation which implies an increase in the relative price variability of grains. Mesike *et al.* (2010) also found out that inflation has a significant positive impact on relative price variability in both the short-run and long-run, and recommended that policies to protect the agricultural sector from inflationary pressure in the short-run.

Murtala (2010) reported a negative and significant relationship between inflation and economic performance in Nigeria and noted that both supply-side policies and demand management policies such as a reduction in real broad money supply should be adopted to reduce inflation in both short-run and the long-run. Ukoha (2007) found out that the effect of inflation on relative price variability is non-neutral for both food crops and cash crops, and that there is a significant positive impact of inflation on price variability in both the short-run and the long-run.

The role of *agribusiness* has become important in the context of the challenges that global economy faces in enhancing food production to cater for increasing demand of food, fuel and feed. The impact of agribusiness on inflation is also both direct and indirect (Khan, 2012). The direct impact is visible in the form of food inflation while the indirect impact is reflected in the rise in cost of living arising from high food inflation leading to higher wages, which, in turn, contributes to generalised inflation through higher cost of production.

From a policy point of view; both global and domestic, one of the channels through which inflation affects fiscal balances is that the overall cost of living increases as food prices increase, more so for low income countries where food constitutes a substantive part of the consumption basket (Canuto, 2011).

3. Methodology

3.1 Type and Source of Data

This study employed time series data on inflationary trend given by inflation rate (1970 – 2011), agricultural productivity given by index of the aggregate of agricultural production (1970 – 2011) and economic growth given by real gross domestic product (1970 – 2011). The data were collected from various issues of Central Bank of Nigeria statistical bulletin

and annual reports (CBN, 2008; 2011) and National Bureau of statistics (NBS, 2010).

3.2 Analytical Procedure

The data sourced were analysed using both descriptive and inferential statistics. Descriptive statistics in the form of mean, median, minimum, maximum, standard deviation, skewness and kurtosis were used to summarize the features of the variables under study. Inferential statistics such as Augmented Dickey Fuller (ADF) test, unrestricted vector autoregression (VAR) and pairwise Granger causality test were employed. The ADF test was used to ascertain the time series properties of all the variables so as to avoid spurious regression which results from the regression of two or more non-stationary time series data. Unrestricted VAR was employed to generate the criteria (likelihood ratio, final prediction error, Akaike information criterion and Schwarz information criterion) which formed the basis for selecting the optimal lag length used in the granger causality test and finally, the pairwise Granger causality test was used to determine the causal links between inflationary trend, agricultural productivity and economic growth in Nigeria. The model of the Augmented Dickey Fuller (ADF) with the constant term and trend is as follows:

3.3 Model Specification

$$\Delta Y_t = a_1 + a_2 t + \beta Y_{t-1} \sum_{i=1}^{n} \gamma_i \Delta Y_{t-1} + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

The null hypothesis ($H_O: \beta = 0$) of the ADF test indicates that the series is not stationary and the alternative hypothesis ($H_O: \beta < 0$) indicates that the series is stationary. If the absolute value of calculated ADF statistic (τ) is higher than the absolute value of the critical values, we cannot reject the hypothesis of stationary. However, if this value is lower than the critical values, the time series is not stationary (Gujarati, 2004). The Granger causality test assumes that the information relevant to the prediction of the respective variables, X and Y, is contained solely in the time series data on these variables. The test involves estimating the following pair of regressions:

$$X_t = \beta_0 + \sum_{i=1}^{p} \beta_i X_{t-i} + \sum_{j=1}^{p} \alpha_j Y_{t-j} + \mu_{1t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

$$Y_t = \gamma_0 + \sum_{i=1}^{p} \gamma_i Y_{t-i} + \sum_{j=1}^{p} \delta_j X_{t-j} + \mu_{2t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

It is assumed that the disturbances μ_{1t} and μ_{2t} are uncorrelated. Thus there is unidirectional causality from X to Y if α_i = 0 and $\delta_i \neq 0$. Similarly, there is unidirectional causality from Y to X if δ_i = 0 and $\alpha_i \neq 0$. The causality is considered as mutual (bilateral causality) if $\delta_i \neq 0$ and $\alpha_i \neq 0$. Finally, there is no link between X and Y (independence) if δ_i = 0 and α_i = 0.

To determine the causal links between inflationary trend agricultural productivity and economic growth in Nigeria, the pairwise granger causality test was modelled as a multivariate vector autoregressive (VAR) model as follows:

$$\boldsymbol{IFT_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i IFT_{t-i} + \sum_{j=1}^{p} \omega_j AGP_{t-j} + \epsilon_{1t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (4)$$

$$\boldsymbol{AGP_t = \beta_0 + \sum_{i=1}^{p} \beta_i AGP_{t-i} + \sum_{j=1}^{p} \varphi_j IFT_{t-j} + \epsilon_{2t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

$$\boldsymbol{IFT_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i IFT_{t-i} + \sum_{j=1}^{p} \omega_j ECG_{t-j} + \epsilon_{1t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (6)$$

$$\boldsymbol{ECG_t = \beta_0 + \sum_{i=1}^{p} \beta_i ECG_{t-i} + \sum_{j=1}^{p} \varphi_j IFT_{t-j} + \epsilon_{2t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (7)$$

$$\boldsymbol{AGP_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i AGP_{t-i} + \sum_{j=1}^{p} \omega_j ECG_{t-j} + \epsilon_{1t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (8)$$

$$\boldsymbol{ECG_t = \beta_0 + \sum_{i=1}^{p} \beta_i ECG_{t-i} + \sum_{j=1}^{p} \varphi_j AGP_{t-j} + \epsilon_{2t}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (9)$$

The VAR model is expressed in matrix notation as:

$$\begin{bmatrix} \boldsymbol{IFT_t} \\ \boldsymbol{AGP_t} \\ \boldsymbol{ECG_t} \end{bmatrix} = \begin{bmatrix} \boldsymbol{a_1} \\ \boldsymbol{a_2} \end{bmatrix} + \begin{bmatrix} \boldsymbol{b_{11,1}} & \boldsymbol{b_{12,1}} & \boldsymbol{b_{13,1}} \\ \boldsymbol{b_{21,1}} & \boldsymbol{b_{22,1}} & \boldsymbol{b_{23,1}} \\ \boldsymbol{b_{31,1}} & \boldsymbol{b_{32,1}} & \boldsymbol{b_{33,1}} \end{bmatrix} \begin{bmatrix} \boldsymbol{IFT_t} \\ \boldsymbol{AGP_t} \\ \boldsymbol{ECG_t} \end{bmatrix} + \begin{bmatrix} \boldsymbol{b_{11,p}} & \boldsymbol{b_{12,p}} & \boldsymbol{b_{13,p}} \\ \boldsymbol{b_{21,p}} & \boldsymbol{b_{22,p}} & \boldsymbol{b_{23,p}} \\ \boldsymbol{b_{31,p}} & \boldsymbol{b_{32,p}} & \boldsymbol{b_{33,p}} \end{bmatrix} \begin{bmatrix} \boldsymbol{ECG_t} \\ \boldsymbol{AGP_t} \\ \boldsymbol{IFT_t} \end{bmatrix} + \begin{bmatrix} \boldsymbol{\epsilon_{1t}} \\ \boldsymbol{\epsilon_{2t}} \end{bmatrix} \ldots (10)$$

Where:

IFT_t = Inflationary trend given by inflation rate (%).

AGP_t = Agricultural productivity given by index of aggregate agricultural production.

ECG_t = Economic growth given by real gross domestic product in ₦' million.

a = Constant terms.

$b =$ Estimated coefficients of inflationary trend, agricultural productivity and economic growth.

$\epsilon_{1t}, \epsilon_{2t} =$ Gaussian white noise error terms.

$p =$ optimal lag length.

The statistical analyses were carried out using Reviews 7.2 statistical package.

4. Results and Discussion

4.1 Descriptive Profiles of Variables

From Table 1, the skewness is an indicator of the asymmetry or deviation of the variables from a normal distribution with an expected value of zero. The kurtosis defines the degree of flattening or peakedness of a distribution with an expected value of three. Jarque bera statistic determines the normally or otherwise of a distribution. IFT has a skewness greater than zero (positively skewness), kurtosis approximately three (mesokurtic) and its Jarque bera statistic (21.398) denotes that its errors are normally distributed. AGP is negatively skewed, leptokurtic and its errors are normally distributed based on the Jarque bera statistic (21.988). ECG is also negatively skewed, leptokurtic and has a Jarque bera statistic of 67.668 which implies that ECG is normally distributed.

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Table 1: Descriptive statistics of Inflationary Trend, Agricultural Productivity and Economic Growth (1970 – 2011).

Statistic	IFT	AGP	ECG
Mean	19.300	116.235	281607.462
Median	13.850	105.770	266464.565
Maximum	72.800	270.600	833400.000
Minimum	3.200	55.160	4219.000
Std. Dev.	15.984	62.057	228451.229
Skewness	1.740	0.898	0.754
Kurtosis	2.658	-0.056	-0.100
Jarque – Bera	21.398	21.988	67.668
Sum	810.500	4881.890	11827513.380
Observations	42	42	42

Source: **Author's computation**

4.2 Augmented Dickey Fuller Unit Root Test

Table 2 indicated lnIFT was found to be integrated of order zero and this implies that lnIFT was stationary at level form. lnAGP and lnECG were found to be integrated of order one at level form and therefore, became stationary after differencing once. Differencing was necessary so as to avoid the phenomenon of spurious regression when series are used in their non-stationary form.

Table 2: Result of Augmented Dickey Fuller Test

Variable	ADF Statistic	Test Critical value(5%)	Inference
Level			
lnIFT	- 4.013819	-3.603202	*I*(0)
lnAGP	-1.336782	-3.603202	*I*(1)
lnECG	1.639852	-3.603202	*I*(1)
First difference		-3.690814	*I*(0)
ΔlnAGP	- 6.587732	-3.612199	*I*(0)
ΔlnECG	- 4.327546		

NB: ln = natural logarithm
Δ = difference operator
Lag length selection was automatic based on Schwarz information criterion (SIC)

4.3
Vector Autoregression (VAR) Lag Order Selection Criteria

VAR model was fitted to the time series data in order to find an appropriate lag structure for the Granger causality test. This was necessitated by the sensitivity of Granger causality to lag length structure (Foresti, 2006; Afzal, 2012, Oyinbo *et al.,* 2012). The result as shown in Table 3 indicates that the optimal lag length is one based on Likelihood ratio (LR), Final prediction error (FPE), Akaike information criterion (AIC) and Schwarz information criterion (SIC).

Table 3: **VAR Lag Order Selection Result**

Lag	LR	FPE	AIC	SIC
0	NA	0.064459	2.933882	1.453467
1	84.62852*	0.000860*	-1.386750*	1.854632*
2	2.881067	0.001067	-1.185864	1.566986
3	4.347656	0.001185	-1.115459	1.426778
4	14.64704	0.000546	-1.955094	1.176634
5	3.039158	0.000660	-1.878057	1. 573249

NB: * indicates lag order selected by the criterion
LR: Likelihood ratio FPE: Final prediction error
AIC: Akaike information criterion Schwarz information criterion

4.4 Granger Causality Test

The Granger causality test was carried out using an optimal lag length of one and is given in Table 4. The result indicates that there is unidirectional causality from inflationary trend to agricultural productivity leading to the rejection of the hypothesis that inflation rate does not granger cause agricultural productivity and also, unidirectional causality from agricultural productivity to economic growth leading to the rejection of the hypothesis that agricultural productivity does not granger cause economic growth. The result also indicated that there was no causality between inflationary trend and economic growth over the period of the study. The implication of the results is that the trend of inflation has been significant in influencing agricultural productivity and agricultural productivity has been significant in influencing economic growth over the study period. The observed influence of inflationary trend on agricultural production can be attributed to the persistent rise in the cost of farm inputs over the years leading to an increase in the cost of agricultural production activities. This phenomenon is referred to as the cost push inflation. The inability of the agricultural sector to attain self-sufficiency in food production has led to a situation of aggregate demand for food to exceed aggregate supply leading to demand pull inflation in the economy

Despite the inability of the agricultural sector to attain self-sufficiency in food production, it has been significant in influencing economic growth over the years. As noted by CBN (2011), the agricultural sector contributes the largest share of the gross domestic product of Nigeria.

Table 4: Result of Pairwise Granger Causality Test

Null Hypothesis(H_0)	Obs.	F- statistic	Prob.	Decision
IFT does not granger cause AGP	41	24.4587	0.0257	Accept H_0
AGP does not granger cause IFT	41	0.08745	0.9988	Reject H_0
IFT does not granger cause ECG	41	0.1734	0.1856	Accept H_0
ECG does not granger cause IFT	41	0.0231	0.7643	Accept H_0
AGP does not granger cause ECG	41	14.5644	0.0614	Reject H_0
ECG does not granger cause AGP	41	1.4389	0.5791	Accept H_0

5. Conclusion and Recommendation

The study was able to establish the nature of links between inflationary trend, agricultural productivity and economic growth over the period of 1970 to 2011. The result of the Granger causality test confirmed the existence of unidirectional causality from inflationary trend to agricultural production, unidirectional causality from agricultural productivity to economic growth with no causality from inflationary trend and economic growth over the data period of the study. The study thus recommended that the monetary authority in Nigeria should carefully monitor the trend of inflation and pursue policies that will ensure a single digit inflation rate with a view to ensuring that the agricultural sector continues to play a major role in the Nigerian economy, especially towards driving the economy in line with the national transformation agenda of poverty and hunger reduction.

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