Impact of Monetary and Fiscal Policy on Rice Productivity in Nigeria

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Abstract

The paper examined the impact of monetary and fiscal policy instrument on rice productivity and employed vector auto-regressive model using Augmented Dickey Fuller unit root text, followed by Johansen Co-integration test among the series using annual data for the period 1981-2016.

The results also show that all the monetary and fiscal policy instrument fitted co-integrate with rice production. Therefore, long run relationship exists among the variables and rice productivity. In the long-run, interest rate, exchange rate, money supply and public expenditure significantly affected rice productivity with adjusted R^2 value of 60%. The result also shows that there is deceleration in exchange rate, interest rate and rice output. The speed of adjustment where monetary and fiscal policies variables will equate rice productivity in the short run is- 0.365830. The study concludes that there exist no short-run effects of policies instruments on rice productivity but on the long run. From this finding, the study recommended regulations of interest rate to a single digit, exchange rate should be friendly. Government should increase spending to agriculture and by extension policy focus on rice production to boost rice productivity). The study also recommended government regulation of policies instruments and to desist from frequent policies change.

Keywords: monetary policy; fiscal policy; vector auto regressive; co-integration; augmented Dickey-Fuller; productivity.

JEL Codes: E63; 011; Q18; R15.

Introduction

The contribution of agricultural sector to the economy cannot be overemphasized when considering its building roles for sustainable development in terms of employment potentials, export and financial impacts on the economy.

Agriculture is an important sector of Nigeria's economy before the discovery of oil in late 1950's and early 1960's, where agriculture was the dominant sector of the country's economy which constitutes over 65% of the country's GDP and provides the bulk of the foreign exchange earnings through the export of its product. (Okoh, 2015). The food sub-sector of Nigeria agriculture parades a large array of staple crop made possible by the agro-ecological production system. The major food crop is: cereal, tubers, legumes and vegetables. These are commodities that are of considerable importance for food security expenditure and income of households.

Rice, wheat and maize are three leading food crops in the world; together they directly supply more than 50 per cent of all calories consumed by the entire human population (Makama *et al.* 2017) Thus, rice is being consumed by more than half of the world population. Available data indicated that, production of milled rice in the world totalled 409.2 million tonnes in 1999 increased to 496.4 million tonnes in 2014. Nigeria produced 4.82 million tonnes of rice in 2013 and reached 6.73 million tonnes in 2014 (Makama *et al* 2017).

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The demand for rice in Nigeria has been soaring as a result of increasing population growth, increased income level, urbanization and associated changes in family occupational structures (Makama *et al*. 2017).

A combination of various factors seems to have triggered the structural increase in rice consumption. Like elsewhere in West Africa, urbanization appears to be the most important cause of the shift in consumer preferences towards rice in Nigeria with consumption broadening across all socio-economic classes, including the poor. Rising demand is as a result of increasing population growth and income level (GAIN 2012) in Oyinbo, *et al.* (2013).

According to Idriss *et al*. (2012) as cited by Makama *et al.* (2017), Nigeria is among the six countries that accounts for approximately 46 per cent of world malnourished. However, rice is of special importance for the nutrition of large reaches of the population in Asia, parts of Latin America and the Caribbean and, increasingly so, in Africa. As a result, it plays a pivotal role for the food security of over half the world population. For those reasons, rice is considered as a "strategic" commodity in many countries, both developed and developing, and has consequently remained subject to a wide range of government controls and interventions (FAO 2015).

In Nigeria, the result of government role in economic activities and the achievements in economic performance have been mixed. The overall picture is low scoring for the country's development efforts since the economy experienced growth in real output in some years and declines in others. The objective of monetary and fiscal policies in Nigeria is widely ranged to include; increase in Gross Domestic Product, growth rate, reduction in the rate of inflation and unemployment, improvement in the balance of payments, accumulation of financial savings and external reserves as well as stability in Naira exchange rate. The policy instruments applied to attain these objectives have until recently been far from adequate, undue reliance has been placed on fiscal policy rather than monetary policy in Nigeria (Abata *et al*. 2012).

Fiscal policy is considered an important variable which may determine changes in national income in developing countries like Nigeria. In stimulating economic growth by fiscal policy, the country has more instruments. These according to Adegboyo *et al.* (2021) are the financing of direct investments which private sector would not provide adequate quantities, the supply of certain public services which are necessary to ensure the basic conditions to display the economic activity and long term investments, and the financing of public activities so as to minimize the distortions to come up with the decisions to spend and invest in the private sector. Public expenditure is one of the fiscal policy instruments which the government uses in achieving the macroeconomic goals. Public spending is an outflow of resources from the government to other sectors of the economy, whether requited or unrequited (Adegboyo and Olaniyan, 2021).

Both monetary and fiscal policies play a key role in the promotion of main government objective of promoting the citizens' welfare. Abata *et al.* (2012) argued that before monetary policy can produce required result as maintained by the classical economist, higher integrated and monetized economy and regular information network system are indispensable. He however, lamented that the Nigerian economy lacks the fundamental, flexibilities (in respect to interest rate, treasury certificates *etc*.) which could have aided a much more effective use of monetary policy. He therefore denounces the classical preference of monetary policy over fiscal policy on the basis of their empirical evidence and predicted that it would only work for developed economy and suggest where necessary the mix of both policies should be adopted in a developing economy like Nigeria for better economic performance.

Some researchers have worked on monetary and fiscal policies instruments for instance, Bodunrin (2016) worked on the impact of fiscal and monetary policy on Nigerian economic growth from 1981 to 2015, Christopher and Akorah (2012) also checked the impact of monetary policy on agricultural development in Nigeria from 1970 to 2010, Olanipekun and Benjamin (2015) worked on fiscal and monetary policy instrument and economic growth sustainability in Nigeria, the researchers want to establish that despite all these works, little or no emphasis has been placed on monetary and fiscal policies as they affect rice production. This is the gap intended to be fill. The study addressed the following objectives: determine the direction of growth of monetary and fiscal policies on rice productivity in Nigeria, examine the long run effect of monetary and fiscal policies on rice productivity and examine the short run effect of monetary and fiscal policies on rice productivity. It was hypothesized that, monetary and fiscal policies have no significant effect on rice productivity in the long run and monetary and fiscal policies have no significant effect on rice productivity in the short run.

1. Literature Review

The paper reviewed work covered some empirical views growth rate as opined by Neoclassical Economists and how monetary and fiscal policies instruments played out in Nigeria agricultural sector.

1.1. Neoclassical Growth Theory

Growth Theory is an important part of modern macro-economics. The analysis of growth has long been based on the Solow (1956) growth accounting approach also termed as neoclassical growth theory, which has two important predictions about growth in the long run: first, that the long –run growth rate is driven by population growth; and second that of the rate of technical progress.

Much of modern growth theory builds on the neoclassical model of exogenous growth (Solow, 1956, 1957, Swan, 1956) which views the accumulation of physical capital associated with a permanent low technical progress as the driver of economic growth. The basic assumptions of the model are constant returns to scale, diminishing marginal productivity of capital, exogenously determined technical progress and substitutability between capital and labor. Technological progress, though important in the long run is regarded as exogenous to the economic system and therefore it is not adequately examined by this model (Petrakos *et al.* 2007).

The neoclassical growth model assumes the Cobb-Douglas production function that in its intensive form is expressed as:

$$Y = AK^{\alpha}$$

where, *Y* and *K* are the output-labor ratio and the capital- labor ratio respectively, α is the capital elasticity of output and A is the total factor productivity (TFP) representing technological capacity of the productive system. Under this model, *A* grows either as a purely exogenous process or through exogenous technical innovations which are embodied in capital goods.

1.2. Trend and Direction of Growth of Monetary Policy

Onyeiwu (2012), examined the impact of monetary policy on the Nigerian economy using ordinary least square (OLS) method, with the result showing that monetary policy represented by money supply exert a positive impact on GDP growth and balance of payment but negative impact on rate of inflation and he concluded that the CBN monetary policy is effective in regulating the liquidity of the economy which affects some macroeconomic variables such as output, employment and prices.

The monetarists emphasized on the supply of money as a key factor affecting the wellbeing of the economy and as well, accepted the need for an effective monetary policy to stabilize an economy. He also has the notion that, in other to promote steady growth rate, money supply should grow at a fixed rate, instead of being regulated and altered by the monetary authorities (Nwoko 2016).

Michael and Ebibai (2014) examined the impact of monetary policy on selected macroeconomic variables like the GDP, inflation, and balance of payment in Nigeria using OLS regression analysis. They then conclude that the provision of investment friendly environment in Nigeria will increase the growth rate of GDP.

1.3. Trend and Direction of Growth of Fiscal Policy

The direction of growth of fiscal policy has generated large volume of empirical studies with mixed findings using cross sectional, time series and panel data. Fiscal policy is generally believed to be associated with growth, or more precisely, it is held that appropriate fiscal measures in particular circumstance can be used to stimulate economic growth and development (Khosravi and Karimi 2010).

The role of economic policy in the achievement of macroeconomic objectives has been extensively dealt with in Keynesian analysis of an activist macroeconomic policy. The Keynesian analysis lead to the conclusion that demand management policies can and should be used to improve macroeconomic performance.

Dar-Atui and Amirkhalkhali (2002) conducted investigation on the endogenous growth model of fiscal policy and concluded that government expenditure and income is very crucial in predicting future economic growth. Nijkamp and Poot (2002) also conducted a meta-analysis of past empirical studies of fiscal policy and growth and found out that in a sample of 41 studies, 29% indicates a negative relationship between fiscal policy and growth, 17% a positive one, and 54% an inconclusive relationship. Abduliah (2000) analyze the relationship between government expenditure and economic growth and found out that the size of government expenditure is very important in determining the performance of the economy. He further advised that, government should not only support and encourage the private sector to accelerate economic growth, but should also increase its budgetary provision on infrastructure, social and economic activities.

1.4. Trend and Direction of Growth of Rice Productivity in Nigeria

Public policy in rice sector has neither been consistent nor appropriate and domestic production has continued to lag behind demand Akande (2003). Akande (2003) then noted that, given the current global trend and an increasingly competitive world economy, Nigeria faces some strategic choices in relation to the rice economy. The demand for rice has been increasing at a much faster rate in Nigeria than in other West African countries since the mid 1970s.

For example, during the 1960's Nigeria had the lowest per-capita annual consumption of rice in the sub-region (average of 3 kg). Since then, Nigerian per-capita consumption levels have grown significantly at 7.3% per annum. Consequently, per-capita consumption during the 1980's averaged 18 kg and reached 22 kg in 1995-1999. Despite the catching up of per-capita consumption with the rest of West Africa, Nigerian consumption levels still lag the rest of the sub- region (34 kg in 1995-1999) Akande (2003). Consequently, above average growth rates in Nigerian per capita rice consumption are likely to continue for some time.

1.5. Long and Short Run Effect of Monetary and Fiscal Policies on Rice Productivity in Nigeria

Dar Atui and Amirkhalkhali (2002) conducted investigation on the endogenous growth model of fiscal policy and concluded that in the endogenous growth model of fiscal policy (government expenditure and tax) is very crucial in predicting future economic growth. Abduliah (2000) analyzed the relationship between government expenditure and economic growth and found that the size of government expenditure is very important in determining the performance of the economy in the long run. He further advised that, government should not only support and encourage the private sector to accelerate economic growth, but should also increase its budgetary provision on infrastructure, social and economic activities.

1.6. Causal Relationship Between Monetary and Fiscal Policies

The interaction between fiscal and monetary policies and the different agencies responsible for implementation of these policies imply there are no exclusive effective fiscal and monetary measurements for dealing with these deformations, given that each policy has its own supporters. So, most countries have been adopting monetary policy, fiscal policy, or a mix of both policies to tackle their economic problems.

Iddrisu *et al*. (2017) studied the impact of monetary policy on stock market performance from twelve (12) African countries, they argued that curbing the fiscal indiscipline of Government will take much more than enshrining fiscal policy rules in our statute books. This is because the statute books are replete with dormant rules and regulation. They noted that there exist a mild long-run equilibrium relationship between economic growth and fiscal policy variables in Nigeria.

Finally, they suggested that for any meaningful progress towards fiscal prudence on the part of Government to occur, some powerful pro-stability stakeholders strong enough to challenge government fiscal recklessness will need to emerge.

2. Methodology

2.1. The Study Area

The focus area is Nigeria. Nigeria is situated in West African region where it is bordered by Niger and Chad to the north, Cameroon to the east and Benin Republic to the southwest. It has a total area of 923,800 sq. km. and occupies about 14% of land area in West Africa. The country lies between latitudes 4˚N and 14˚N, and longitudes 3˚E and 15˚E. Nigeria is located within the tropics and therefore experiences high temperatures which vary from 32˚C along the coast to 41˚C in the far north, while the mean minimum figures range from 21˚C in the coast to below 13˚C in the north. The climate of the country varies from a very wet coastal area with annual rainfall greater than 3,500 mm to the Sahel region in the north. It is divided into six geopolitical regions: North Central, North East, North West, South West, South East and South South. It can also be divided based on the geo-ecological zones into the dry savannah (North East, North West and part of North Central), the humid forest (parts of South West, South East, North Central and South South) and moist savannah, some part of South West, South East and mainly South South (Abolarin 2017).

Method of Data Collection

Secondary data consisting of annual time series covering a period of 36 years (1981 – 2016) were used for this study. Variable of interest includes public expenditure on rice, rice output, interest rate, exchange rate, inflation, money supply and labour which were obtained from the Central Bank of Nigeria (CBN) and National Bureau of Statistics (NBS).

2.2. Data Analysis Techniques

Descriptive statistics such as mean, median, mode, graphs and trend analysis were used to achieve objective one. The Johansen co-integration test was used to achieve objective two. The vector autoregressive model (VAR) was used to achieve objective three as co-integration exists; and the t-test VAR estimation was used to test the hypotheses.

2.3. Model Specification

Trends Analysis

Following Gujarati (2004) trend model which is specified as follow

$$Y_t = Y_0(1+r)^t \quad (1)$$

where: y = value of variables of interest (interest rate, exchange public expenditure, taxes, money supply, inflation, budget to rice sec)*; t* = time of period*; r* = compound production rate.

Therefore, if we take the natural logarithm of both sides:

$$ln\ y_t = \ t\ ln\ (1+r) \quad (2)$$

where: *ln* is the natural logarithm

If we let $ln\ y_0 = \ \alpha\ and\ ln\ (1+r) = \beta$. Then the equation will be written as:

$$\text{In } y_t = \alpha + \beta_t \quad (3)$$

Adding the disturbance term (u_t) to the equation, we obtain:

$$\text{In } y_t = \alpha + \beta_t + u_t \quad (4)$$

where α = intercept; β = trend variables and u = econometric error term.

The rice productivity model can therefore be specified using the variables of interest as follow:

$$lny_t = \alpha + \beta_{pc}t + u_t \quad (5)$$

$$lny_t = \alpha + \beta_{inf}t + u_t \quad (6)$$

$$lny_t = \alpha + \beta_{tax}t + u_t \quad (7)$$

$$lny_t = \alpha + \beta_{int}t + u_t \quad (8)$$

$$lny_t = \alpha + \beta_{ms}t + u_t \quad (9)$$

$$lny_t = \alpha + \beta_{exc}t + u_t \quad (10)$$

$$lny_t = \alpha + \beta_{ETR}t + u_t \quad (11)$$

$\beta_{pe}, \beta_{inf}, \beta_{tax}, \beta_{int}, \beta_{ms}, \beta_{exc}, \beta_{ETR}$ are coefficient of the trend variables for public expenditure, inflation, taxes, interest rate, money supply, exchange rate, expenditure on rice respectively. A semi-log growth rate model will be developed for this study instead of a linear trend model because the study interested in absolute and relative change in the parameters of interest for this research. The parameter of utmost interest in equation (4) is coefficient of β(6), the slope coefficient which measures the constant proportional or relative change in Y for a given absolute change in the value of the regressor to firstly, multiply b by 100, gave the instantaneous productivity rate (IPR) at a point in time.

$$\text{IPR} = b \times 100 \quad (12)$$

where: IPR = instantaneous productivity rate, and b = least-square estimate of the slope coefficient β.

Secondly, taking the antilog of b, subtracting 1 from it and then multiplying the difference by 100 gave the compound productivity rate (CPR) over a period of time. The compound productivity rate (CPR) in percentage in each of the four cases can be recovered from the equation 11 – 20 in the following manners

$$CPR = (e^{\beta_i} - 1)^{*}100 \quad (13)$$

where: β_i = the coefficient of the trend variable in the respective cases.

Decision Rule

- If the *b* is positive and statistically significant, there is acceleration in productivity rate;
- If the *b* is negative and statistically significant, there is deceleration in productivity rate;
- And if the *b* is not statistically significant, there is stagnation in the productivity rate.

Unit Root Test

Augmented Dickey fuller (ADF) was used to test for the presence of unit root or stationarity of each variable in other to avoid spurious relationship. The model of ADF test with a constant and trend is specified below:

$$\Delta y_t = \alpha_0 + \alpha_2 t + \beta_1 + y_{t-1} + \sum_{1-1}^{p} \beta_2 \Delta y_{t-1} + et \quad (14)$$

where: y_t = current value of rice productivity or monetary policy of fiscal policy; y_{t-1} = immediate past values of rice productivity or mometary policy or fiscal policy; t = variable time; Δ = change operator; p = optimal lag length; α_0 = constant; $\alpha_2, \beta_1, \beta_2,$ = parameters coefficients to be estimated; e_t = error term.

The unit root equation for rice productivity, monetary policy and fiscal policy are specified below respectively:

$$\Delta RP_t = \alpha_0 + \alpha_2 t + \beta_1 RP_{t-i} + \sum_{i-1}^{n} B_2 \, \Delta RP_{t-i} + e_t \quad (15)$$

$$\Delta RP_t = \alpha_0 + \alpha_2 t + \beta_1 MP_{t-i} + \sum_{i-1}^{n} B_2 \, \Delta MP_{t-i} + e_t \quad (16)$$

$$\Delta FP_t = \alpha_0 + \alpha_2 t + \beta_1 FP_{t-i} + \sum_{i-1}^{n} B_2 \, \Delta FP_{t-i} + e_t \quad (17)$$

Decision rule

- If the ADF statistics is greater than the critical value, that means the series is stationary in nature.
- If the ADF statistics is less than the critical value, that means the series is non-stationary in nature.

Johansen Co-Integration Test

The Johansen co-integration test is used to test for the long run relationship among variables of interest. The method employed for this study was based on the estimation of vector Autoregressive (VAR) model since co-integration exists among variables. If there is no co-integration among the variables, the regression is transformed to its VECM form, but if there is co-integration, it is left in its VAR form.

$$y_t = A_t y_{t-1} + - - - - + A_p y_{t-p} + BX_t + e_t \quad (18)$$

where: y_t = K – vector of non-stationary 1(i) variables; x_t = d – vector of deterministic variables; e_t = vector.

The VAR can latter assume the following form:

$$\Delta y_t = \Pi y_{t-1} + \sum_{i-1}^{k-1} \Gamma_i \, \Delta y_{t-i} + BX_t + e_t \quad (19)$$

where: $\Pi = \sum_{i-1}^{p} A_i \; and \; \Gamma_i = -\sum_{i-1+i}^{p} A$

Granger's representation theorem asserts that if the coefficient matrix Π has reduced rank y<k then there exist kxr matrices α and β each with rank r such that $\Pi = \alpha^{\beta'}$ and $\alpha\beta_t$ is I (0), where r is the number of cointegration relationship and each column of β is the co-integration vector. Johansen's method is to estimate the Π matrix from an unrestricted VAR and to test whether we can reject the restriction implied by the reduced rank of Π.

Decision Rule

- The hypothesis of co-integration is accepted if the number of co-integration relationship is greater than or equal to one. The decision rule opens which to accept or not that there exists a long run relationship between variables of interest is thus the likelihood ratio (L.A) and the critical value at a certain significance level determines whether to accept or reject the null hypothesis. If the likelihood ratio is less than the critical value at a given level of significance, the null hypothesis is accepted and vice versa. The hypothesis indicates the number of co-integration equation(s), and the significance levels are usually 1% and 5%.
- Expenditure on rice was measured in Naira.
- Exchange rate was measured in terms of dollar to Naira.
- Interest rate was measured in percentage.
- Inflation rate was measured in percentage.
- Money supply was measured in Naira.
- Rice output was measured in tonnes.3.

3. Results and Discussion

3.1 The Direction of Growth of Exchange Rate

The result of direction of growth of exchange rate is presented in Table 1 below with the result showing that the coefficient of (R^2) is 0.974 indicating 97.4%. The variation of exchange rate is explained by time. Furthermore, the coefficient of exchange rate (-0.005) is significant at 1% and negative, this means that exchange rate is decelerated under the reviewed year. This result agrees with the findings of Ozcan (2020) that exchange rate and economic growth are inversely related, it however disagrees with the finding of (Egbeadumah 2018) that exchange rate is accelerating during the period of 1981 to 2016.

Table 1. Direction of growth of exchange rate

Dependent Variable: LNEXCHANGE RATE				
Method: Least Squares				
Date: 04/21/18 Time: 20:46				
Sample: 1981 2016				
Included observations: 36				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
@TREND	0.382357	0.020271	18.86260	0.0000
@TREND^2	-0.005947	0.000560	-10.62264	0.0000
C	-0.931815	0.153321	-6.077537	0.0000
R-squared	0.974022	Mean dependent var		3.296500
Adjusted R-squared	0.972448	S.D. dependent var		1.950948
S.E. of regression	0.323836	Akaike info criterion		0.662495
Sum squared resid	3.460697	Schwarz criterion		0.794455
Log likelihood	-8.924906	Hannan-Quinn criter.		0.708552
F-statistic	618.6551	Durbin-Watson stat		0.869548
Prob(F-statistic)	0.000000			

Note: Decision; Decelerated.
Source: Author's Computation

3.2 The Direction of Growth of Inflation

The result on direction of growth of inflation is represented in Table 2 below with the result showing that the coefficient of R^2 is 0.121 indicating 12.1%. The variation is explained by time. Also, the coefficient of inflation rate (-0.001) is not significant at 5%. This means that there is a stagnation in inflation rate under the years reviewed. This result disagrees with the finding of (Hakan *et al*. 2008) that inflation has a negative relationship with output growth in Turkey within the reviewed year.

Table 2. Direction of growth of inflation

Dependent Variable: LNINFLATION				
Method: Least Squares				
Date: 04/21/18 Time: 20:47				
Sample: 1981 2016 Included observations: 36				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
@TREND	0.031673	0.043538	0.727486	0.4721
@TREND^2	-0.001465	0.001202	-1.218431	0.2317
C	2.737486	0.329307	8.312882	0.0000
R-squared	0.121649	Mean dependent var		2.685004
Adjusted R-squared	0.068415	S.D. dependent var		0.720629
S.E. of regression	0.695541	Akaike info criterion		2.191402
Sum squared resid	15.96466	Schwarz criterion		2.323362
Log likelihood	-36.44524	Hannan-Quinn criter.		2.237460
F-statistic	2.285193	Durbin-Watson stat		1.094670
Prob(F-statistic)	0.117632			

Note: Decision; Decelerated.
Source: Author's Computation

3.3 The Direction of Growth of Interest Rate

The result of direction of growth of interest rate is presented in table 3 below and the result shows that the coefficient of (R^2) is 0.513 indicating 51.3%, the variation is also explained by time. The coefficient of interest rate (-0.001) is significant at 5% and negative. This indicates that there is a decelerated interest rate under the reviewed year. This result agrees with the findings of Samuel *et al*. (2017) who noted an inverse relation between interest rate and economic growth disagrees with the finding of Egbeadumah (2018) that interest rate is accelerating during the period of 1981 to 2016.

Table 3. Direction of growth of interest rate

Dependent Variable: LNINTEREST RATE				
Method: Least Squares				
Date: 04/21/18 Time: 20:49				
Sample: 1981 2016 Included observations: 36				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
@TREND	0.063967	0.013485	4.743537	0.0000
@TREND^2	-0.001372	0.000372	-3.684942	0.0008
C	2.467523	0.101998	24.19186	0.0000
R-squared	0.513524	Mean dependent var		3.018573
Adjusted R-squared	0.484041	S.D. dependent var		0.299921
S.E. of regression	0.215434	Akaike info criterion		-0.152668
Sum squared resid	1.531591	Schwarz criterion		-0.020708
Log likelihood	5.748022	Hannan-Quinn criter.		-0.106610
F-statistic	17.41742	Durbin-Watson stat		0.858241
Prob(F-statistic)	0.000007			

Note: Decision; Decelerated.
Source: Author's Computation

3.4. The Direction of Growth of Money Supply

The result of direction of growth of money supply is presented in Table 4 below with the result showing that the coefficient of (R^2) is 0.991 indicating 99.1%. The variation of money supply is explained by time. Furthermore, the coefficient of money supply (-0.0003) is significant at 10% and positive. This means that there is acceleration in money supply within the reviewed years. This result agrees with the finding of (Egbeadumah 2018) that exchange rate is accelerating during the period of 1981 to 2016.

Table 4. Direction of growth of money supply

Dependent Variable: LNMONEY SUPPLY				
Method: Least Squares				
Date: 04/21/18 Time: 20:50				
Sample: 1981 2016				
Included observations: 36				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
@TREND	0.247355	0.014552	16.99804	0.0000
@TREND^2	-0.000362	0.000402	-0.901560	0.3738
C	2.179189	0.110067	19.79875	0.0000
R-squared	0.991735	Mean dependent var		6.357840
Adjusted R-squared	0.991234	S.D. dependent var		2.482978
S.E. of regression	0.232477	Akaike info criterion		-0.000398
Sum squared resid	1.783499	Schwarz criterion		0.131562
Log likelihood	3.007164	Hannan-Quinn criter.		0.045660
F-statistic	1979.796	Durbin-Watson stat		0.242011
Prob(F-statistic)	0.000000			

Note: Decision; Decelerated.
Source: Author's Computation

3.5 The Direction of Growth of Rice Output

The result of direction of growth of rice output is presented in Table 5 below. The result shows that the coefficient of (R^2) is 0.851 indicating 85.1%. The variation is explained by time. The coefficient of rice output is (-0.0006) is significant at 10% and negative. This means that there is deceleration in rice output under the studied years. This finding agreed with the resolution of (Fwah 2017) who found out that there is deceleration in agricultural productivity from 1980 to 2014.

Table 5. Direction of growth of rice output

Dependent Variable: LNRICE OUTPUT				
Method: Least Squares				
Date: 04/21/18 Time: 20:52				
Sample: 1981 2016				
Included observations: 36				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
@TREND	0.061466	0.011385	5.398631	0.0000
@TREND^2	-0.000622	0.000314	-1.979589	0.0561
C	14.08287	0.086116	163.5331	0.0000
R-squared	0.851226	Mean dependent var		14.90072
Adjusted R-squared	0.842210	S.D. dependent var		0.457897
S.E. of regression	0.181890	Akaike info criterion		-0.491178
Sum squared resid	1.091767	Schwarz criterion		-0.359218
Log likelihood	11.84120	Hannan-Quinn criter.		-0.445120
F-statistic	94.40657	Durbin-Watson stat		0.767957
Prob(F-statistic)	0.000000			

Note: Decision; Decelerated.
Source: Author's Computation

3.6. The Direction of Growth of Expenditure on Rice

The result is presented in Table 6 below with the result showing that the coefficient of (R^2) is 0.864 indicating 86.4%. The coefficient of expenditure on rice (-0.001) is not significant at 5%. This indicates a stagnated expenditure on rice over the years reviewed. This finding disagrees with the finding of (Egbeadumah 2018) that public expenditure is accelerating during the period of 1981 to 2016.

Table 6. Direction of growth of rice expenditure

Dependent Variable: LNRICE EXPENDITURE				
Method: Least Squares				
Date: 04/21/18 Time: 20:53				
Sample: 1981 – 2016				
Included observations: 36				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
@TREND	0.234538	0.044760	5.239905	0.0000
@TREND^2	-0.001978	0.001236	-1.599832	0.1192
C	15.52758	0.338551	45.86475	0.0000
R-squared	0.864321	Mean dependent var		18.81293
Adjusted R-squared	0.856098	S.D. dependent var		1.885009
S.E. of regression	0.715068	Akaike info criterion		2.246776
Sum squared resid	16.87362	Schwarz criterion		2.378736
Log likelihood	-37.44198	Hannan-Quinn criter.		2.292834
F-statistic	105.1104	Durbin-Watson stat		1.007634
Prob(F-statistic)	0.000000			

Note: Decision; Decelerated.
Source: Author's Computation

3.7 The Direction of Growth of Labour

The result is represented in Table 7 below. The result shows that the coefficient of (R^2) is 0.0958 indicating 9.58%. This variation is explained by time. The coefficient of labor (-0.0004) is not significant at 5%. This means stagnation in labor over the reviewed years.

Table 7. Direction of growth of labor

Dependent Variable: LNLABOUR				
Method: Least Squares				
Date: 04/21/18 Time: 21:15				
Sample: 1981 2016:				
Included observations: 36				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
@TREND	0.009453	0.015633	0.604701	0.5495
@TREND^2	-0.000448	0.000432	-1.038062	0.3068
C	0.975277	0.118245	8.247901	0.0000
R-squared	0.095819	Mean dependent var		0.955092
Adjusted R-squared	0.041021	S.D. dependent var		0.255037
S.E. of regression	0.249751	Akaike info criterion		0.142950
Sum squared resid	2.058392	Schwarz criterion		0.274910
Log likelihood	0.426898	Hannan-Quinn criter.		0.189008
F-statistic	1.748566	Durbin-Watson stat		1.187450
Prob(F-statistic)	0.189763			

Note: Decision; Decelerated.
Source: Author's Computation

Decision Rule

- If β coefficient is significantly positive, it means there is acceleration in the dependent variable.
- If β coefficient is significantly negative, it means there is deceleration in the dependent variable and finally when β coefficient is not significant meaning that there is stagnation in the dependent variable.

3.8 Unit Root Test (Stationary Test).

The result of unit root test is as presented in Table 8 below. From the results, the variables exchange rate, inflation, labor and interest rate were stationary at levels, while money supply, rice output and government expenditures on rice were stationary at first difference.

Table 8. Analysis of unit root test

Variables	At level		At first difference		
	t-statistics	Probability	t-statistics	Probability	Decision
Exchange rate	-1.31	0.86	-5.27	0.0007	I(I)
Inflation rate	-4.20	0.01	-5.68	0.0003	I(I)
Interest rate	-2.86	0.18	-6.09	0.0001	I(I)
Money supply	-2.10	0.52	-3.34	0.0206	I(d)
Rice output	-1.87	0.64	-9.03	0.0000	I(d)
Expenditure on rice	-3.15	0.10	-6.62	0.0000	I(d)
Labor	-3.55	0.04	-5.92	0.0001	I(I)

Source; Author's computation

Johansen Co-integration Test

Table 9. Unrestricted Cointegration Rank Test (Trace)

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.889068	220.0256	125.6154	0.0000
At most 1 *	0.797291	145.2652	95.75366	0.0000
At most 2 *	0.744035	91.00178	69.81889	0.0004
At most 3	0.546187	44.66943	47.85613	0.0966
At most 4	0.308908	17.80702	29.79707	0.5804
At most 5	0.108088	5.244612	15.49471	0.7823
At most 6	0.039082	1.355446	3.841466	0.2443

Note: Trace test indicates 3 cointegrating eqn(s) at the 0.05 level; * denotes rejection of the hypothesis at the 0.05 level; **MacKinnon-Haug-Michelis (1999) p-values

Source: Author's computation

3.9 Long-Run Impact of Monetary and Fiscal Policies on Rice Productivity

The vector autoregressive model was applied due to co-integration of variables. The result is presented in table 10. From the analysis, the coefficient of interest rate is negative (-0.969427) and highly significant at 1%. This implies that a unit increase in interest rate will decrease rice productivity by 96%. This result met the theoretical expectation which may be associated with decreased rice production of a high interest rate. This also agrees with the findings of Egbeadumah (2018) who opined that the interest rate in the previous year significantly affect agricultural growth. Samuel *et al.* (2017) have noted an inverse relationship between interest rate and economic growth in Nigeria.

The coefficient of exchange rate is positive (0.311919) and significant at 1% level of probability. This implies that a unit increase in exchange rate will increase rice productivity by 31%. This may be attributed to the export receipts of rice. This study is in line with the work of Mffon (2017) as cited by Egbeadumah (2018) that exchange rate increases agricultural growth in Nigeria from 1981 to 2013. Ozcan (2020) found that exchange rate and economic growth are inversely related in Turkey economy.

Further analysis indicates that the coefficient of money supply previously is positive (0.290537) and significant at 10%; an indication that a unit increase in money supply in the previous year increases rice productivity by 29%. This could be associated with the fact that the increase in money supply if invested in agriculture will boost rice production. This result agrees with the findings of Prasert *et al.* (2015) who noted that increase in money supply is a significant variable in agricultural growth.

Further analysis shows that the coefficient of public expenditure the previous year is positive (0.287412) and highly significant at 1% level of probability; indicating that a unit increase in public expenditure on rice will lead to increased rice productivity by 28%. This could be attributed to the fact that the funds might have been judiciously used for the intended purpose thus leading to increase in rice productivity. It could also mean that government might have set some machinery in place to prevent funds diversion. This result agrees with that of Komain (2013) who opined that public expenditure and agricultural growth are directly related, Djomo (2017) also noted that public expenditure increases agricultural growth in Cameroon.

Table 10. Long-run effect of Monetary and Fiscal Policies on Rice Productivity.

Variables	Coefficients	S.E	t-statistics
RP(-1)	1.00000	0.0000	0.0000
INT(-1)	-0.969427×××	0.14706	-6.59195
EXC(-1)	0.311919×××	0.07212	4.32502
MS(-1)	O.290537×	0.16426	1.97494
REXP(-1)	0.287412×××	0.03556	8.08189
CONST.	0.436227		

Note: ×××, × denote significance at 1% and 10% level of probability respectively; where RP is rice productivity, EXC is exchange rate, INT is interest rate, MS is money supply, REXP is rice expenditure.

Source: Author's Computation

3.10. Short-Run Impact of Monetary and Fiscal Policies on Rice Productivity

Using vector autoregressive model, the short-run impact of monetary and fiscal policies on rice productivity is as presented in Table 11. From the results, ECT is -0.365830 which indicates a low speed of adjustment of monetary and fiscal policies instruments towards equilibrium, implying that the speed of adjustment in the short run is 36% (-0.365830). This also implied that 36% of the disequilibrium in the rice production is offset by short run adjustment in each year.

From another side, the speed of adjustment where the monetary and fiscal policies variables will equate rice productivity was -0.365830. Samuel *et al.* (2017) noted a low speed of adjustment in the short run in their study on interest rate and economic growth.

From the analysis, the coefficient of adjusted R^2 is 0.6000 an indication that 60% of the variation in rice productivity is attributed to the variables fitted in the model. From the results, there is no short-run effect of monetary and fiscal policies on rice productivity. Akanbi *et al.* (2019) and Keji and Efuntade (2020) found that Nigeria government expenditure has no significant impact on agricultural output growth in the short run, but contribute positively and significantly to long run agricultural output growth.

Table 11. Short-run effect of monetary and fiscal policies on rice productivity

Error Correction	D(LNRICEOUT,2)	D(LNLABOUR,2)	D(LNINFLA,2)	D(LNINTEREST,2)	D(LNEXCH,2)	D(LNMONEY,2)	D(LNRICEEXP,2)
CointEq1	-0.365830	-0.434220	-1.820263	1.115569	-0.212013	0.122872	3.514131
	(0.29226)	(0.34358)	(0.99054)	(0.34652)	(0.66845)	(0.15613)	(0.83023)
	[-1.25175]	[-1.26382]	[-1.83765]	[3.21939]	[-0.31717]	[0.78697]	[4.23272]
CointEq2	0.731880	-2.938727	-5.521018	-1.663411	-1.230051	-1.176938	0.681694
	(0.88956)	(1.04577)	(3.01497)	(1.05472)	(2.03463)	(0.47523)	(2.52704)
	[0.82274]	[-2.81011]	[-1.83120]	[-1.57712]	[-0.60456]	[-2.47656]	[0.26976]
CointEq3	-0.249876	0.504616	0.578580	0.693738	0.384483	0.321505	-0.566235
	(0.29115)	(0.34228)	(0.98681)	(0.34521)	(0.66594)	(0.15554)	(0.82710)
	[-0.85822]	[1.47427]	[0.58632]	[2.00961]	[0.57736]	[2.06697]	[-0.68460]
D(LNRICEOUT (-1),2)	-0.562279×××	0.049028	0.475015	-0.586404	0.383664	-0.211656	-1.802405×××
	(0.22021)	(0.25888)	(0.74634)	(0.26109)	(0.50366)	(0.11764)	(0.62556)
	[-2.55342]	[0.18939]	[0.63646]	[-2.24598]	[0.76175]	[-1.79916]	[-2.88128]
D(LNLABOUR (-1),2)	-1.039297	0.577992	1.924318	0.806878	-0.316156	0.576637	-0.528366
	(0.61528)	(0.72333)	(2.08536)	(0.72951)	(1.40729)	(0.32870)	(1.74787)
	[-1.68914]	[0.79908]	[0.92277]	[1.10605]	[-0.22466]	[1.75428]	[-0.30229]
D(LNINFLA (-1),2)	0.451236××	0.059134	-0.043221	-0.177706	0.263270	-0.129500	0.243206
	(0.21975)	(0.25834)	(0.74480)	(0.26055)	(0.50262)	(0.11740)	(0.62427)
	[2.05338]	[0.22890]	[-0.05803]	[-0.68204]	[0.52379]	[-1.10308]	[0.38959]
D(LNINTEREST(-1),2)	-0.261600	-0.420706××	-1.342560××	-0.103743	-0.613153	0.130306	1.533547×××
	(0.17487)	(0.20557)	(0.59268)	(0.20733)	(0.39996)	(0.09342)	(0.49676)
	[-1.49599]	[-2.04649]	[-2.26525]	[-0.50037]	[-1.53303]	[1.39484]	[3.08711]

Error Correction	D(LNRICEOUT,2)	D(LNLABOUR,2)	D(LNINFLA,2)	D(LNINTEREST,2)	D(LNEXCH,2)	D(LNMONEY,2)	D(LNRICEEXP,2)
D(LNEXCH (-1),2)	0.056269	-0.238304××	-0.545270	0.035764	-0.250840	-0.069146	-1.489787×××
	(0.09964)	(0.11713)	(0.33769)	(0.11813)	(0.22789)	(0.05323)	(0.28304)
	[0.56475]	[-2.03449]	[-1.61469]	[0.30274]	[-1.10071]	[-1.29904]	[-5.26349]
D(LNMONEY(-1),2)	-0.391039	-0.783046×	-1.642700	-0.339962	-0.848645	-0.262591	1.158953
	(0.35955)	(0.42268)	(1.21860)	(0.42630)	(0.82236)	(0.19208)	(1.02139)
	[-1.08759]	[-1.85256]	[-1.34802]	[-0.79747]	[-1.03196]	[-1.36708]	[1.13469]
D(LNRICEEXP(-1),2)	-0.032685	0.069211	0.232354	-0.014054	-0.047199	-0.035362	0.212362
	(0.04594)	(0.05401)	(0.15571)	(0.05447)	(0.10508)	(0.02454)	(0.13051)
	[-0.71143]	[1.28143]	[1.49220]	[-0.25800]	[-0.44917]	[-1.44076]	[1.62714]
C	-0.003834	-0.017617	-0.046602	-0.004570	0.001166	-0.001514	0.015228
	(0.03006)	(0.03534)	(0.10189)	(0.03564)	(0.06876)	(0.01606)	(0.08540)
	[-0.12755]	[-0.49848]	[-0.45738]	[-0.12821]	[0.01695]	[-0.09426]	[0.17832]
R-squared	0.730029	0.783671	0.742614	0.726431	0.376908	0.527814	0.871001
Adj. R-squared	0.607314	0.685340	0.625620	0.602081	0.093684	0.313185	0.812365
Sum sq. resids	0.652125	0.901267	7.491135	0.916753	3.411537	0.186119	5.262631
S.E. equation	0.172169	0.202402	0.583529	0.204134	0.393789	0.091978	0.489091
F-statistic	5.949008	7.969703	6.347467	5.841845	1.330777	2.459186	14.85438
Log likelihood	17.92146	12.58264	-22.35898	12.30154	-9.380787	38.60997	-16.53301

Note: ×××, ××, × denote significance at 1%, 5% and 10% level of probability respectively; *where:* RiceOut is rice output, INFLA is inflation, EXCH is exchange rate, INTEREST is interest rate, MONEY is money supply, RiceEXP is rice expenditure.

Source: Author's Computation

Conclusion

The study analyzed the impact of monetary and fiscal policies on rice productivity in Nigeria using time series data from 1981 to 2016. The study showed that interest rate, exchange rate, money supply and public expenditure significantly affected rice productivity during the period under review in the long-run. In the short-run, the result indicates a low speed of the variables towards equilibrium. The speed of adjustment where monetary and fiscal policies instruments will equate rice productivity was -0.365830 and significant. The result shows a very high adjusted R^2 value of 60%. This finding concludes that there is no short-run effect of policies instruments on rice productivity and that the instrument will affect rice productivity at the long run. Productivity of rice moved in line with the policy prescription of the government and the variables instrument co-integration. The study recommends regulation of policy instrument, much spending on agriculture and by extension on rice, lowering of interest rate to a single digit and government should set up monitoring and evaluation team to restructure and manage the policies instruments primarily to make timely decision as it affects rice productivity.

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