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FISCAL POLICY, MONETARY POLICY AND AGRICULTURAL OUTPUT IN NIGERIA

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Abstract
Controversies abound over the relative contributions of monetary and fiscal policies on different economies of the world. Previous studies in Nigeria focused on either the effect of monetary or fiscal policy on economic growth without taking cognizance of their joint effects on agricultural output. This study is carried out in order to identify the policy-mix that drives the agricultural output growth in Nigeria. The study utilizes the Quantity Theory of Money by the Monetarists vis-à-vis Keynesian Theory with time series data spanning from 1981 to 2020. The study uses the Vector Error Correction Model (VECM) and the Autoregressive Distributed Lag Model (ARDL) techniques to achieve its objectives. The results reveal that money supply contributes 1.14% to the forecast error variance in agricultural output in the second year and it attains its peak of 3.1% in the third year before decreasing to 2.16% and 1.39% in the seventh and tenth years respectively. Government expenditure accounts for 0.003% of the forecast error variance in agricultural output in the second year and it reaches its peak of 5.63% in the third year before decreasing steadily as it accounts for 2.87% and 1.23% in the sixth and the tenth years respectively. Also, the results indicate that the interactive effect of government expenditure and money supply on agricultural output is positive and significant; implying that fiscal and monetary policies act as complement for agricultural output performance in Nigeria. Thus, the two-policy measures should be coordinated to maximize agricultural output.

Keywords: *Fiscal policy, Monetary policy, Economic policy, Agricultural output, Vector error correction model*

Introduction
Can any man do without food? Agriculture is essential for the survival of human existence as it helps immensely in the satisfaction of both human needs and wants. The concentration of two goals to the agriculturally related matters (goals 2 and 12) in the Sustainable Development Goals (SDGs) portrays the essentiality of the agricultural sector in achieving SDGs globally. Hence, every economy, especially the developing ones,

is expected to make concerted efforts in promoting agriculture. Thus, governments are preoccupied with the responsibility of economic management that is fundamental to the coordination of macroeconomic variables such as output, inflation, money supply, aggregate demand, and interest rate which are essential for propelling the growth path and development of an economy (DeLong et al. 2012; Dzorgbo, 2017). Meanwhile, a set of policy measures adopted by the government to regulate the economy for the attainment of macroeconomic objectives basically requires the mixture of two sets of complementary tools which are: monetary policy and fiscal policy (Nakamura & Steinsson, 2015; Olanipekun & Folorunso, 2015; Nwaogwugwu & Evans, 2016).

Friedman (1969) defines monetary policy as the action taken by the monetary authorities, usually the Central Bank, to affect monetary and other financial conditions by influencing the availability and cost of credit in the pursuit of the broad objectives of sustainable growth of output, price stability and a healthy balance of payments position. Fiscal policy has to do with the utilization of government expenditure and taxation to influence aggregate demand and the level of economic activities (Alimi et al., 2016).

The role of agriculture cannot be overemphasized in the Nigerian economy. It contributes immensely to national income, employment generation, foreign exchange earnings and serves as a source of food for the country (Ordior, 2014). However, the performance of the agricultural sector in Nigeria has remained abysmally low as it is characterized by years of inertia and unpredictability.

Nevertheless, one major area of disagreement in the literature is on the efficacy of the two policies in achieving macroeconomic objectives of the government. Both fiscal and monetary policies are used in the pursuit of macro-economic stabilization in developing countries, but the policies importance has been a serious debate between the Keynessians and the Monetarists. The Keynessians believe that fiscal policy has greater impact on the economic activities while the reverse holds for the Monetarists. Most extant studies (Mishkin, 2002; Bernanke et al., 2005; Rafiq & Mallick, 2008; Karagoz & Keskin, 2016; Williams & Abere, 2019; Ojeyinka & Yinusa, 2020) have concentrated on either the effect of monetary policy or fiscal policy on economic growth.

However, the empirical studies that have been carried out to delve into the relative importance of the two policies on economic growth portray divergent results. The findings of the studies by Ajisafe & Folorunso (2002), Sen & Kaya (2015), Anowor & Okotie (2016), and Kabanda (2016) tend to corroborate the monetarists as they reveal that the monetary policy plays dominant role in boosting economic performance of a nation. Even though the studies by Cazacu (2015), Karagoz & Keskin (2016) and Lawal et al. (2018) fail to establish significant relationship between fiscal policy and economic activities, a number of studies (Rossi & Zubairy, 2011; Chowdhury & Afzal, 2015; Croatia & Dskar-Skrbic, 2015; Sen & Kaya, 2015) that have examined the relative effects of the two policies show that both fiscal and monetary policies are effective in stimulating economic activities, despite the dominance of the monetary policy.

Accordingly, some studies that have examined the interactive effect of fiscal and monetary policies reveal opposing results. While the findings of the studies by Ajisafe & Folorunso (2002) and Sahid et al. (2016) suggest complementary relationship between the two policies, the studies by Afonso et al. (2019) and Ojeyinka & Yinusa (2020) imply that both policies exhibit substitute relationships. Meanwhile, most of these existing studies focus on the aggregate economy. In Nigeria, there is hardly any evidence to link the fluctuations in the agricultural output to changes in the economic policies as the only known study (Lawal et al., 2018) that has examined the impact of fiscal policy on agricultural output does not find significant relationship between the two variables. The extant studies in Nigeria have not only failed to consider the relative contributions of the two policies to the agricultural output, but also failed to explore their interaction on it; hence, this study.

Thus, this present study sets out to examine the relative and the interactive effects of fiscal and monetary policies on the agricultural output in Nigeria. The remaining parts of the study are as stated below. Section two captures the Literature Review while Section three entails the Methodology utilized in the study. Section four comprises of Data Analyses and Discussion of Results while Section five rounds off the study with Conclusion and Section six captures the Recommendations.

Literature Review

There have been controversies regarding the relative effects of fiscal and monetary policies on output since time immemorial. This argument begins with the theoretical propositions of the Keynesian theory and the Monetarists. Generally, both expansionary fiscal policy and expansionary monetary policy are expected to lead to increase in investment through lower interest rate, and thus, leading to increase in output. Meanwhile, the effect of an expansionary fiscal policy in the form of increase in government spending on investment is observed to be ambiguous since income and interest rate enter investment model with opposite effects. While increase in income will lead to increase in investment, increase in interest rate will lead to decrease in investment. Whether net investment will increase or not is a function of which of these two variables' effect dominates. If investment is more sensitive to income than interest rate, then investment will increase, and vice-versa.

It is in the light of this ambiguity that the Keynesians maintain that it is only fiscal policy that can significantly influence income and output, while the monetarists maintain that it is only monetary policy that can significantly influence income and output. The Keynesians theory is based on the liquidity trap which refers to a situation where the interest rate is extremely low while the saving rate is very high, thereby rendering the monetary policy ineffective. The Keynesians argue that, even with the existence of liquidity trap, expansionary fiscal policy still has the tendency to boost income and output. However, the critics of the Keynesians view, especially the monetarists, argue that liquidity trap is a mere mirage that does not exist in any economy. This argument is

buttressed by the fact that most developing economies, Nigeria inclusive, are witnessing high interest rates rather than liquidity trap. Hence, the view that monetary policy could be rendered nonfunctional is not likely to be applicable to Nigeria, as investment is likely to be sensitive to the interest rate. Similarly, the contrary view in which only the monetary policy solely affects income while fiscal policy is ineffective appears to be far from reality. These controversies, thus call for the need to subject the relative effects of both policies to empirical investigations, especially with respect to agricultural output.

Some empirical review of literature is carried out to pin-point the relative contributions of fiscal and monetary policies to output. Ajisafe & Folorunso (2002) examine the relative effectiveness of monetary and fiscal policies on economic activities in Nigeria by using ECM approach. The results reveal that monetary rather than fiscal policy exerts a greater impact on economic activity. The study, however, suggests that both policies should be complementary. Similarly, Croatia & Dskar-Skrbic (2015) adopt structural vector autoregressive (SVAR) approach to examine the relative effectiveness of fiscal and monetary policies on economic growth. The results reveal that expansionary fiscal and monetary policies stimulate economic activities. Adopting the same methodology in Turkey, Sen & Kaya (2015) found that monetary policy is more effective than fiscal policy despite the fact that both policies are effective in stimulating economic growth.

Using Bayesian VAR technique, Karagoz & Keskin (2016) examine the role of fiscal policy on macroeconomic structure of Turkey. The results show that fiscal policy plays limited stabilization role on output, inflation and stock market index. Also, Kabanda (2016) carries out a study on the relative effectiveness of fiscal and monetary policies on output on Rwandan economy by utilizing VAR technique. The findings show that monetary policy is more effective than fiscal policy, but further reveal the existence of interaction between the two policies. Similarly, the study by Chowdhury & Afzal (2015) reveals that both fiscal and monetary policies have relative effect on GDP in Bangladesh.

Rossi & Zubairy (2011) examine the role of monetary and fiscal policy in understanding macroeconomic fluctuations in the United States. The study reveals that monetary policy is responsible for fluctuations in output at business cycle while fiscal policy accounts for significant variations in output and consumption in both the medium- and the long-run terms. Thus, fiscal policy is effective in stabilizing output fluctuations in the medium and the long terms while monetary policy performs the major stabilization role in the short term. In the same vein, Cazacu (2015) investigates the joint effects of both fiscal and monetary policies on output and inflation in Romania. Using SVAR approach, the study could not establish any relationship between the two policies as it is discovered that fiscal policy does not have significant effect on both output and inflation and the effect of monetary policy is neutral over the study period.

Sahid et al. (2016) examine the effects of fiscal and monetary interaction on output in Pakistan by using a DSGE model. The study reveals that interest rate significantly influences output and economic growth in Pakistan. The effect of interaction shows that an increase in interest rate is accompanied by an increase in tax rate, and thus confirming

a complementary relationship between the two policies in the economy. Similarly, Afonso et al. (2019) examine the nature of fiscal and monetary policies interactions on output and inflation among 28 European Union countries. The study establishes that the two policies interact negatively, thus suggesting evidence of substitute relationships among the countries examined.

Furthermore, Anowor & Okorie (2016) examine the impact of monetary policy on economic growth in Nigeria by using the Error Correction Model technique. The findings of the study show the existence of positive relationship between cash reserve ratio and economic growth in Nigeria. Meanwhile, Lawal et al. (2018) examine the impact of fiscal policy on agricultural output in Nigeria through the use of ARDL technique. The results show that government expenditure does not have significant contribution to the agricultural output while custom duty on fertilizer has significant negative effect on agricultural output. Using the same technique as Lawal et al. (2018) with Beta-Coefficient, Williams & Abere (2019) examine the relative effects of recurrent and capital expenditures on economic growth in Nigeria. The study reveals that the relative effect of capital expenditure is more pronounced than that of recurrent expenditure in the short-run while the reverse holds in the long-run.

Also, Ojeyinka & Yinusa (2020) investigate the effect of fiscal and monetary policy interactions on major macroeconomic variables in Nigeria with the use of generalized method of moment. The study shows that interest rate and government expenditure have significant effect on output and inflation. It further shows that both fiscal and monetary policies interact as strategic substitutes in Nigeria as the interaction of both fiscal and monetary policies indicates significant negative effect on output and inflation. The implication of the findings, as maintained by Ojeyinka & Yinusa (2020) is that the two policies perform better when combined in achieving price stability and sustained output growth in Nigeria.

Methodology

Theoretical Framework

This study takes after the study by Ajisafe & Folorunso (2002) in adapting the 'Quantity Theory of Money' postulated by the Monetarists to portray the effects of fiscal and monetary policies on agricultural output in Nigeria. The theory is as stated in Equation (1):

$$MV = PY \quad (1)$$

In Equation (1), M, V, P, and Y denote the money stock, the velocity of money in circulation, the index of price level, and the income level, respectively. Noting that PY represents the nominal national income, such that there exists a direct relationship between the money stock and the national income when V is assumed to be constant. Thus, Equation (1) becomes Equation (2):

$$M = kPY \quad (2)$$

Assuming that the price level is constant such that it is only the change in the money stock that induces change in the real income as shown in Equation (3) to portray the view of the Monetarists.

$$m = ky \quad (3)$$

Analogously, the view of the Keynesians may be stated as in Equation (4)

$$f = ky \quad (4)$$

Since empirical studies suggest that both views tend to exhibit either complementary or substitute relationship, this study incorporates both views into a single model as in Equation (5).

$$y = k(f, m) \quad (5)$$

Model Specification

In an attempt to examine the relative effects of fiscal policy (FP) and monetary policy (MP) on agricultural output (AO) in Nigeria, this study specifies its model as in Equation (6).

$$AO_t = f(FP_t, MP_t) \quad (6)$$

Representing FP by total government expenditure (TGE), MP by broad money supply (M2) and interest rate (INTR), and incorporating exchange rate (EXR) as a proxy for trade policy as well as inflation rate (INFL) and oil price (OP) as control variables, Equation (6) is restated as in Equation (7).

$$AO_t = f(TGE_t, M2_t, INTR_t, EXR_t, INFL_t, OP_t) \quad (7)$$

By expressing Equation (7) explicitly in semi-log form, it becomes Equation (8).

$$lnAO_t = \alpha_0 + \alpha_1 lnTGE_t + \alpha_2 lnM2_t + \alpha_3 INTR_t + \alpha_4 lnEXR + \alpha_5 INFL_t + \alpha_6 lnOP_t + \mu_t \quad (8)$$

where μ_t is the stochastic term and α_i $(i = 1,2, \dots ,6)$ are the parameters to be estimated. The vector error correction model (VECM) for Equation (8) can be written in matrix form as in Equation (9).

$$\begin{bmatrix} \Delta LnAO \\ \Delta LnTGE \\ \Delta LnM2 \\ \Delta INTR \\ \Delta LnEXR \\ \Delta INFL \\ \Delta LnOP \end{bmatrix}_t = \Gamma(L) \begin{bmatrix} \Delta LnAO \\ \Delta LnTGE \\ \Delta LnM2 \\ \Delta INTR \\ \Delta LnEXR \\ \Delta INFL \\ \Delta LnOP \end{bmatrix}_t + DZ_t + \Pi \begin{bmatrix} LnAO \\ LnTGE \\ LnM2 \\ INTR \\ LnEXR \\ INFL \\ LnOP \end{bmatrix}_{t-1} + \varepsilon_t \quad (9)$$

where DZ is the short-run relationship, $\Pi = \alpha\beta$ and Δ is the operator of change.

In an attempt to determine the interactive effect of fiscal and monetary policies on agricultural output, Equation (8) is restated as Equation (10).

$$lnAO_t = \alpha_0 + \alpha_1 lnTGE_t + \alpha_2 lnM2_t + \alpha_3 INTR_t + \alpha_4 lnEXR + \alpha_5 INFL_t + \alpha_6 lnOP_t +$$

$$\alpha_7(lnTGE_t * lnM2_t) + \alpha_8(lnTGE_t * INTR_t) + \mu_t \quad (10)$$

Representing $(lnTGE_t * lnM2_t)$ by $(lnTGM_t)$ and $(lnTGE_t * INTR_t)$ by $(lnTGI_t)$, Equation (10) becomes Equation (11).

$$lnAO_t = \alpha_0 + \alpha_1 lnTGE_t + \alpha_2 lnM2_t + \alpha_3 INTR_t + \alpha_4 lnEXR + \alpha_5 INFL_t + \alpha_6 lnOP_t + \alpha_7 lnTGM_t + \alpha_8 lnTGI_t + \mu_t \quad (11)$$

Based on the ground that interactions are often considered in the context of regression analysis (Hayes & Matthes, 2009; Balli & Sorensen, 2012), this study would have estimated Equation (11) through the use of ordinary least squares (OLS) method if not that the variables in the model consist of combination of I(0) and I(1). Subsequently, this study utilizes the autoregressive distributed lag (ARDL) approach developed by Pesaran et al. (1996) and Pesaran & Shin (1999). The ARDL technique does not necessarily require that the variables in the model to be I(1) or to be of the same order. Hence, it can conveniently accommodate a mixture of I(0) and I(1) variables in a model. Thus, the unrestricted error correction form of the ARDL model for Equation (11) is portrayed thus:

$$\Delta \ln AO_t = \beta_0 + \sum_{i=1}^{p} \tau_i \Delta \ln AO_{t-i} + \sum_{i=0}^{q_i} \theta_i \Delta H_{t-i} + \beta_1 \ln AO_{t-1} + \beta_i H_{t-1} + \upsilon_t \quad (12)$$

Where Δ is the differenced operator, $\beta_i, \tau_i, \theta_i$ are parameters to be estimated, p is the number of lags of the dependent variable and q_i is the number of lags of the explanatory variables. H is a row vector comprising: *lnTGE, lnM2, INTR, lnEXR, INFL, lnOP, lnTGM, lnTGI*.

Estimation Techniques

The estimation technique captures the approaches that are utilized in order to achieve the objectives of the study. In order to examine the relative effects of fiscal and monetary policies on agricultural output, the study uses the VECM technique while it uses ARDL approach to determine their interactive effect on agricultural output in Nigeria.

Sources of Data

This study makes use of the secondary source of data from 1981 to 2020 for all the variables involved. These are sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin and the Organisation of Petroleum Exporting Countries (OPEC) Statistical Bulletin database.

Data Analyses and Discussion of Results

Descriptive Statistics of Data

This section focuses on the descriptive analysis and it contains the measure of central tendency (mean and median), measure of variation and other statistical characteristics of the variables. Performing descriptive statistics before the analysis of time series data is very important in order to identify the properties of the data. Table 1 presents the descriptive statistics of the variables. From the Table 1, the total number of observation

is 40. All the variables are expressed in log except interest rate and inflation rate. It can be observed from the table that the mean and the median of the variables are very close except for inflation rate whose mean and median are respectively 20.69 and 13.99. The proximity of the mean and median of the variables implies that the variables have normal distribution. The great discrepancy between the values of the mean and the median of the inflation rate reveals dynamics in the variable in Nigeria. However, the mean and the median of all the variables fall below the maximum values.

Table 1: Descriptive Statistics

	LNAO	LNTGE	LNM2	INTR	INFL	LNEXR	LNOP
Mean	8.77	6.20	6.84	17.42	20.69	3.71	3.54
Median	8.50	6.89	7.06	17.38	13.99	4.71	3.38
Maximum	9.82	9.36	10.29	29.80	76.76	5.73	4.65
Minimum	7.74	2.27	2.78	7.75	0.22	-0.45	2.57
Std. Dev.	0.72	2.31	2.58	4.56	17.92	1.97	0.65
Skewness	0.10	-0.43	-0.15	0.29	1.53	-0.99	0.32
Kurtosis	1.45	1.78	1.59	3.72	4.56	2.63	1.81
Jarque-Bera	4.07	3.67	3.47	1.43	19.72	6.82	3.02
Probability	0.13	0.16	0.18	0.49	0.00	0.03	0.22
Sum	350.92	248.14	273.51	696.63	827.48	148.34	141.57
Sum Sq. Dev.	20.05	208.58	260.42	812.44	12525.1	150.65	16.34
Observations	40	40	40	40	40	40	40

Besides, standard deviation which is a measure of the spread or dispersion of the data shows that inflation rate is the most widely dispersed variable followed by interest rate and money supply (M2). This implies that inflation rate, interest rate and money supply have been unstable during the study period. On the other hand, skewness measures the asymmetry of the distribution of the series around the mean. If its value is zero, it implies that the data exhibit normal distribution. Positive skewness implies that the distribution has a right tail while negative skewness indicates that the distribution has left tail. From Table 1, it is observed that agricultural output (AO), inflation rate (INFL), interest rate (INTR), and oil price (OP) are positively skewed and as such, they have right tails. This positive skewness implies that their means are greater than their medians and their medians greater than their modes. Money supply (M2), total government expenditure (TGE) and exchange rate are negatively skewed, implying that they have left tails. By inference, their means are less than their median and their medians are less than their modes.

In the same vein, Kurtosis statistic measures the peak or flatness of the distribution of the series. If the value of Kurtosis statistic is above three, the distribution would be peaked or become leptokurtic but if the kurtosis is less than three, the distribution would be flat or turned platykurtic. From Table 1, interest rate (INTR) and inflation rate (INFL)

are peaked or leptokurtic because the values of their kurtosis are greater than three, while those of exchange rate (EXR), money supply (M2), total government expenditure (TGE), oil price (OP) and agricultural output (AO) are less than three; and as such become platykurtic.

The Jarque-Bera statistic is also used to test for the normal distribution of the series. It measures the goodness of fit in testing weather sample data have the skewness and kurtosis matching a normal distribution. From Table 1, Jarque-bera probability reveals that only inflation rate (INFL) variable rejects the assumption of normal distribution while other variables are normally distributed.

Correlation Analysis of Data

This section examines the correlation among the variables used in the study. Correlation analysis helps to detect whether the variables have high multicollinearity among one another. The rule of thumb is that if the pair-wise or zero-order correlation coefficient between two regressors are high (in excess of 0.8), then multi-collinearity would be a serious problem. The shortcoming with this criterion is that, it is not necessary the correlation coefficient must be so high to have collinearity because zero-order correlation may suggest high collinearity (Gujarati & Porter, 2009). The possible strength of the degree of the linear association among the variables used are shown by correlation analysis. Also, the direction of correlation is either positive or negative as the correlation coefficient lies between the limit of -1 and +1. Meanwhile, zero coefficient implies statistical linear independence. That is, there is no linear relationship between the variables in question. Correlation coefficient of -1 or +1 indicates a negative perfect linear relationship or positive perfect linear relationship respectively.

Table 2: Correlation Analysis

	LNAO	LNTGE	LNM2	INTR	INFL	LNOP	LNEXR
LNAO	1.00						
LNTGE	0.96	1.00					
LNM2	0.98	0.69	1.00				
INTR	0.07	0.18	0.11	1.00			
INFL	-0.45	-0.44	-0.44	0.17	1.00		
LNOP	0.79	0.68	0.75	-0.23	-0.47	1.00	
LNEXR	0.86	0.76	0.72	0.36	-0.37	0.48	1.00

From Table 2, the correlation analysis result reveals that the correlation among money supply (LNM2), interest rate (INTR), inflation rate (INFL), oil price (LNOP), exchange rate (LNEXR), total government expenditure (LNTGE) and agricultural output (LNAO) is moderately high.

Unit Root Test Result

Since non stationarity of time series data could pose some intricacies in the economic data analysis result, it is essential to verify stationarity properties of a time series data

prior to its analysis. This is important because it has been established in the literature that most macroeconomic time series data are non-stationary and using such data without appropriate methodology could lead to estimating spurious regression results (Engle & Granger, 1987). It has also been established in the literature that Ordinary Least Square (OLS) regression estimate produces spurious results while using data that are not stationary (have unit root). In order to check stationary properties of the time series data used in this study, unit root tests are performed on all the variables used so as to determine their order of integration. Augmented Dickey Fuller (ADF) and Philip-Peron unit (PP) root tests are used to test the stationarity level of the variables as shown in the Table 3. The unit root result reveals that agricultural output (LNAO), total government expenditure (LNTGE), money supply (LNM2), oil price (LNOP) and exchange rate (LNEXR) are stationary at first difference, that is the variables are 1(1) series, while interest rate (INTR) and inflation rate (INFL) are stationary at level, that is the variables are 1(0) series.

Table 3: Unit Root Test Result

	ADF		PP		
Variable	**Intercep**	**Trend & intercept**	**Intercep**	**Trend & intercept**	**Remark**
LNAO	-0.169	-1.934	-0.171	-1.998	
	(0.9341)	(0.6176)	(0.9339)	(0.5840)	
ΔLNAO	-5.968	-5.881	-5.967	-5.880	1(1)
	(0.0000)*	(0.0001)*	(0.0000)*	(0.0001)*	
LNTGE	-1.395	-0.532	-1.066	-0.982	
	(0.5746)	(0.9774)	(0.7195)	(0.9349)	
ΔLNTGE	-2.034	-7.791	-7.428	-7.665	1(1)
	(0.2718)	(0.0000)*	(0.0000)*	(0.0000)*	
LNM2	-1.331	-0.585	-1.075	-0.549	
	(0.6054)	(0.9742)	(0.7162)	(0.9766)	
ΔLNM2	-3.606	-3.811	-3.611	-3.740	1(1)
	(0.0102)**	(0.0268)**	(0.0101)**	(0.0316)**	
INTR	-2.369	-5.037	-3.471	-3.256	1(0)
	(0.1571)	(0.0014)*	(0.0142)**	(0.0888)***	
ΔINTR	-6.044	-3.179	-9.759	-10.271	
	(0.0000)*	(0.1066)	(0.0000)*	(0.0000)*	
INFL	-3.119	-3.904	-2.968	-3.186	1(0)
	(0.0333)**	(0.0216)**	(0.0469)**	(0.1020)	
ΔINFL	-5.390	-2.831	-13.730	-13.603	
	(0.0001)*	(0.1974)	(0.0000)*	(0.0000)*	
LNOP	-1.224	-2.084	-1.224	-2.130	
	(0.6542)	(0.5384)	(0.6542)	(0.5138)	
ΔLNOP	-5.682	-5.581	-5.646	-5.532	1(1)
	(0.0000)*	(0.0003)*	(0.0000)*	(0.0003)*	
LNEXR	-2.479	-1.262	-2.601	-1.135	
	(0.1282)	(0.8825)	(0.1015)	(0.9098)	
ΔLNEXR	-6.096	-6.943	-6.127	-6.943	1(1)
	(0.0000)*	(0.0000)*	(0.0000)*	(0.0000)*	

Note: () are probability values; *, **, and *** represent 1%, 5%, and 10% levels of significance respectively

Co-Integration Test

Co-integration process integrates short-run dynamics with long-run equilibria (Maddala, 2001). Pesaran et al. (1996), Pesaran & Shin (1999) and Acaravci & Ozturk (2012) introduce the Autoregressive Distributed Lag (ARDL) approach as a method of

testing for co-integration. This study utilizes the ARDL Bound Test to determine the existence of long-run relationship among the variables. The Bound Test result in Table 4 reveals that F-statistic value is significant at 1% level as the F-statistic value ($F = 434.68$) lies above the upper band of the tabulated F. This implies strong evidence of co-integration, and thus, confirms the existence of long-run relationship among the variables in the estimated model.

Table 4: ARDL Bounds Test

Null Hypothesis: **No long-run relationships exist**		
Test Statistic	**Value**	**K**
F-statistic	434.6819	6
Critical Value Bounds		
Significance	**I(0) Bound**	**I(1) Bound**
10%	2.12	3.23
5%	2.45	3.61
2.50%	2.75	3.99
1%	3.15	4.43

Relative Effect of Fiscal and Monetary policies on Agricultural Output

Impulse Response of VECM Result

This section has to do with the determination of the relative effect of fiscal and monetary policies on agricultural output in Nigeria. The impulse response result in Figure 1 indicates how agricultural output (AO) responds to total government expenditure (TE) which is used as a proxy for fiscal policy, money supply (M2) and interest rate (INTR) which are used as proxies for monetary policy, as well as the control variables which are inflation rate (INFL), exchange rate (EXR) and oil price (OP) in Nigeria. The result shows that agricultural output responds positively to shock in money supply throughout the time horizon, with the effect ranging between 0.010% and 0.014%. Precisely, one standard deviation shock in money supply causes agricultural output to increase to 0.01% in the 2nd year and this increases slightly to its peak of 0.014% in the 7th year. The implication of this result is that money supply has a positive and stable effect on the agricultural output in Nigeria. The result is consistent with the finding of Ajayi & Aluko (2017) that money supply has positive and significant effect on growth in output of the economy. It is also in line with the study by Anowor & Okotie (2016) that establishes the existence of positive relationship between cash reserve ratio and economic growth in Nigeria. The result further portrays that agricultural output responds negatively to shock in interest rate between the 2nd and the 6th years, but the effect turns positive as from the 7th year. Precisely, one standard deviation shock in interest rate causes agricultural output to decrease to -0.0014% in the 2nd year but this increases slightly to 0.00012% and 0.0048% in the 7th and the 10th years respectively.

The result further shows that agricultural output responds positively to total government expenditure in the 2nd year of the time horizon while the response turns negative from the 3rd year till the 8th year. Specifically, one standard deviation shock in total government expenditure influences agricultural output to increase marginally to 0.0004% in the 2nd year. Then total government expenditure causes agricultural output to decrease to -0.0035% and -0.0029% in the 6th and 8th years before the effect turns positive from the 9th year (0.0010%) to the last horizon. This result is consistent with the finding by Lawal et al. (2018) that government expenditure does not have significant contribution to agricultural output. The result reveals that agricultural output responds positively to shock in oil price throughout the time horizon. The result fits in with the findings of Alley et al. (2014) that oil price shock has significant effect on economic growth.

The result in Figure 1 further indicates that agricultural output responds negatively to shock in inflation rate throughout the time horizon. It is evident that inflation rate has negative but stable effect on agricultural output in Nigeria as the effect is in the performance range of -0.0063% and -0.054% throughout the entire time horizon. The result further shows that the response of agricultural output to exchange rate is negative in the 2nd year of the time horizon. The response is positive between the 3rd and the 4th years but it turns negative as from the 5th year and the negative response is maintained up till the 10th year.

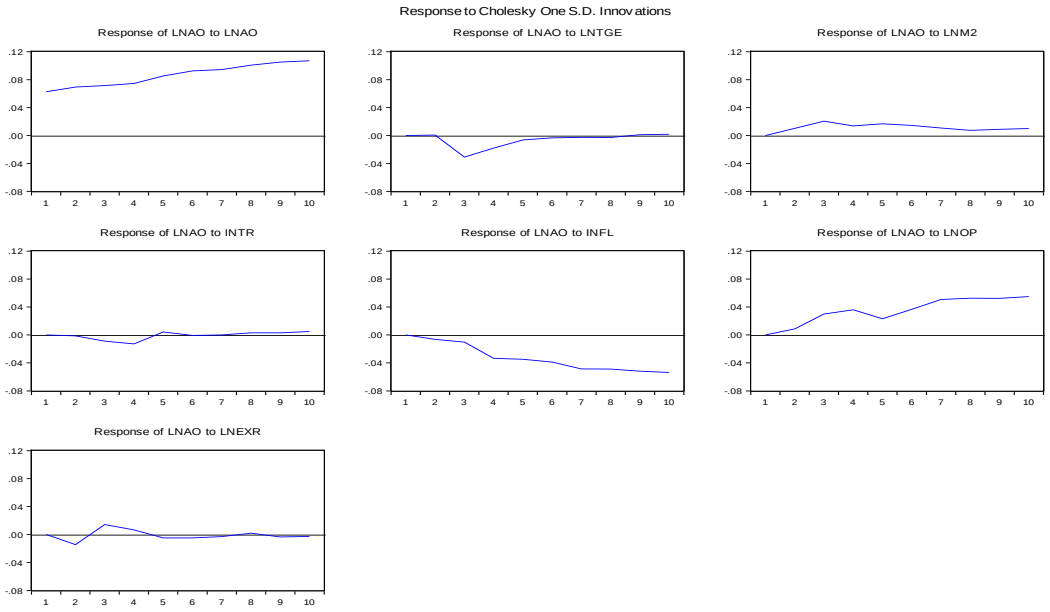

Figure 1: Response of Agricultural output to Various Variables

Variance Decomposition of VECM Result

The forecast error variance decomposition usually depicts the percentage of forecast error in a variable that is attributable to its own shock as well as shocks in other variables in the model (Abere & Akinbobola, 2020). The result in Table 5 reveals that agricultural output's own shock is responsible for approximately 100% of its forecast error variance

in the first year and this slightly decreases to 95% in the second year before its influence gradually decreases in the longer horizons as it accounts for about 71% and 70% in the 9th and 10th years respectively. The result shows that exchange rate is temporarily dominant in the forecast error variance of agricultural output in the second year while oil price becomes dominant as from the 3rd year all through the remaining time horizons. Oil price accounts for barely 0.81% in the 2nd year, but its contribution increases considerably in the longer horizons as it accounts for about 8.82% and 13.85% in the 4th and 10th years respectively. Thus oil price is dominant in the forecast error variance of agricultural output in most of the periods.

Money supply accounts for about 1.14% in the 2nd year and its contribution increases temporarily as it attains its peak of 3.10% in the 3rd year before it decreases slightly in the subsequent year all through the longer horizons as it accounts for about 2.16%, 1.56% and 1.40% in the 7th, 9th and 10th years respectively. Inflation rate accounts for about 0.43% in the 2nd year but its contribution increases slightly to 0.84% in the 3rd year before it begins to increase steadily in the subsequent horizons as it accounts for about 4.88%, 10.41% and 12.95% in the 4th, 7th and 10th years respectively. Total government expenditure accounts for about 0.003% of the forecast error variance in agricultural output in the 2nd year and it reaches peak of about 5.63% in the 3rd year before it decreases steadily in the longer horizons as it accounts for about 2.87%, 1.78% and 1.23% in the 6th, 8th and 10th years respectively. Thus, total government expenditure which is used as a proxy for fiscal policy accounts for significant percentage of agricultural output forecast error variance more than what money supply and interest rate which are used as proxies for monetary policy account for in term of significant percentage to agricultural output forecast error variance. The result portrays that both fiscal and monetary policies relatively contribute to agricultural output in Nigeria. This is in tandem with the findings by Rossi & Zubairy (2011), Chowdhury & Afzal (2015), Croatia & Dskar-Skrbic (2015) Sen & Kaya (2015). Furthermore, interest rate contributes about 0.02% to the forecast error variance in agricultural output in the 2nd year and its influence remains negligible throughout the entire periods as it contributes less than 1% all through.

Table 5: VECM Variance Decomposition Results

Period	S.E.	LNAO	LNTGE	LNM2	INTR	INFL	LNOP	LNEXR
1	0.063	100.00	0.00	0.00	0.00	0.00	0.00	0.00
2	0.096	95.32	0.003	1.14	0.02	0.43	0.81	2.27
3	0.13	81.82	5.63	3.10	0.46	0.84	5.70	2.45
4	0.16	75.76	5.02	2.78	0.95	4.88	8.82	1.79
5	0.187	76.24	3.79	2.83	0.75	7.04	7.99	1.38
6	0.216	75.55	2.87	2.56	0.56	8.48	8.89	1.09
7	0.246	72.83	2.22	2.16	0.43	10.41	11.10	0.85
8	0.276	71.46	1.78	1.80	0.36	11.43	12.49	0.68
9	0.304	70.61	1.46	1.56	0.3	12.28	13.21	0.56
10	0.304	69.80	1.23	1.40	0.27	12.95	13.85	0.49
Cholesky Ordering: LNAO LNTGE LNM2 INTR INFL LNOP LNEXR								

Interactive Effect of Monetary and Fiscal Policies on Agricultural Output

Since the Autoregressive Distributed Lag (ARDL) approach can suitably handle the combination of I(0) and I(1) variables, Equation (12) is estimated using the approach. The results in Tables 6 and 7 capture the interactive effect of fiscal and monetary policies on agricultural output in Nigeria. The interactive effect of total government expenditure and money supply (LNTGM) on agricultural output is positive and significant at 5% level of significance in both short-run and long-run ($t=2.70$, $p<0.05$; $t=2.99$, $p<0.05$). Similarly, the interactive effect of total government expenditure and interest rate (LNTGI) is positive and significant at 5% level of significance ($t=2.75$, $p<0.05$; $t=2.86$, $p<0.05$). The result reveals that 1% increase in the interaction of LNTGM leads to 0.03% and 0.07% increases in short-run and long-run respectively in agricultural output. Also, 1% increase in the interaction of LNTGI leads to 0.01% and 0.03% increases in short-run and long-run respectively in agricultural output. This implies that both fiscal and monetary policies have positive significant effect on agricultural output in both short-run and long-run in Nigeria. The significant positive magnitude of the interactive term implies that both policies are complementary. Notably, when fiscal authority embarks on expansionary policy, the Central Bank of Nigeria responds with expansionary policy in order to boost the potential rise in agricultural output. The result is consistent with the findings by Ajisafe & Folorunso (2002) and Sahid et al. (2016). However, the result is at variant with the findings by Afonso et al. (2019) and Ojeyinka & Yinusa (2020) which reveal that both policies exhibit substitute relationships.

The coefficient of the co-integrating term which measures the speed of adjustment towards long-run equilibrium is rightly signed, that is negative. The statistical significance of the co-integrating term suggests that agricultural output adjusts to correct long-run disequilibrium between itself and its determinants. The coefficient of -0.42 implies that 42% of the disequilibrium between the short-run and the long-run is covered within a year.

Table 6: ARDL Co-integrating Form

Dependent Variable: **LNAO**				
Co-integrating Form				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(LNTGE)	-0.27**	0.12	-2.28	0.04
D(LNTGE(-1))	0.37*	0.09	3.93	0.00
D(LNM2)	-0.08	0.14	-0.57	0.58
D(INTR)	-0.02	0.01	-1.62	0.12
D(INTR(-1))	0.02***	0.01	1.83	0.08
D(INFL)	0.00	0.00	-0.61	0.55
D(LNOP)	0.02	0.06	0.29	0.77
D(LNOP(-1))	-0.14***	0.07	-1.96	0.07
D(LNEXR)	0.11***	0.06	1.90	0.07
D(LNEXR(-1))	-0.19*	0.05	-3.57	0.00

D(LNTGM)	0.03**	0.01	2.70	0.01
D(LNTGI)	0.01**	0.00	2.75	0.01
D(LNTGI(-1))	-0.00***	0.00	-1.93	0.07
CointEq(-1)	-0.42**	0.15	-2.89	0.01
*Note: *, **, and *** indicate 1%, 5%, and 10% levels of significance respectively*				

Table 7: ARDL Long Run Coefficient

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNTGE	-1.57*	0.48	-3.25	0.00
LNM2	-0.19	0.33	-0.56	0.58
INTR	-0.10**	0.04	-2.33	0.03
INFL	-0.001	0.00	-0.61	0.55
LNOP	0.57**	0.24	2.43	0.03
LNEXR	0.68**	0.28	2.42	0.03
LNTGM	0.07**	0.02	2.99	0.01
LNTGI	0.03**	0.01	2.86	0.01
C	10.21*	1.13	9.01	0.00
*Note: *, **, and *** indicate 1%, 5%, and 10% levels of significance respectively*				

Conclusion

This study concludes that fiscal policy has adverse effect on agricultural output in both the short-run and the long-run, but the effect turns positive in the very long-run. Monetary policy has positive effect on agricultural output all through. All the same, both fiscal policy and monetary policy contribute relatively to agricultural output in Nigeria. Since the interaction of fiscal and monetary policies on agricultural output is positive and significant, the two policies strategically complement each other over the study periods.

Recommendations

There is need for macroeconomic policy coordination between the two-policy measures in Nigeria so as to maximize agricultural targeted output of the country and to protect the economy against unanticipated shocks. Fiscal policy measures should be undertaken alongside monetary policy, as both are re-enforcing and complementary, that is, both policies cannot exist in isolation but have to move in tandem to achieve macroeconomic objectives. Government should re-engineer the channels of advancing soft loans to farmers at a reasonable interest rate, particularly small-scale farmers who may not have the capacity to attract credit, while loans and advances to non-agro businesses should be controlled. Also, there is need for the Central Bank Nigeria to make stringent punishment for non-compliance to monetary policies by financial institutions, especially in the provision of credit facilities to the agricultural sector.

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