Asian Economic and Financial Review
ISSN(e): 2222-6737
ISSN(p): 2305-2147
DOI: 10.18488/journal.aefr.2021.113.205.218
Vol. 11, No. 3, 205-218.

URL: www.aessweb.com

MONETARY POLICY CHANNELS AND AGRICULTURAL PERFORMANCE: EVIDENCE FROM NIGERIA

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Article History
Received: 17 July 2020
Revised: 22 January 2021
Accepted: 1 March 2021
Published: 10 March 2021

Keywords
Monetary policy
Employment
Output
Export
Agriculture
Nigeria.

JEL Classification:
E5; J2; O4; F1; Q1.

ABSTRACT

The implications of monetary policy on agricultural performance have not been given adequate attention in literature to date, especially in connection with employment and export in the agricultural sector. Determining the right channels of monetary policy can help to achieve sustainable growth in developing economies. This study examines the impact of monetary policy channels on agricultural performance in Nigeria using structural vector autoregression (SVAR) and dynamic ordinary least squares (DOLS). The study uses output employment and export as metrics for agricultural performance, and the channels of monetary policy considered are credit, interest rate, money and exchange rate. The SVAR variance decomposition findings show that the forecast error shocks of monetary policy channels affect agricultural performance. Likewise, the long-run equations from the DOLS show that output has a positive relationship with money supply, a negative relationship between employment and interest rate, and a negative relationship between exchange rate and export. Based on the findings, the study suggests that the Nigerian government should look beyond the primary objective of stabilizing the economy via money supply and interest rate and consider the secondary benefits of bolstering output and employment in the agricultural sector.

Contribution/Originality: This study contributes to the existing literature by investigating monetary policy channels' impact on Nigeria's agricultural performance using structural vector autoregression (SVAR) and dynamic ordinary least squares (DOLS).

1. INTRODUCTION

Understanding the channels in which monetary policy affects the agricultural performance in developing economies may promote long-term output, employment and growth. The majority of people in the region depend on the agricultural sector to earn their living. Bernanke and Gertler (1995) stressed that there are different channels in which monetary policy affects the economy, however, its implication on output remains unknown. In addition, monetary policy is used to achieve short-term objectives, such as ensuring stability in the economy. The effects of the short-term implications generate long-term consequences on sustainable growth and development that have been neglected in empirical studies, while a fraction of the literature focused on developed economies

(Junankar, 2019; Khan, 2010). Growth in African economies has witnessed enormous improvement recently. The real production growth increased by 3.6 percent in 2017 and grew to 4.1 percent in 2018 (African Development Bank, 2018). In general, growth recovery, particularly in non-resource-intensive economies, has been stronger than expected. Similarly, global economic development has improved financial markets, which has promoted growth and development across the nations, yet obstacles remain, in particular, for the systemic changes that will produce more employment and mitigate poverty by expanding agricultural investment and growth of agricultural value chains to promote new outputs and services.

The Nigerian Central Bank has implemented policies and programmes via monetary policy to stimulate economic development. However, most of these policies are characterized by discontinuity and mismanagement of resources over time (Oladipo, Iyoha, Fakile, Asaleye, & Eluyela, 2019a, 2019b). Similarly, the high unemployment rate and poverty's prevailing problems continue despite the Nigerian government's attempts. The Agricultural Policy was introduced in 2016 to cover the period from 2016 to 2020. The policy aimed to provide food security, encourage import substitution, create employment and economic diversification. Most of the policies and programmes were geared towards making the agricultural sector fundamental to dynamic structural effects and promote growth and development throughout the sector (Popoola, Asaleye, & Eluyela, 2018). The promotion of the agricultural sector in Nigeria is an avenue to accelerating economic development, reducing poverty and promoting broad-based growth. Oil and gas currently contribute to around 99 percent of exports and almost 85 percent of government revenue, while the employment contribution was estimated at only 4 percent in 2019. Exports from agriculture are negligible and accounted for an average of 0.2 percent of total exports in the last decade. Over the last few years, agricultural production has increased slowly. However, the growth rate in agricultural production in recent times was not enough to avoid a rise in rural deprivation. Subsequently, since the reduction of oil demand in the international market during 2016, Nigeria's economy continued its slow pace of recovery; this was followed by tightening monetary measures by the Nigerian government to stabilize the economy. The stability of the economy is an important prerequisite to ensuring sustainable development and growth. However, promoting the economy's growth rate via an improved standard of living with increased per capita consumption should be prioritized to achieve broad-based growth.

The implications of monetary policy on agricultural performance have not been given adequate attention in literature, especially in connection with employment and export. However, studies have documented that monetary policy affects the economy through the money, interest rate, exchange rate, credit, asset price and expectation channels (Khan, 2010; Mishkin, 1995). Besides, many studies have shown that monetary effect causes shocks to the economy in general (Alam & Gilbert, 2016; Iddrisu & Alagidede, 2020), while others stressed its long-run impacts (Abuka, Alinda, Minoiu, Peydro, & Presbitero, 2019). In Nigeria, most studies ignored these channels (Adama, Asaleye, OYE, & Ogunjobi, 2018; Ajudua, Davis, & Okonkwo, 2015; Oboh, Tule, & Ebuh, 2019). Against this background, this study contributes to the existing literature by investigating the shocks and long-run effects of monetary policy channels on Nigeria's agricultural performance.

After the introduction in Section 1, Section 2 presents a review of the literature, Section 3 comprises the materials and method, Section 4 discusses the result and Section 5 concludes the research.

2. LITERATURE REVIEW

Numerous theoretical and empirical studies have examined the relationship between monetary policies and macroeconomic performance. The study by Klein and Goldberger (1955) showed the connection between macroeconomic policies and agricultural sectors, however, in most empirical studies, attention has been given to the aggregate economy and manufacturing sector (Asaleye, Popoola, Lawal, Ogundipe, & Ezenwoke, 2018; Junankar, 2019; Schuh, 1974). Theoretically, the monetarist and structuralist schools of thought explain the connection between monetary policy and agricultural performance. The structuralist school of thought shared the perspective

that monetary policy influences the agricultural sector's performance based on two assumptions (Sunkel, 1958). The first assumption expresses the rigidity in the supply of agricultural production, while the second stressed the inadequacy and fluctuation of exports' purchasing power. The structuralist explained that agricultural output is price inelastic, making it flexible to demand changes like the manufacturing output, which is rigid downward. As a result, during economic transformation, resources are transferred from the agricultural sector to the manufacturing sector. It was further argued that resource allocation stagnates output in the agricultural sector despite persistent increase in demand. This effect, coupled with the inadequacy and fluctuation of exports' purchasing power, results in an undesirable effect on the long-run agricultural performance.

On the other hand, the monetarist shared the perspective that a surplus in demand caused by an excessive supply of money results in inflation and generates prompt action by financial institutions to improve the situation by adopting contractionary measures. These institutions can also embark on expansionary measures if the need arises, and the agricultural sector will benefit from this through the credit channel. The channels and ways in which monetary policy influences economics can be traced back quite a way, however, the actual effects of monetary policy on macroeconomic variables in the long- and short-run aggregate outputs, market stability, balance of payments and several other targets remain controversial issues among scholars (Alam & Waheed, 2006; Ibrahim, 2005). The consensus is that the main influence of monetary policy has short-run effects on the economy. The study by Ibrahim (2005) stressed that the implications of monetary policy differ across economic sectors. The management of macroeconomic indicators become imperative to weigh how monetary policy shocks are propagated across various sectors in the economy (Alam & Waheed, 2006).

The study by Davoodi, Dixit, and Pinter (2013) examined the impact of monetary policies on East African communities using structural vector autoregression (SVAR), Bayesian vector autoregression (BVAR) and factor-augmented vector autoregression (FAVAR). The authors reported that the effects of monetary policies differed across the regions. In the study by Davoodi et al. (2013), six channels through which monetary policy can be transmitted to the economy were identified. The first is the money channel (MC). It was argued that the impact of monetary policy could be through broad money, which has an economy-wide impact via the multiplier effect of money. Second, the argument for the interest rate channel (IRC) is through the Keynesian IS-LM framework. The exchange rate channel (ERC) was documented as the third channel. The theory of uncovered interest rate parity (UIP) shows the connection between monetary and exchange policies; it is presumed that the domestic and foreign interest rate affects the nominal exchange rate. Likewise, the institution authority's responses on exchange rate policies to promote export and achieve macroeconomic objectives affect domestic and foreign goods' relative prices in the local market, which might trigger changes in the monetary measures. The fourth is the credit channel (CC), which is due to the asymmetric information in the financial market (Bernanke & Gertler, 1995). The fifth is the asset price channel (ASP); Mishkin (1995) used Tobin's Q and reported that equities are less costly to interchange cost of capital in production. With this, the effect of monetary policies can affect the economy through the influence on equities. Consequently, the equity price can cause income or consumption effects on the agents as stressed by the permanent income hypothesis. Finally, the expectation channel (EC) is the result of a forward-looking approach and the rationality assumptions of the economies' agents. The ASP and EC are believed to be involved in all other channels. Also, regarding the EC, expectations from the agents' perspectives can cause either short- or long-run impacts on the economy, which may not be accounted for over time. In this study, we ignored the ASP and EC due to their complexity and the unavailability of data.

Empirically, one strand of literature has examined monetary policy implications, but with attention given to other sectors in the economy. For example, Iddrisu and Alagidede (2020) investigated the impact of monetary policy on food inflation in South Africa using a quantile regression analysis. In addition, Kilinc and Tunc (2019) examined the symmetric effect of monetary policy in Turkey, Abuka et al. (2019) investigated the effect of monetary policy and bank lending on loan applications in developing countries, Baek and Miljkovic (2018) investigated the

relationship between monetary policy and oil price in the United States, and the study by Alam and Gilbert (2016) examined the effect of monetary shocks on agricultural commodity prices using structural and factor-augmented VAR analysis in the United States. The authors' findings showed that monetary policy, global economic conditions and exchange rate are vital factors that influence commodity prices. However, the study found a limited effect of monetary policy on commodity prices.

Schiff and Valdes (1967) stated that the agricultural sector could be tapped to increase aggregate export and output and employment generation if properly managed and stimulated by effective economy-wide policies, such as monetary and exchange rate policies. According to the World Bank (2008) macroeconomic policy, the exchange rate and monetary measures have negatively affected the agricultural sector in most developing economies. Many studies concluded that the exchange rate is the main monetary policy transmission mechanism to the agricultural sector Asaleye et al. (2018). Nevertheless, it was stressed that understanding the channels of monetary policy depends on the transition process of interest rates, deposits, exchange rates, asset values and other policies that influence financial institutions (Mishkin, 1995). The monetary policy channel shows how monetary policy transmission causes changes in businesses, households, financial intermediaries, investors, and economic activity and prices (Mishkin, 1995).

Chisasa and Makina (2015) examined the relationship between banking credit and agricultural production in South Africa using the error correction model (ECM). The ECM result showed a positive relationship between bank loans and long-run agricultural production, while the authors reported a negative short-run relationship between agricultural output and bank credit. Likewise, in the authors' study, the effect of monetary policy on employment and export in the agricultural sector was not analyzed. In a similar study in South Africa, Muftaudeen and Hussainatu (2014) used the vector error correction model to examine the connection between monetary and agricultural performance, while the indicator for agricultural performance was limited to output. They also documented that the consumer price index has negative implications on output in the agriculture sector, while the exchange rate and interest rate positively impact the output.

Studies in Nigeria have focused on the exchange rate, institutional reforms and macroeconomic performance. For example, Adekunle and Ndukwe (2018) examined the impact of exchange rate on agricultural performance. At the same time, Onoh (2017) investigated monetary policy's impact on the commercial bank turnover rate. Kolawole (2013) investigated the connection among institutional reforms, interest rate policy and agricultural sector financing using the error correction mechanism (ECM). Even though studies were carried out in relation to the agricultural sector, most of these studies ignored the effect of the monetary policy channels identified in the literature (Aremu et al., 2019; Asaleye, Alege, Lawal, Popoola, & Ogundipe, 2020; Popoola., Alege, Gershon, & Asaleye, 2019). Other studies, such as that by Oboh et al. (2019), investigated monetary policy's effect on agricultural sector performance in Nigeria using the autoregressive distributed lag approach.

Likewise, Ajudua et al. (2015) used the ordinary least squares (OLS) method to investigate the impact of monetary policy on output in Nigeria's agricultural sector. The scholars reported that interest rates negatively affect agriculture production, while money supply promotes output in the sector. Udeaja and Udoh (2014) also investigated the impact of monetary policy on the agricultural sector using autoregressive distributed lags. Likewise, in Nigeria, Muftaudeen and Hussainatu (2014) analyzed the macroeconomic policy impact on agriculture using the VECM method. The results showed that government spending has a positive and substantial impact on agricultural productivity, while short-term credit to agriculture has a negative effect on agricultural productivity. Ehionomen and Charles (2012) investigated the impact of monetary policy on agricultural development using ordinary least squares. They reported that series were non-stationary; however, the error correction model would have been a suitable technique instead of the least squares approach.

This study is distinguished from the above studies by investigating monetary policy channels' effects on Nigeria's agricultural performance. Proxies used for agricultural performance were the agricultural sector's output,

employment and export, whereas the monetary policy channels considered were the money channel, interest rate channel, exchange rate channel and credit channel. We have ignored the asset price channel and expectation channel due to their complexity and lack of available data. Structural vector autoregression (SVAR) was employed, while the dynamic least squares (DOLS) approach was used to investigate the long-run impact.

3. MATERIALS AND METHOD

This study aims to investigate the impact of monetary policy channels shocks and long-run effects on agricultural performance. Employment, output and export are used as proxies for agricultural performance. To achieve the objectives of this study, two models were used for the analysis. First, the shock impacts, which is referred to as a model one. Second, the long-run effects, which are referred to as model two. The model specifications are explained as follows:

3.1. Impact of Monetary Policy Shock on Agricultural Performance (Model 1)

The study uses structural vector autoregression (SVAR) to examine the impact of monetary policy shock on Nigeria's agricultural performance. Unlike the vector autoregression (VAR), the SVAR brings theoretical foundations to the system through its identification process (Lutkephohl, 2006), though the recursive VAR attempted to establish an identification structure in the system through the ordering process. However, Stock and Watson (2001) stated that the SVAR uses economic theory to relate the correlation to the causal relationship, which could be used to identify the system in the short-run[1]. Studies by Blanchard and Quah (1989); King, Plosser, Stock, and Watson (1991) used long-run restrictions emphasizing the long-run neutrality of money in the identification process of monetary policy shock. Some studies have imposed short-run restrictions using contemporaneous restrictions in the system (Asaleye, Lawal, Popoola, Alege, & Oyetade, 2019; Gordon & Leeper, 1994; Sims & Zha, 1999). The reduced form of the VAR is given as:

$$Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_n Y_{t-n} + v_t \tag{1}$$

The study by Mishkin (1995) showed that the transmission mechanism by which monetary policies affect the economy includes the money channel (MC), interest rate channel (IRC), exchange rate channel (ERC) and credit channel (CC). The author also deduced that monetary policies affect aggregated output. Hence, the variables considered for this study are the agricultural performance indicators, namely agricultural output, agricultural employment and agricultural export. The channels of monetary policy indicators considered are money supply (MMS2) for MC, real interest rate (INTR) for IRC, real exchange rate (EXCR) for ERC and credit to the agricultural sector (CRAS) for CC. The ordering of the variables is important in the recursive structure of the VAR. Therefore, this study follows the approach outlined by Starr (2005) as follows:

$$\begin{pmatrix} AGDP \\ INTR \\ EXCR \\ MMS2 \\ CRAS \\ AEXP \\ AEMP \end{pmatrix} = \begin{pmatrix} \beta_1 \\ \beta_2 \\ \beta_3 \\ \beta_4 \\ \beta_5 \\ \beta_6 \\ \beta_7 \end{pmatrix} + \sum_{i=1}^{k} \begin{pmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} & \alpha_{14} & \alpha_{15} & \alpha_{16} & \alpha_{17} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} & \alpha_{24} & \alpha_{25} & \alpha_{26} & \alpha_{27} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} & \alpha_{34} & \alpha_{35} & \alpha_{36} & \alpha_{37} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} & \alpha_{44} & \alpha_{45} & \alpha_{46} & \alpha_{47} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} & \alpha_{54} & \alpha_{55} & \alpha_{56} & \alpha_{57} \\ \alpha_{61} & \alpha_{62} & \alpha_{63} & \alpha_{64} & \alpha_{65} & \alpha_{66} & \alpha_{67} \\ \alpha_{71} & \alpha_{72} & \alpha_{73} & \alpha_{74} & \alpha_{75} & \alpha_{76} & \alpha_{77} \end{pmatrix} \begin{pmatrix} AGDP_{t-i} \\ INTR_{t-i} \\ EXCR_{t-i} \\ MMS2_{t-i} \\ CRAS_{t-i} \\ AEXP_{t-i} \\ AEMP_{t-i} \end{pmatrix} \begin{pmatrix} \mu_{1t} \\ \mu_{2t} \\ \mu_{3t} \\ \mu_{4t} \\ \mu_{5t} \\ \mu_{6t} \\ \mu_{7t} \end{pmatrix} \tag{2}$$

[1] Estimating long-run behaviour through identification is not the objective of this study.

In Equation 2, k is the optimal lag, $\beta's$ are the intercepts, $\alpha's$ are the coefficients and $\mu's$ are the error terms. The structural representation of Equation 1 can be written as:

$$A_0 Y_t = A_1 Y_{t-1} + A_2 Y_{t-2} + ... + A_p Y_{t-p} + D v_t \quad (3)$$

In Equation 3, Y_t is the dependent variable expressed with the variable lags, while 't' is the period of observation. Breitung and Pesaran (2005) expressed the relationship between the reduced form and the structural equation, as shown in Equation 4:

$$Y_t = A_0^{-1} A_1 Y_{t-1} + A_0^{-1} A_2 Y_{t-2} + ... + A_0^{-1} A_n Y_{t-n} + A_0^{-1} v_t \quad (4)$$

Hence, the relationship between the reduced form and the structural disturbance can further be expressed as:

$$A Y_t = \Gamma Z_{t-1} + D e_t \quad (5)$$

In Equation 5, Y_t is the vector of endogenous variables, e_t represents the vector of structural disturbance and Γ represents the matrix of the finite-order polynomial. The matrix of the variables showing the contemporaneous relationship among the variables is given in Equation 6 as:

$$A = \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 & 0 \\ a_{11} & 1 & 0 & 0 & 0 & 0 & 0 \\ a_{21} & a_{22} & 1 & 0 & 0 & 0 & 0 \\ a_{31} & a_{32} & a_{33} & 1 & 0 & 0 & 0 \\ a_{41} & a_{42} & a_{43} & a_{44} & 1 & 0 & 0 \\ a_{51} & a_{52} & a_{53} & a_{54} & a_{55} & 1 & 0 \\ a_{61} & a_{62} & a_{63} & a_{64} & a_{65} & a_{66} & 1 \end{pmatrix} \begin{pmatrix} V_t^{AGDP} \\ V_t^{INTR} \\ V_t^{EXCR} \\ V_t^{MMS2} \\ V_t^{CRAS} \\ V_t^{AEXP} \\ V_t^{AEMP} \end{pmatrix} B = \begin{pmatrix} b_{11} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & b_{22} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & b_{33} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & b_{44} & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & b_{55} & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & b_{66} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & b_{77} \end{pmatrix} \begin{pmatrix} e_t^{AGDP} \\ e_t^{INTR} \\ e_t^{EXCR} \\ e_t^{MMS2} \\ e_t^{CRAS} \\ e_t^{AEXP} \\ e_t^{AEMP} \end{pmatrix} \quad (6)$$

VAR results are often analysed using impulse response and forecast error variance decomposition (Sims., 1992).

3.2. Long-Run Relationship between Monetary Policy and Agricultural Performance

To establish the long-run relationship between monetary policy and agricultural performance in Nigeria, preliminary tests were carried out using the unit root tests to consider the time-series properties of the series used in this study. Different approaches have been identified in literature to examine the long-run relationship. In the presence of non-stationary data, the error correction model (ECM) can be used. Studies have shown that the ECM may be biased in small sample data, though Johansen (1991) overcame this problem by using the maximum likelihood procedure. In this approach, the existence of only one cointegrating vector is not certain. Stock and Watson (1993) developed an alternative approach, which overcame the shortcoming of the ECM and was an improvement on the maximum likelihood technique called the dynamic least square (DOLS). The main advantage of this technique is that it is more suitable for a small sample and takes into consideration the dynamic source of bias. This approach is a robust single equation approach to examine long-run impacts (Masih & Masih, 1996). [2]The long-run models showing the relationship between monetary policy and agricultural performance can be given as:

$$AGDP = f(INTR, EXCR, MMS2, CRAS) \quad (7)$$

[2] Emphases on the long-run equation are on agricultural output and employment. Both variables are used as dependent variables respectively in the equations stated.

In Equation 7, output in the agricultural sector was used as the dependent variable, while in Equation 8, employment in the agricultural sector was used as the dependent variable. In Equation 9, export in the agricultural sector was used as the dependent variable. We used output, employment and export in the agricultural sector to proxy the sector's performance.

$$AEMP = f(INTR, EXCR, MMS2, CRAS) \tag{8}$$

$$AEXP = f(INTR, EXCR, MMS2, CRAS) \tag{9}$$

The explicit forms of the two equations are given as:

$$AGDP = \alpha_1 + \alpha_2 INTR + \alpha_3 EXCR + \alpha_4 MMS2 + \alpha_5 CRAS + \mu_{1t} \tag{10}$$

$$AEMP = \beta_1 + \beta_2 INTR + \beta_3 EXCR + \beta_4 MMS2 + \beta_5 CRAS + \mu_{2t} \tag{11}$$

$$AEXP = \lambda_1 + \lambda_2 INTR + \lambda_3 EXCR + \lambda_4 MMS2 + \lambda_5 CRAS + \mu_{2t} \tag{12}$$

In Equations 10, 11 and 12, α_1, β_1 and λ_1 are the constant terms, $\alpha_2, ..., \alpha_5$; $\beta_2, ..., \beta_5$ and $\lambda_2, ..., \lambda_5$ are the coefficients of the monetary policy, and agricultural performance indictors using AGDP, AEMP and AEXP are the dependent variables. Equations 10 to 12 can be modified and written in DOLS forms as:

$$\Delta AGDP_t = Y_{1t} X_1^1 + \sum_{i=1}^{n} \partial_i \Delta INTR_{t-i} + \sum_{i=1}^{n} \varpi_i \Delta EXCR_{t-i} + \sum_{i=1}^{n} \sigma_i \Delta MMS2_{t-i} + \sum_{i=1}^{n} \lambda_i \Delta CRAS_{t-i} + \varepsilon_{1t} \tag{13}$$

$$\Delta AEMP_t = Y_{2t} X_2^1 + \sum_{i=1}^{n} \phi_i \Delta INTR_{t-i} + \sum_{i=1}^{n} \varphi_i \Delta EXCR_{t-i} + \sum_{i=1}^{n} \vartheta_i \Delta MMS2_{t-i} + \sum_{i=1}^{n} \psi_i \Delta CRAS_{t-i} + \varepsilon_{2t} \tag{14}$$

$$\Delta AEXP_t = Y_{3t} X_3^1 + \sum_{i=1}^{n} \Omega_i \Delta INTR_{t-i} + \sum_{i=1}^{n} \square_i \Delta EXCR_{t-i} + \sum_{i=1}^{n} Z_i \Delta MMS2_{t-i} + \sum_{i=1}^{n} \theta_i \Delta CRAS_{t-i} + \varepsilon_{3t} \tag{15}$$

In Equations 13 to 15, the series is assumed not stationary at levels; then the DOLS can estimate the equations. The data used in this study covers the period from 1981 to 2018. Agricultural output (AGDP), interest rate (INTR), exchange rate (EXCR), money supply M2 (MMS2) and agricultural export (AEXP) were obtained from the Central Bank of Nigeria (2020), while employment in the agricultural sector (AEMP) was obtained from the Nigerian National Bureau of Statistics (various issues).

4. PRESENTATION OF RESULTS

Table 1. Phillips–Perron Unit Root Test.

Phillips–Perron Test Statistics							
Series	**At level**			**At First Difference**			
	C	**C&T**	**None**	**C**	**C&T**	**None**	**I(D)**
AGDP	1.872673	-1.037185	1.709337	-3.065805**	-3.091518**	-3.261529**	I(1)
INTR	-3.027099*	-3.220415*	0.497997	-9.005194***	-9.566599***	-9.014671***	I(1)
EXCR	-1.582769	-1.318806	1.503417	-5.307679***	-5.717557***	-4.397498**	I(1)
MMS2	-0.642402	-1.295592	1.424180	-3.712966**	-3.634287***	-3.310777**	I(1)
AEXP	-1.118636	-2.635164	2.738829	-7.377086***	-9.214457***	-5.427019***	I(1)
CRAS	-0.994370	-1.401176	1.736728	-5.421275***	-5.441470***	-4.988743**	I(1)
AEMP	0.920286	-1.426188	2.055187	-4.583986**	-4.898710**	-4.252551**	I(1)

Table 1 presents the results of the unit test using the Phillips–Perron approach. Evidence from the results indicates all the series are stationary at the first difference. However, given the inclusion of constant and trend, INTR is stationary at 10 percent of significance at the level. In the first difference form, only constants INTR, EXCR, AEXP and CRAS are stationary at the 1 percent significance level, while MMS2 and AEMP are stationary at the 5 percent significance level. With the inclusion of a constant and trend, INTR, EXCR, MMS2, AEXP and CRAS are stationary at the 1 percent significance level, while AGDP and AEMP are significant at the level of 1 percent. When no constant or tread are included, INTR and AEXP are stationary at the level of 1 percent significance, while AGDP, EXCR, MMS2, CRAS and AEMP are stationary at the 5 percent significance level. In this study, the 5 percent level of significance was used; hence all the series are integrated of order 1.

Table 2. Variance Decomposition.

Variance Decomposition of Interest Rate							
Period	**AGDP**	**INTR**	**EXCR**	**MMS2**	**CRAS**	**AEXP**	**AEMP**
2	12.62240	58.95210	8.654471	4.531184	3.914543	10.87771	0.447586
4	15.04651	42.22821	9.533493	3.398182	8.284390	20.62004	0.889175
6	15.86510	36.46100	9.842080	2.919072	7.513444	21.40627	5.993032
8	15.65024	35.23243	9.981940	2.823688	7.368656	21.46070	7.482337
10	16.44926	30.46952	8.805185	2.498141	6.761244	21.91711	13.09953
Variance Decomposition of Exchange Rate							
Period	AGDP	INTR	EXCR	MMS2	CRAS	AEXP	AEMP
2	25.04547	11.76735	54.29485	3.823223	0.124772	1.735113	3.209228
4	17.18510	2.219469	20.55235	2.973779	0.896667	2.068809	54.10383
6	17.50421	1.837070	20.62009	3.484272	0.691254	2.230791	53.63231
8	15.72656	2.723025	17.21652	5.033827	1.492390	6.681339	51.12633
10	14.79331	2.522950	12.14337	3.957987	2.960763	12.16599	51.45563
Variance Decomposition of Money Supply							
Period	AGDP	INTR	EXCR	MMS2	CRAS	AEXP	AEMP
2	3.174901	1.549245	32.78134	62.22631	0.133162	0.000463	0.134585
4	7.738196	0.757087	36.07118	39.00404	0.583054	0.827415	15.01904
6	17.20094	0.198992	23.41401	14.35048	0.851905	3.851761	40.13191
8	20.82993	0.143882	20.38790	10.09212	0.875893	4.629547	43.04073
10	21.92128	0.454259	21.21554	11.72945	0.745943	4.269247	39.66428
Variance Decomposition of Credit to the Agricultural Sector							
Period	AGDP	INTR	EXCR	MMS2	CRAS	AEXP	AEMP
2	18.95766	3.921096	1.234089	10.78226	56.33009	5.894754	2.880052
4	27.16582	1.192055	3.862987	1.906466	11.01861	15.08019	39.77388
6	21.84685	0.884916	4.582972	1.173543	5.497406	19.00681	47.00751
8	23.10607	0.862390	4.931842	2.612962	5.098930	19.80166	43.58614
10	21.02040	1.240717	4.496615	3.787803	5.094830	18.12760	46.23204

Table 2 presents the variance decomposition of the monetary channel shocks on agricultural performance in a ten-period horizon. The emphasis is on the agricultural performance indicators: output, employment and export. In the variance decomposition of interest rate, the forecast error shock of interest rate affects the ten-period horizon's agricultural output rather than agricultural export and employment. The impact was also prolonged in agricultural export and had a minimal effect on agricultural employment until the eighth horizon. In the variance decomposition of the exchange rate, money supply and credit to the agricultural sector, it can be deduced that the forecast error shocks affect employment in the agricultural sector more; this is then followed by output. This study's findings are in line with those of the study by Alam and Gilbert (2016) who reported that monetary policy influences agricultural performance in the United States.

Table 3. Long-run Relationship.

Dependent Variable: AGDP				
Series	**Coefficient**	**t-statistic**	**Standard error**	**Probability**
INTR	-0.231138	-0.504652	0.458015	0.6203
EXCR	0.187865	0.779012	0.241159	0.4467
MMS2	0.437120***	3.337852	0.130959	0.0031
CRAS	0.284466***	2.528412	0.112508	0.0216
Constant	5.509072***	8.607946	0.639999	0.0000
R-squared: 0.859442		Adjusted R-squared: 0.821271		
Dependent Variable: AEMP				
Series	**Coefficient**	**t-statistic**	**Standard error**	**Probability**
INTR	-0.777688***	-2.301344	0.337928	0.0343
EXCR	0.462588***	2.599841	0.177929	0.0187
MMS2	-0.244345	-1.464263	0.166873	0.1614
CRAS	0.061788	0.744351	0.083009	0.4668
Constant	8.006099***	16.95499	0.472197	0.0000
R-squared: 0.892267		Adjusted R-squared: 0.790871		
Dependent Variable: AEXP				
Series	**Coefficient**	**t-statistic**	**Standard error**	**Probability**
INTR	3.339383***	3.207122	1.041240	0.0052
EXCR	-1.012396*	-1.846616	0.548244	0.0823
MMS2	1.791735***	3.484672	0.514176	0.0028
CRAS	-0.065587	-0.256425	0.255772	0.8007
Constant	-2.905923*	-1.997257	1.454957	0.0621
R-squared: 0.886136		Adjusted R-squared: 0.873087		

Table 3 shows the long-run equations using output in the agricultural sector, employment and export as the dependent variables. In the output equation, the independent variables of interest rate (INTR) and exchange rate (EXCR) are not statistically significant. This outcome contradicts the study by Ajudua et al. (2015) that documented a negative relationship between output and interest rate, while the study by Muftaudeen and Hussainatu (2014) showed that exchange rate and interest rate positively correlate with output. The money supply (MMS2) and credit to the agricultural sector (CRAS) are statistically significant at the level of one percent, and both MMS2 and CRAS have a positive relationship with the dependent variable output in the agricultural sector (AGDP). This finding is in line with Chisasa and Makina (2015) who showed a positive relationship between credit and output in the agricultural sector. The implication of this result showed that an increase in money supply and credit channeled to the agricultural sector could be used to promote output in the long run. The general belief is that an increase in money supply will result from an increase in general price levels. However, monetary policy via money supply and credit to the agricultural sector can be used as countercyclical tools since prices and wages may be fixed in the short run; in this case, the money supply can be adjusted to boost output and employment in the long run.

In the employment equation, INTR and EXCR are statistically significant at one percent, while MMS2 and CRAS are not statistically significant. INTR has a negative relationship with the dependent variable of employment in the agricultural sector (AEMP) and EXCR has a positive relationship with AEMP. The result shows that the exchange rate policy could help to promote long-term employment. However, the interest rate could affect employment adversely in the long run. Competitive real exchange rates are important in the development process because it is one of the main requirements and prerequisites to creating a conducive environment to increase employment opportunities. However, for the competitive exchange rate to promote output and employment via the agricultural sector, the sector's capital accumulation rate must be positively reliant on the exchange rate. The exchange rate tends to affect the allocation of labor within and across industries due to its relative production cost. Consistent depreciation of currency could result in inflationary pressures, which might negatively affect growth and employment in the long run. The productive sector that imports their inputs majorly will tend to be affected when

fluctuations in the exchange rate. Such industries are bound to be negatively affected by foreign competition; this, on the other hand, will make employment to be elastic to the exchange rate.

In the export equation, CRAS is not statistically significant. INTR and MMS2 are statistically significant at the level of 1 percent while EXCR is significant at the level of 10 percent. INTR and MMS2 have a positive relationship with the dependent variable (Export in the agricultural sector, AEXP). EXCR has a negative relationship with EXCR; this means that long-run export can be promoted through the interest rate and money supply while the exchange rate has not been favorable to promote long-term export in the agricultural sector. The R-squared and the adjusted R-squared in the three equations indicate that models have a good fit; the independent variables explain the dependent variables' variations. The R-squared for output, employment and export equations are 86 percent, 89 percent and 89 percent, respectively. Likewise, the adjusted R-squared for output, employment and export equations are 82 percent, 79 percent and 87 percent, respectively.

5. CONCLUSION

Most of the literature investigates the effect of monetary policy on inflation and aggregate output. The Nigerian government attempts to keep inflation levels and fluctuation low with less attention given to how monetary policy affects agricultural performance. Similarly, there is little research on how monetary policy channels affect output, employment and export in the agricultural sector. Generally, studies have documented that monetary policy on macroeconomic performance is to promote growth and development in the economy. In light of this, we investigated the effect of monetary policy channels on agricultural performance. The agricultural performance was proxied using output, employment and export in the sector, while the monetary policy channels considered were money channel, interest rate channel, exchange rate channel and credit channel. The study ignored the asset price and expectation channels due to their complexity and the unavailability of data and because these channels' effects were incorporated into other channels. The shock effects and long impacts between the monetary channels and agricultural performance were examined using the structural vector autoregression analysis (SVAR) and dynamic ordinary least squares (DOLS) approach, respectively.

The SVAR variance decomposition findings show that the forecast error shock of interest rate affects agricultural output more than export and employment. In addition, the forecast error shocks of the exchange rate, money supply and credit to the agricultural sector affect employment more than output and export in the agricultural sector. The results of the long-run equations from the DOLS depicted that output in the agricultural sector has a positive relationship with money supply and credit given to the agricultural sector. In this study, the agricultural sector's output is measured by its contribution to gross domestic product. The employment equation shows a negative relationship between employment and interest rate and a positive relationship with the exchange rate. In the export equation, interest rate and money supply have a positive relationship with export in the agricultural sector and a negative relationship between exchange rate and export.

The credit channel is more important to promote growth in the agricultural sector. Hence, it is suggested that the Nigerian government use monetary policy via changes to the credit restrictions to promote output from the sector. Likewise, it is recommended that the Nigerian government look beyond the primary objective of stabilizing the economy via money supply and interest rate and consider the secondary benefits of bolstering output and employment in the agricultural sector. An incentive to encourage agricultural exportation and regulation of the prices of exported goods should be implemented to ensure that benefits from external trade are maximized.

Funding: This study received no specific financial support.
Competing Interests: The authors declare that they have no competing interests.
Acknowledgement: All authors contributed equally to the conception and design of the study.

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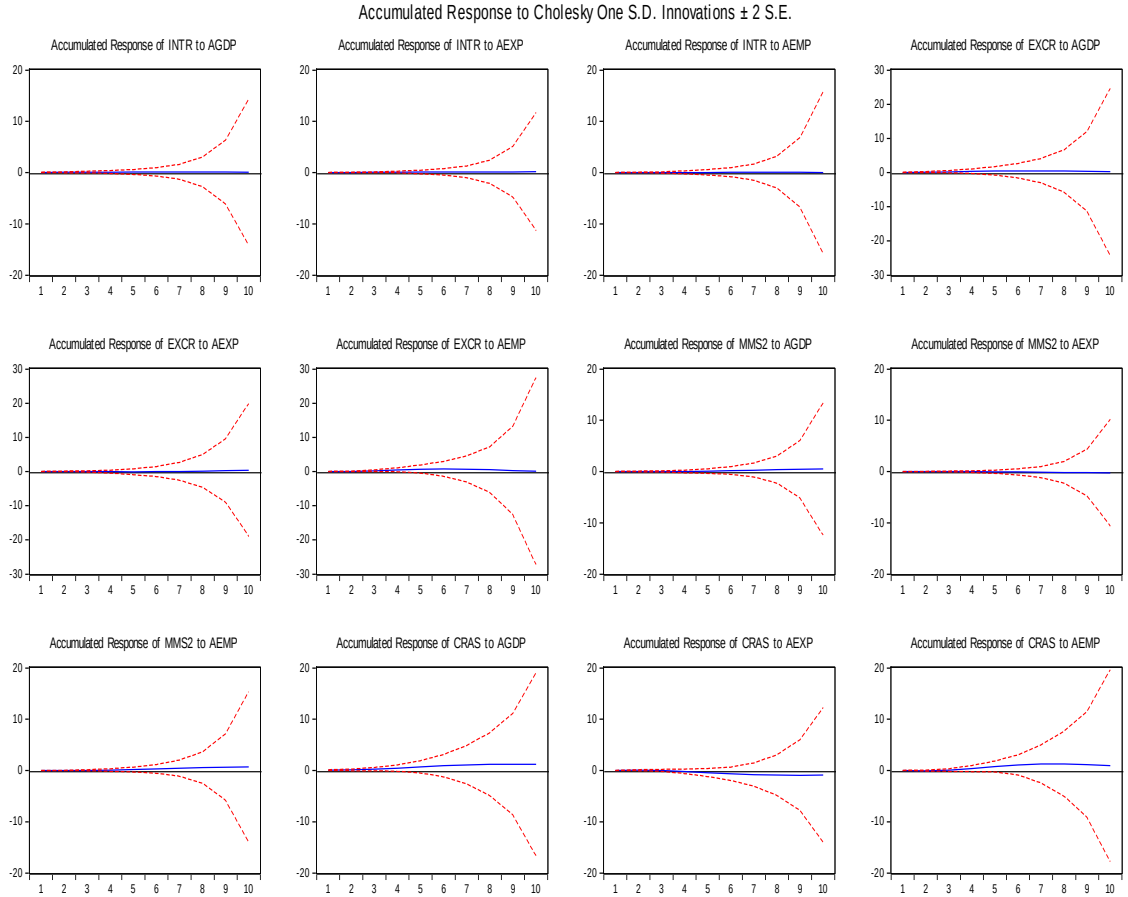
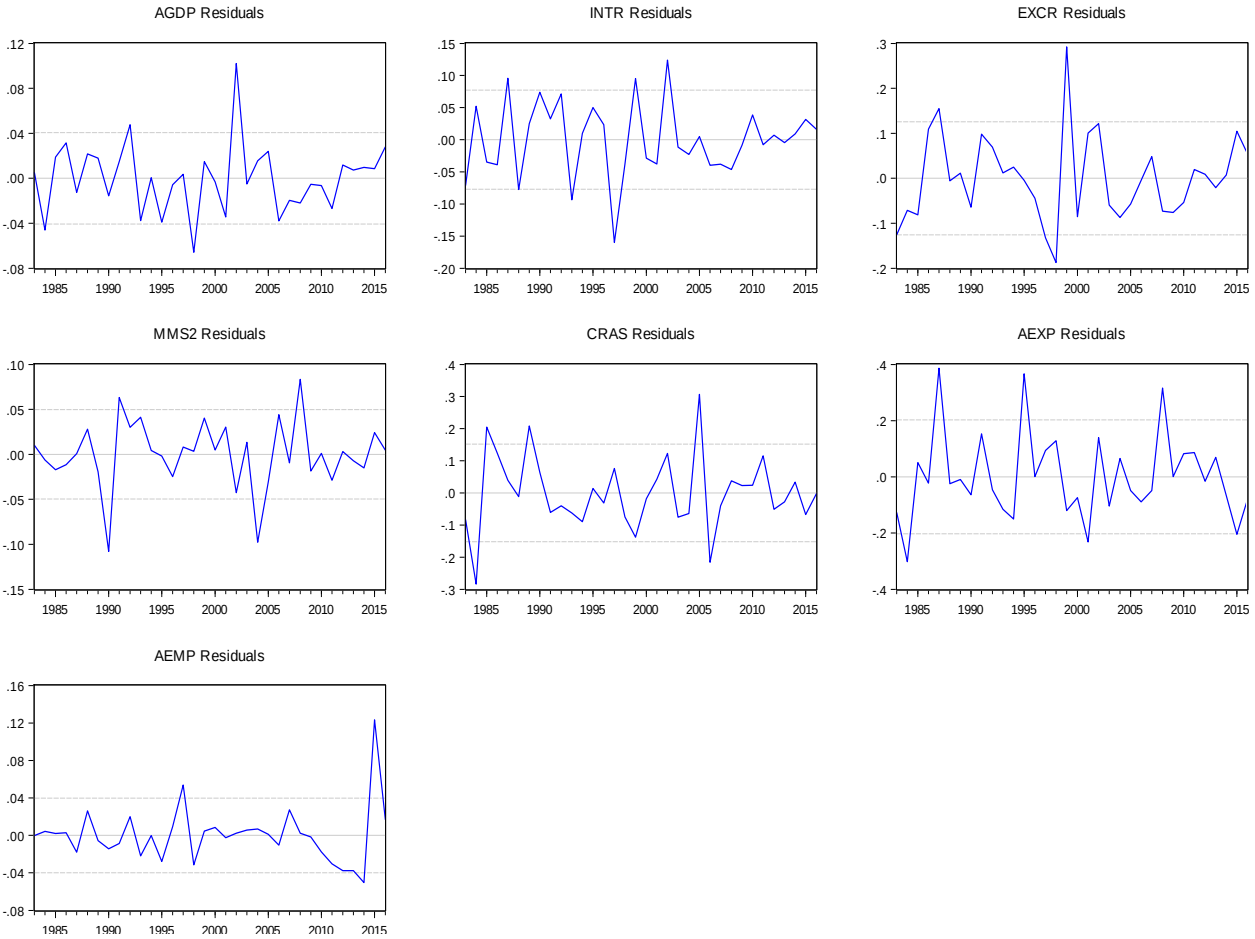
APPENDIX

Impulse Response Function



Residual



Stability Test