



## **IMPACT OF BROAD MONEY AND EXCHANGE RATE ON AGRICULTURAL GROSS DOMESTIC PRODUCT: AN UNRESTRICTED VAR MODEL APPROACH**

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### **ABSTRACT**

Expansionary monetary policy is a major driver of economic changes via money supply. Broad money, which represents total money supply in an economy, has several economic impacts. The study examines the impact of broad money (MS2) and exchange rate (XR) on agricultural gross domestic product (AGDP) in Nigeria. Secondary data from 1981 to 2018 were obtained from the Central Bank of Nigeria. Descriptive statistics, Augmented Dickey-Fuller, Johansen Co-integration test and Vector Autoregression model were employed. Broad money had a large coefficient of variation. Variables were stationary at the first difference, supported by a spurious regression of  $d\ln agdp$  on  $d\ln ms2$  and  $d\ln xr$  whose  $R^2$  (0.2411) was greater than Durbin Watson statistics (1.889914). Johansen's Co-integration test rules out the long-run relationship. Using the AGDP model of the VAR, the result shows that the  $\chi^2$  statistic (16687.39) is statistically significant ( $P < 0.01$ ), with an  $R^2$  of 0.9978. MS2 and XR have coefficients of 0.3389 and 0.2502, respectively, with statistically significant ( $P < 0.01$ ) and z-statistics of 3.92 and 5.44, respectively. The findings suggest increased broad money for increased agricultural gross domestic product. An increase in the exchange rate should be adopted for an increased agricultural gross domestic product but with caution to forestall the trade-off effect on inflation.

**Keywords:** Agricultural finance, Broad money, Exchange rate, Johansen, Money supply.

### **INTRODUCTION**

In diverse manners, monetary policies affect agricultural economy. The agricultural sector easily passes in most literature as the mainstay of the economy for many developing countries (Adekunle and Ndukwe, 2018). The agricultural sector in these economies is the most crucial sector and perhaps indispensable in generating output and employment (Anh *et al.*, 2020). Apart from impacting directly on economic growth, Ndor *et al.* (2020) asserted that agriculture sustains economic development in all ramifications. This is why the government accords the agricultural sector substantial attention through financial interventions. Agricultural financing implies the supply of funds for the development of the agricultural sector. This can be done both at micro and macro levels. The aim, according to Adongo *et al.* (2020), is to ameliorate such constraints as inadequate supply of inputs, lack of capital, low level of technology adoption, pest and disease invasions, lack of proper storage facilities, poor post-harvest handling, poor marketing infrastructure, climate change and unsatisfactory extension services, among others.

Agricultural financing can also be viewed from direct and indirect perspectives. Due to the widespread nature of agricultural activities in most developing countries, virtually every fund in circulation could have a measure of influence on the growth of the sector. It is from this viewpoint that the impact of monetary policy instruments on the various aspects of



agriculture can be examined. Monetary policy is a deliberate action taken by the Central Bank to control money supply and credit availability in an economy by manipulating the interest rates so as to be consistent with economic growth and the price objectives as set by the government (Musa, 2015). According to Mashinini *et al.* (2019), monetary policy is adopted by government to control the supply of money as well as credit condition in an economy to achieve economic goals such as the economic growth, stability in inflation rate as well as exchange rate and employment. The goal of this control is to enhance access to funding for growth in key sectors of the economy.

In order to sustain growth in agricultural sector, finance is indispensable. Based on this axiom, the Federal Government of Nigeria evolved and implemented several packages through the Central Bank of Nigeria. Agricultural finance is concerned with the acquisition and utilization of funds for the development of agriculture. Ehinomen and Charles (2012) stated that agricultural finance is basically related to agricultural development. It refers to the processes by which funds are made available to rural farmers to enable them adopt innovations that will facilitate agricultural development. The government provides the finance because the rural capital market cannot supply adequate funds for the sector.

For this reason, Muroyiwa and Sibanda (2014) indicated that farm sector agents participate in the money market where they borrow money to secure agricultural machinery, inputs and working capital. This way, monetary conditions enhance the availability of credit which ultimately influences agricultural sector performance. Nwoko and Ihemeje (2016) added that one of the major objectives of monetary policy is to stabilize economic growth. The main idea is that the occurrence of inflation will directly affect people's expectations, resulting in the production of inventory, and the destruction of imbalance between supply and demand of agricultural products, so the money supply could cause a drastic change in the prices of agricultural products through the inventory (Jiansheng, 2018).

Two important instruments of monetary policy that can remarkably affect the growth of the agricultural sector, negatively or positively, are broad money supply and exchange rate. It has been observed that monetary policy could play a key role in the development of the agricultural sector directly through the provision of resources and indirectly through control of market prices (Apere and Karimo, 2015; Jiansheng, 2018). For instance, by regulating the bank rates, monetary policy impacts the supply of money which in turn leads to a decline in the demand for agricultural output and, invariably, a decline in agricultural output. Similarly, when exchange and inflation rates are high, the gross domestic product (GDP) of the sector could decline too; and vice versa (Anyanwu and Kalu, 2015; Wagan and Rahman, 2016; Gatawa and Mahmud, 2017).

Money supply refers to the volume of money in circulation in an economy. It is the prerogative of the Central Bank to determine the size and rate of growth of money supply, which in turn affects interest rates (Anyanwu and Kalu, 2015). The exercise is often targeted at a certain rate of interest that can promote economic growth and stability. When interest rates rise, borrowing for investment in agriculture becomes prohibitive. In other words, an increase in interest rate contracts flow of fund to agriculture or raises the cost of financing agricultural activities. It has been noted that increasing money supply and reducing interest rate indicates an expansionary policy. The reverse of this is a contractionary monetary policy. For example, liquidity is important for an economy to spur growth. To maintain liquidity, the central bank recourses to monetary policy. By purchasing bonds through open market operations, the Central Bank introduces money into the system and reduces the interest rate, thereby encouraging investors to seek credits (Anyanwu and Kalu, 2015).



Monetary policy actions undertaken by central banks prompt instant effect on money supply which is often the intermediate target in developing countries (Zehra *et al.*, 2020). This ultimately leads to enhanced credit availability which would spur funding to the real sector such as agriculture and increase productivity. With credit to invest in production, processors can have sufficient raw materials. Farmers can also have higher values for their produce as they may no longer sell their products until they command high prices and values.

This study adopts exchange rate as a moderating variable between the volume of money in circulation and the value of agricultural goods and services that depend in one way or the other on the standard currency, the US dollar. It is a measure of the terms of trade between the traded and non-traded sectors of the economy, or between countries, which provides the signal for resource movements. Akinniran (2016) observed that exchange rate policy has been a significant instrument for macroeconomic management in Nigeria as it has been frequently applied in the past to preserve the value of the naira, maintain a comfortable external reserves position and ensure price stability. Similarly, Ali *et al.* (2020) indicated that monetary policy has been driven by efforts to maintain a stable exchange rate and build up foreign exchange reserves.

According to Adekunle and Ndukwe (2018), the agricultural sector like any other sector remains largely affected by exchange rate fluctuations. This is usually in respect of the sector's importation of raw materials and other modern farm implements as well as the exportation of its output. Changes in exchange rate policy, therefore, have significant consequences for a country's domestic relative prices and economic growth through their effects on the real exchange rate. The effect is more palpable in agriculture which constitutes the dominant occupation of the populace in most developing countries and is at the centre of their development policy. As Kayongo *et al.* (2020) noted, exchange rate stability is critical for proper planning by various economic actors.

Consequently, public interventions in agriculture that will improve market access, strengthen research and extension, enhance land use and crop development and enable farmers to gain access to affordable credit facilities and production inputs in line with favourable policies and legal structures are expedient for the prosperity of the agricultural sector (Adongo *et al.*, 2020). The ultimate result will be a sustained increase in agricultural gross domestic product. The agricultural gross domestic product is the measure of the value of goods and services produced from the sector in a given year in an economy. It comprises components like crop, livestock, fisheries and forestry.

Agricultural GDP is the value of the total goods and services attributable to the agricultural sector in a given year. The sub-components of agricultural GDP include crop production, livestock, forestry and fishing. Based on classification by the Central Bank of Nigeria, the agricultural sector is one of the five broad contributors to the nation's overall GDP. The other sectors are industry, construction, trade and services. From 1980 to 2018, the mean ratio of agricultural GDP to national GDP was 23.196%, with a coefficient of variation of 0.225. The least ratio was 11.77%, while the maximum was 37.52%. It is, therefore, imperative to lend empirical content to the relevance of key monetary variables to agricultural GDP. Myriads of problems have confronted Nigeria's agricultural sector. Raifu and Aminu (2020) noted that despite the centrality of agricultural sector to the Nigerian economy, its contribution has waned over time. Olukunle (2013) has it that the rate of capacity utilization by agro-allied industry in the country has been declining partly because of irregular and inadequate supply of raw materials. Another constraint is the peasant nature of the production system, with its low productivity, poor response to technology adoption strategies and poor returns on investment (Olukunle, 2013).



There are other factors including crude methods of production, dilapidating infrastructural facilities such as good road, rural electrification, lack of storage facilities and inconsistent agricultural policy (Olukunle, 2013; Raifu and Aminu, 2020). Omodero (2021) attributed the drawbacks on future growth of agriculture in Nigeria to shortage of finance and access to a low-interest loan for farmers. These constraints are expected to be ameliorated by money supply. With favourable exchange rate, available fund can exhibit meaningful impact on agricultural economy. According to Raifu and Aminu (2020), it was in order to address these problems that the Nigerian government, over the years, made concerted efforts in terms of programmes, policies and establishment of institutions.

The theoretical underpinning for this study is hinged on Fisher's cash transaction theory. Much as it has been argued that money supply is an impetus for agricultural development, Fisher's analysis of the cash transactions theory, captioned the equation of exchange, is not in total agreement. In the identity equation, the product of money supply and velocity of money (MV) is equal to the price level and output (PY). This school of thought holds that money supply (M) exerts a direct influence on the price level (P) but not the output (Y) (Musa, 2015). This perspective is hinged on the assumption that markets clear on their own. On the other hand, the Keynesian theory accepts the assumption that prices are sticky and therefore markets do not clear on their own (Uzowulu *et al.*, 2008). The authors asserted that a nation could remain in low output and unemployment without the invisible hands guiding the economy back to full employment and optimum level of output. In like manner, the monetarists posit that changes in money supply could affect the level of economic activity in both the real and nominal terms (Anyanwu and Kalu, 2015). This is Friedman's view, which was based on the premise that money is not just a close substitute for a small class of assets but rather a substitute for a large spectrum of financial assets and even non-financial assets such as securities, durable and semi-durable goods and services. These assets have implications for the growth of key sectors of any economy such as agriculture (Gatawa and Mahmud, 2017).

Empirical literature revealed exist mixed results on the impact of monetary policy variables on the agricultural sector output and GDP (Adongo *et al.*, 2020; Onyiriuba *et al.*, 2020; Mashinini *et al.*, 2019; Adekunle and Ndukwe, 2018; Oye *et al.*, 2018; Musa, 2015; Muroyiwa and Sibanda, 2014; Arize *et al.*, 2003). Hence, broad money supply and exchange rate, which are also intertwined, can be seen as impetus to agricultural financing and, consequently, agricultural gross domestic product; and have been, therefore, selected for this study. Discussion on the impact of monetary policy is ongoing. According to Rashid and Jehan (2014), the debate on monetary policy has evolved from policy ineffectiveness to the identification of the long- and short-run impact of monetary policy on macroeconomic performance. They further elucidate that monetary policy is likely to be effective in the short run but almost completely ineffective in the long run. Hence, this study seeks to analyze agricultural GDP from 1981 to 2018, assess broad money, and evaluate exchange rate for the same period. It was hypothesized that broad money and exchange rate have no significant effect on agricultural GDP in Nigeria. This study, therefore, seeks to contribute to the debate and put the result in a better and more current perspective.

The findings of this study will have policy implications. For instance, stakeholders in agricultural finance will be enabled to locate the scope of their projections within the long-run or short-run with respect to broad money and exchange rate. In addition, findings on the nature of impact of selected exogenous variables on agricultural gross domestic product will be useful for necessary adjustment towards enhancing sustainable growth in agricultural GDP.





## **MATERIALS AND METHODS**

### **Data Source**

The study was carried out using secondary data obtained from the publication of the central bank of Nigeria (CBN) statistical bulletin spanning from 1981 to 2018. The period was chosen on the basis of data availability.

### **Diagnostic Test**

Musa (2015) noted that many economic variables are non-stationary due to shocks, changes and fluctuations over time. Arize *et al.* (2003) indicate that unit root tests should be performed before applying co-integration tests because statistical inference from time series is usually based on the assumption of stationarity. Three reasons support stationarity test. According to (Djokoto *et al.*, 2014), stationarity test is conducted to avoid infinite persistent shocks of data series, eliminate spurious regression and conform to the standard assumptions for asymptotic analysis that ensure that the t-ratios follow a t-distribution. Hence, it is compulsory to conduct preliminary diagnostics tests on the properties of the variables to avoid spurious results and unreliable predictions. This is usually done with Augmented Dickey-Fuller (ADF) test for unit root.

### **Johansen Co-integration Test**

Johansen Co-integration test was carried out so as to check for the presence or otherwise of long-run relationship among the variables (Adongo *et al.*, 2020). Johansen Co-integration test comprises both trace and the maximum Eigenvalue statistics (Siaw *et al.*, 2017). These tests show and confirm the number of co-integrating equations, if any. A confirmation of existing co-integration equation(s) leads to the adoption of vector error correction model. Conversely, absence of co-integration equation leads to the adoption of vector autoregression model. This forecloses long-run relationship and presupposes that only short-run relationship exists among the variables in the system equation. Anetor *et al.* (2016) affirmed that if co-integration is detected between series, there exists a long-term equilibrium relationship hence; it becomes appropriate to use vector error correction model (VECM) in place of VAR; and in the absence of co-integration, VAR becomes more relevant.

According to Sukati (2013), if two variables are co-integrated, it implies that they have a stationary long-run relationship, even though individually they are stochastic. Subsequently, investigation of such processes starts with the concept of VAR. Co-integration tests test the null hypothesis of no co-integration. In the words of Mencet *et al.* (2006),  $x_t$  and  $y_t$  are said to be co-integrated if a parameter like  $\alpha$  exists, such that

$u_t = y_t - \alpha x_t$  is a stationary process.

### **VAR model**

Vector autoregression (VAR) is a technique often used by macroeconomists to characterize the joint dynamic behaviour of variables without requiring strong restrictions. A VAR model contains a set of  $m$  variables, each of which is expressed as a linear function of  $p$  lags of itself and of all of the other  $m - 1$  variable, plus an error term. In other words, a variable is a function of its lagged version. The VAR models which established the interaction of the variables of this study are expressed as follows:

$$\ln agdp_t = \sigma + \sum_{i=1}^k \beta_1 \ln agdp_{t-i} + \sum_{j=1}^k \phi_j \ln ms2_{t-j} + \sum_{m=1}^k \varphi_m \ln x_{t-m} + \mu_{1t} \quad \dots(1)$$

$$\ln ms2_t = \sigma + \sum_{i=1}^k \beta_1 \ln agdp_{t-i} + \sum_{j=1}^k \phi_j \ln ms2_{t-j} + \sum_{m=1}^k \varphi_m \ln x_{t-m} + \mu_{2t} \quad \dots(2)$$

$$\ln x_t = \sigma + \sum_{i=1}^k \beta_1 \ln agdp_{t-i} + \sum_{j=1}^k \phi_j \ln x_{t-j} + \sum_{m=1}^k \varphi_m \ln ms2_{t-m} + \mu_{3t} \quad \dots(3)$$



where;

$\ln agdp$  = Logarithm of agricultural gross domestic product

$\ln ms$  = Logarithm of broad money supply

$\ln xr$  = Logarithm of exchange rate

$u_{ts}$  = stochastic error term called impulses or innovations or shocks in VAR

It is important to note, however, that in a VAR model, a variable is a function of its lagged version.

## RESULTS AND DISCUSSION

### Summary Statistics of Variables

The summary statistics of the variables in the model are presented in Table 1. The result shows that the  $agdp$  had the highest mean and standard deviation within the period of the study, while  $ms2$  had the highest coefficient of variation. The large variation could have adverse implications for  $agdp$  as planning or projection could be hampered.

**Table 1:** Summary Statistics of Variables

Variables	Mean	Standard Deviation	Coefficient of variation
$Agdp$	6,281.85	8,016.15	1.28
$ms2$	5,153.39	7,536.50	1.46
$Xr$	95.05	83.93	0.88

Source: Computed from CBN Statistical Bulletin, 2019

A line graph of  $\ln agdp$ ,  $\ln ms$  and  $\ln xr$  is shown in Figure 1. The graph depicts upward trend away from the mean. This is suggestive of non-stationarity of the logarithm of the variables. A spurious regression of  $\ln agdp$  on  $\ln ms2$  and  $\ln xr$  is presented in Table 2. The result shows that the  $R^2$  of the regression was greater than Durbin Watson statistic. This further confirmed that the series were not stationary.

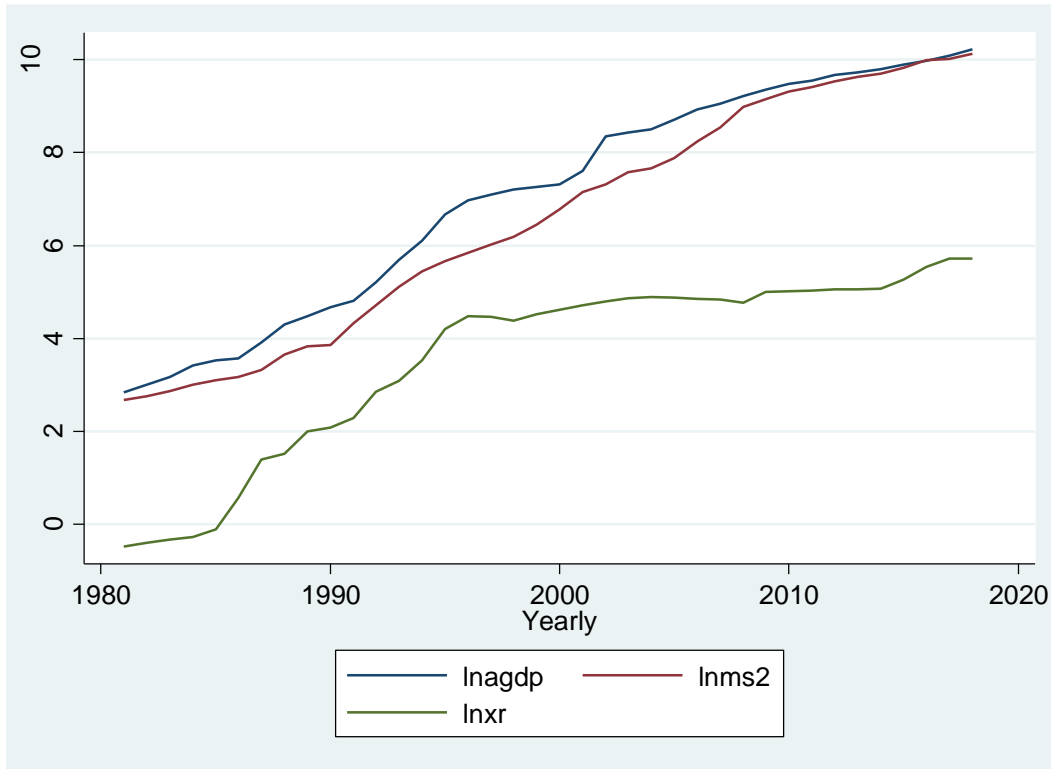


Figure 1: *Graph of  $\ln agdp$ ,  $\ln ms$  and  $\ln xr$*

After the first differencing of the variables, another line graph of  $d1\ln agdp$ ,  $d1\ln ms$  and  $d1\ln xr$  was fitted as shown in Figure 2. The graph depicts mean-reversion. In other words, the variables revert around the mean. This is suggestive of stationarity of the detrended variables.

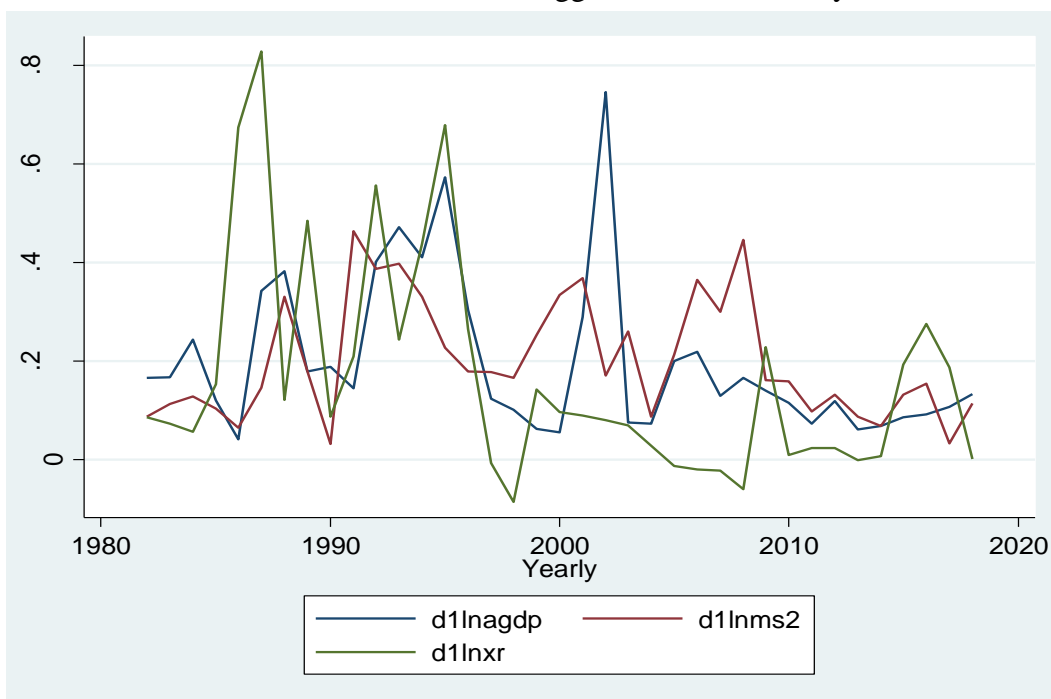


Figure 2: *Graph of  $d1\ln agdp$ ,  $d1\ln ms$  and  $d1\ln xr$*



The result of Augmented Dickey-Fuller test in Table 2 shows that the variables had unit roots. Therefore, they cannot be used for further analysis.

**Table 2:** Confirmation of Unit Roots with ADF Test of Stationarity

Variable	t-statistic	Critical values at 1%	Critical values at 5%	Critical values at 10%	Shape
Lnagdp	-1.642	-2.445	-1.692	-1.308	dfuller lnms2, drift regress lags (1)
Lnms2	-0.990	-2.445	-1.692	-1.308	dfuller lnms2, drift regress lags (1)
Lnrx	0.692	-2.642	-1.950	-1.604	noconstant regress lags (1)

$R^2 = 0.9960$ ; DW stat = 0.8364404

Source: Computed from CBN Statistical Bulletin, 2019

Table 3 presents the summary of unit root tests results obtained at first difference. The Augmented Dickey-Fuller test conducted on all the variables showed that agricultural GDP, broad money supply, and exchange rate were stationary at first difference at 5% and 10% critical values as their t-statistics values at first differencing were greater than the critical value at 5% and 10%. A spurious regression of d1lnagdp on d1lnms2 and d1lnrx had  $R^2$  which was greater than Durbin Watson statistics. This further confirmed that the series became stationary after first differencing.

**Table 3:** Stationarity Test 2 and Order of Integration of Series

Variable	t-statistics	Critical values at 1%	Critical values at 5%	Critical values at 10%	Shape	$P >  t $	Order of integration
Lnagdp	-2.609	-2.457	-1.697	-1.310	drift regress lags (2)	0.0070	I(1)
Lnms2	-2.455	-2.457	-1.697	-1.310	drift regress lags (2)	0.0101	I(1)
Lnrx	-2.249	-2.457	-1.697	-1.310	drift regress lags (2)	0.0160	I(1)

Source: Computed from CBN Statistical Bulletin, 2019

### Co-integration Result

The result of Johansen test for co-integration is presented in Table 4. It has two statistics, trace and maximum, to be compared with critical values at 5%. The maximum ranks denote null hypotheses. Using Rank 0 of the trace statistics, the result shows that the trace statistic was less than the critical value. As a rule, the null hypotheses could not be rejected. Hence, there is no co-integration in the system's equation. Using Rank 0 of the maximum statistics, the maximum statistic was less than the critical value. Similarly, the null hypothesis could not be rejected, implying that there is no co-integration in the system's equation.





**Table 4:** Johansen tests for Co-integration

Hypothesized number of cointegration equation(s)	Parms	LL	Eigen value	Trace statistics	Critical value at 5%
None	30	62.977911	.	24.8339*	29.68
At most 1	35	70.666765	0.37249	9.4562	15.41
At most 2	38	74.011007	0.18346	2.7677	3.76
At most 3	39	75.394876	0.08045		
		Max Eigen value			
None	30	62.977911	.		
At most 1	35	70.666765	0.37249	15.3777	20.97
At most 2	38	74.011007	0.18346	6.6885	14.07
At most 3	39	75.394876	0.08045	2.7677	3.76

Source: Computed from CBN Statistical Bulletin, 2019

Since it has been confirmed that there is no co-integration among the variables in the system's equation, the possibility of a long-run relationship among the variables was ruled out. It then becomes appropriate to run the vector autoregressive (VAR) model to probe the short-run relationship among the variables. The lag selection-order process involved several criteria. In Table 5, the FPE, AIC, HQIC and SBIC were used to choose the optimal lag length. The rule is that for each criterion, the lower the value, the better. The result shows that the FPE, AIC, HQIC, and SBIC selected one lag. According to Adongo *et al.* (2020), the FPE means Final Predictor Error; AIC means Akaike Information Criterion; HQIC means Hannan-Quinn information criterion; and SBIC means Schwarz Information Criterion.

**Table 5:** Lag Selection-order criteria

Lag	LL	LR	Df	P	FPE	AIC	HQIC	SBIC
0	-94.6638				0.062746	5.74493	5.79086	5.87961
1	68.6879	326.7	9	0.000	7.2e-06*	-3.33458	-3.15086*	-2.79586
2	75.6793	13.983	9	0.123	8.2e-06	-3.21643	-2.89493	-2.27368
3	85.0845	18.81	9	0.027	8.3e-06	-3.24026	-2.78097	-1.89348
4	90.4511	10.733	9	0.294	0.000011	-3.02653	-2.42945	-1.27571

\*the lag order selected by criterion

Source: Computed from CBN Statistical Bulletin, 2019

### Result of VAR of ADGP, MS2 and LNXR

Using the AGDP model, the result (Table 6) of VAR of AGDP, MS2 and XR, as presented in Table 6 shows that the chi2 statistic (16687.39) was statistically significant ( $p < 0.01$ ). This means that total money supply and exchange rate had a significant effect on AGDP. The  $R^2$  of the model (0.9978) indicated that the total money supply and exchange rate accounted for 99.78% of the variations in AGDP. This underscores the relevance of money supply and exchange rate to AGDP.



**Table 6:** Vector autoregression of ADGP, ms2 and lnxr

AGDP	Coefficient	Std. Err	z	P> z	[95% Conf. Interval]	
Ms2	0.3390	0.0864	3.9200	0.0001	0.1696	0.5084
Xr	0.2502	0.0460	5.4400	0.0001	0.1600	0.3404
_cons	1.0528	0.1490	7.0700	0.0001	0.7608	1.3448

Number of obs = 37; Chi2 = 16687.39; Prob> Chi2 = 0.000; R-squared = 0.9978; Root MSE = 0.1174

Source: Computed from CBN Statistical Bulletin, 2019

The constant of the model was statistically significant ( $P < 0.01$ ). This implied that in the absence of total money supply by the government and exchange rate, there was some AGDP. The result confirms that agriculture is a traditional occupation in Nigeria. In other words, the sector would thrive without intervention from the government or monetary policy.

The result further showed that the z-statistic of ms2 was statistically significant ( $p < 0.01$ ). The coefficient was positive, implying if a 10 % increase in MS2 increased AGDP by 3.39 % in the short run. This is a measure of the relevance of the government's financial intervention in the agricultural sector. According to Raifu and Aminu (2020), the Nigerian government has made concerted efforts in terms of programmes, policies and establishment of institutions to mitigate constraints and invariably facilitate the development of agricultural sector. This is why governments seek to ease participation and redress constraints on access to finance in agriculture through policy interventions as a means of sustainable economic growth (Onyiriuba *et al.*, 2020). It has also been indicated that monetary policy is likely to be effective in the short run (Rashid and Jehan, 2014). The result of this study is in consonance with Arize *et al.* (2003) that broad money aggregate could be used as an intermediate target of monetary policy. The result also agreed with Adongo *et al.* (2020) that broad money supply had a positive influence on agricultural GDP in Kenya. Furthermore, this result conforms to Maputo Declaration Target which rallied African governments to increase spending in the agricultural sector to stimulate agricultural growth, reduce poverty, and build food and nutrition security (Sekyi *et al.*, 2017).

In addition, the z-statistic of the exchange rate was statistically significant ( $P < 0.01$ ). Its coefficient was positive, implying that a 10% increase in exchange rate increased AGDP by 2.50% in the short-run. An increase in the exchange rate means a lower value of the local currency against the standard currency, the dollar. In real terms, it implies that the cost and values of agricultural goods and services that are dollar-dependent would rise. So, at higher exchange rates, the value of agricultural goods and services would also rise within the period of study. Zehra *et al.* (2020) noted that with increasing trade liberalization, capital market globalization, adoption of flexible exchange rate regime, innovation and technological advancements, central banks around the globe are now more than ever concerned in establishing determinants of money demand. This arises from the fact the exchange rate affects money demand for key sectors of an economy. According to Zehra *et al.* (2020), money demand has been empirically observed to respond asymmetrically to macroeconomic indicators like inflation, interest rate and exchange rate, with resultant effect on the overall economy. Also, Ho and Saadaoui (2020) reported empirical results from Vietnam that when the exchange rate shock is symmetric, the money demand increases by 3.7 percent in the long term; when the shock is asymmetric, there was an increase of 15.6 percent in the money demand; and for a permanent nominal depreciation of one percent, there was a decrease of 7.4 percent in the money demand. Kayongo *et al.* (2020) also empirically determined that exchange rate appreciation positively effects real money demand. The result of this study is at variance



with Adongo *et al.* (2020) that the exchange rate displayed a negative impact on the performance of the agricultural sector in Kenya between 1981 and 2019.

## CONCLUSION AND RECOMMENDATIONS

The study concluded that in the short-run, both broad money and exchange rate increased agricultural gross domestic product in Nigeria for the period under review. Hence, broad money supply and exchange rate are relevant macroeconomic variables to the value of agricultural goods and services in the short-run. These findings have implications for agricultural gross domestic product from the perspective of monetary policy.

One, the Central Bank of Nigeria should minimize variations in money supply through the use of appropriate policy instruments. This measure will facilitate effective agricultural production and processing planning to the extent that anticipated goals of actors in agricultural value chain can be largely attained. Such intentions of the government on money supply should be communicated early via the economic blueprint for a fiscal year will be communicated early since agricultural operations are time-bound.

Two, there is need to increase and channel money supply to the agricultural sector. This will enhance the adoption of modern technologies that will improve overall productivity and processing of agro-products, thereby growing the agricultural sector GDP and, invariably, the entire economy. Increased productivity of agricultural sector has positive implications for other sectors of the economy. This will mitigate the tradeoff that could manifest in inflationary trend associated with increase in the volume of money in circulation.

Three, the monetary authority should be cautious in increasing the exchange rate for the purpose of attaining increased agricultural GDP as indicated by the empirical result of this result, because it can be counterproductive. For instance, while increased exchange rate would favour the export of improve agricultural technologies from foreign countries to enhance the growth of the sector, the local currency can be adversely disadvantaged. The possibility exists for some form of subsidies to be selectively applied to make such foreign technologies affordable to local farmers and processors. In this case, export of food products from the country can rake in substantial foreign exchange.

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