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Causality Relationship among Money Supply Growth, Inflation and Real Output Growth in Nigeria.

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ABSTRACT

This study examines the causality relationship among money supply growth, inflation and real output growth in Nigeria. The main objective is to identify the direction of causality among the three macroeconomic variables. Annual time series data on growth of broad money supply (M_2), inflation rate (measured by consumer price index) and real output (measured by real GDP growth) were collected from CBN statistical bulletin, 2020 edition for the period 1985-2020. To analysis the data, autoregressive distributed lag (ARDL) model bounds test and Toda and Yamamoto VAR Granger causality were adopted to test for the long run relationship and direction of causality among the variables respectively. The empirical results reveal the existence of long run relationship among the variables. The results also indicate a bidirectional causality between money supply growth and inflation, a unidirectional causality between inflation and real output, which runs from inflation to real output, and no causality relationship between growth in money supply and real output. Since money supply growth is the only variable that has positive and significant effect on inflation in the long run, monetary authorities in Nigeria should adopt money supply targeting as an intermediate tool in order to control inflation and boost growth in the country.

Keywords: Money supply, inflation, real output, ARDL, Toda-Yamamoto Causality, Jel Classification; E32, E51, 055

INTRODUCTION

The overriding macroeconomic objectives of every nation include, maintaining low and stable level of inflation, controlling the growth of money supply, achieving economic growth and full employment. Thus, monetary policy in Nigeria involves the management of interest rate, and exchange rate, money supply and the level of liquidity in the economy in order to achieve the desired level of aggregate demand, the rate of inflation, output and employment [1]. In this regard, the Central Bank of Nigeria (CBN) has continued to focus on the target growth rate of money supply, first through the credit guidelines before 1985 and later through the market directed policies since the implementation of the structural adjustment programme (SAP) in 1986. Furthermore, the CBN, as a member of economic management team of the Federal Government of Nigeria (FGN), participated in the drafting of the National Economic Empowerment and Development Strategy (NEEDS) document in 2004, which was published by the National Planning Commission [2,3]. The NEEDS (2004) document sets out the medium term macroeconomic framework for the Nigerian economy. This is to achieve macroeconomic stability and support more efficient use of resources to grow the economy. With respect to price stability, inflation rate, as measured by the changes in the consumer price index (CPI), has been on the increase [4,5,6,7]. The CBN (2020) Statistical Bulletin shows that in 1985, inflation rate was 1.0 percent. Although it was below the target growth rate of 30 per cent that year, in 1995, it increased to 51.6 per cent far above the target growth rate of 15 per cent, in a period of ten years. In 2005, inflation rate was 11.6 percent against the

target growth rate of 10 percent. In 2015, it decreased to 9.6 percent but the value is still above the target growth rate of 8 percent [8,9]. Then, in 2020, it increased further to 15.8 percent against the target of 14.07percent. Similarly, the broad money supply (M_2) grew by 12.44 percent; no target was set for the year by the monetary authority [10]. It increased to 19.41 percent against the target of 10.10 percent in 1995 and further to 24.35 percent against the target of 15percent in 2005. Although it declined to 6.06 percent against the target of 15.24 percent in 2015, it increased further to 30.57 percent in 2020 against the target growth rate of 15.70 percent. With respect to the growth rate of real GDP, which measures the real output, it grew by 8.52 percent above the target of 1.0percent in 1985 [11,12,13]. In 1995, it declined to 1.87 percent against the target of 4 percent. However, in 2005, it grew by 2.75 percent. In 2020, it recorded a negative growth rate of -1.92 percent [14,15,16]. The above preceding shows that the actual growth rates of the variables (money supply, inflation and real GDP) are more than their desired targets by the monetary authorities in Nigeria. It is against this problem that this study sets out to analyse the causality relationship among the three variables. This will help the monetary authorities in Nigeria to identify the appropriate intermediate tool to adopt in order to control inflation in Nigeria.

Objectives of the Study

The main objective of this study is to analyse the causality relationship between money supply, inflation and real GDP in Nigeria for the period 1985-2020. Specifically, the study seeks to:

i. Examine the direction of causality between broad money supply growth and inflations in Nigeria.
ii. Examine the direction of causality between broad money supply growth and real output in Nigeria and
iii. Analyse the direction of causality between inflation and real output growth in Nigeria.

This paper is divided into five sections. Section one is the introductory part while section two is the literature review, which comprises the theoretical and empirical literature. Section three is the methodology, which comprises the basic model and its specification, data collected and their sources and estimation and analytical techniques. Section four presents and discusses the estimated results. The last sections, section five, presents the summary of the findings, conclusion and recommendations based on the findings.

LITERATURE REVIEW

Theoretical Literature

The monetarist theory and Keynesian theory of inflation are examined here to understand the link between inflation, money supply and real output. The monetarists hold the view that money plays an active role which leads to changes in income and prices. The earlier explanation of this approach is found in the Quantity Theory of Money, here referred to as QTM. The transaction version of OTM is attributed to [12]. The Fisher's famous equation of exchange is expressed as:

$$MV = PQ \quad \ldots\ldots 1$$

Where, M is the quantity of money, V is the velocity of the circulation, P is the average price level and Q is the total output of goods and services. The QTM is based on the proposition that the velocity (V) is stable. Therefore, if money supply (M) increases, with the velocity remaining constant, the total spending (PQ) will rise. This means that money is the key determinant of aggregate demand.However, the modern Quantity theorists led by Milton Friedman (1956) hold the view that inflation is always and everywhere a monetary phenomenon, which arises from a more rapid expansion in the quantity of money than in real output. According to them, money is used to

purchase not only the final output (Q) but also intermediate products. The transaction version of the modern quantity theory is thus expressed as:

$$MV_t = PT \ldots\ldots 2$$

Where, T represents total transactions and V_t is the transaction velocity, which is defined as :

$$V_t = PT/M$$

Therefore, the monetarists maintain that monetary policy is a more potent instrument than fiscal policy in economic stabilization. They suggest a unidirectional causation that runs from money to income and prices without any feedback. The conclusion drawn by the monetarists is that changes in income and prices in an economy are mainly caused by changes in money stock.

The Keynesian theorists hold the view that money does not matter and as such, fiscal policy is a more powerful tool for economic stabilization. According to [17], the increase in aggregate demand is the source of demand-pull inflation. Thus, when the aggregate demand exceeds the aggregate supply at full employment inflationary gap sets in. The larger this gap, the more rapid the inflation. The Keynesian chain of causation between changes in nominal income and prices is indirect through the interest rate. When the quantity of money increases, it first affects the interest rate, which tends to fall. A fall in interest rate will in turn increase investment which will raise aggregate demand. A rise in aggregate demand will affect output first and not prices as long as there are unemployed resources. Therefore, the Keynesians argue that changes in income cause changes in money stock via demand for money. This implies that the direction of causation runs from income to money. They conclude that changes in prices are not mainly because of the change in money supply but rather by non monetary factors. This study adopted the Quantity Theory of money because it links money supply, inflation and real output.

Empirical Literature

A good number of empirical studies have been carried out at both international and national levels on the causal links between pairs of money supply, inflation rate and real output. At international level, the following studies have been conducted. [2] examined the long run relationship between money supply, real GDP and price level for Sudan economy for the period 1960-2005. Granger causality test was carried out to explore the direction of causality between the variables. The empirical result shows that there exists unidirectional causality between real GDP and inflation rate with the causality that flows from real GDP to inflation [18,19,20]. The cointegration analysis shows that there is the existence of long run relationship among the variables [21,22,23,24,25]. [26] analysed the causality relationship between money supply, inflation and real GDP in Ethiopia for the period 1975-2014. Employing the techniques of Vector Autoregression (VAR) Granger causality test in the analysis, the result shows a unidirectional causality between money supply and inflation, real GDP and money supply, and real GDP and inflation, where causality runs from money supply to inflation, real GDP to money supply and real GDP to inflation respectively. [19] analysed the causality relationship between money supply, inflation and real GDP in case of Ethiopia for the period 1975-2014 using VAR Granger causality test. The empirical result shows the existence of strong and significant correlation between the variables pair vise. The direction of causation is found to be unidirectional between money supply and inflation, real GDP and money supply, and between real GDP and inflation, where the causation runs from money supply to inflation, real GDP to money supply and real GDP to inflation respectively.

In Ghana, [18] examined the causal linkages among money growth, inflation and interest rate using data for the period 1960-2017. Applying Autoregressive Distributed Lag (ARDL) bounds test, they found that money

growth has both short run and long run relationship with inflation. The result of causality test indicates unidirectional causality between inflation and money growth which flows from inflation to money growth. [4] evaluated the relationship between money supply, inflation and economic growth in Algeria for the period 1970-2018. The result of the cointegration test confirmed the long run relationship among the variables. The causality test results show the existence of hidden causalities among the variables running from cumulative components not from the natural series. The result, thus, supports the monetarist view of inflation. [21] determined whether inflation is a monetary or fiscal phenomenon using empirical evidence from south Asian countries using data spanning the period 1993-2017. The results of their panel data analysis indicate that money supply Granger causes inflation. The conclusion drawn is that inflation is monetary phenomenon in the countries studied. In a comparative study, long, [9] examined the relationship between money supply, inflation and output in Vietnam for the period 1986-2016 and China for the period 1978-2008 after 30 years of reform. In the study, Error connection Model (ECM), VAR model and canonical cointegration were employed in the estimation. The empirical results show that, while in Vietnam inflation is strongly influenced by expected inflation and output growth, inflation in china is strongly influenced by money supply growth and output growth. At the national levels, [8] employed cointegration and Granger causality techniques to analyse money, income and prices in Nigeria. The results indicate that there is no cointegration among the variables. The results also show that there is unidirectional causality between money supply and inflation, and between money supply and output, which runs from money supply to inflation, and from money supply to output respectively. [14] analysed the link between money supply and economic growth in Nigeria using VAR model. The results indicate that money supply has both short run and long run positive and significant link on real GDP. The results also indicate a unidirectional causality flow from money supply to real GDP in Nigeria. [13] examined the impact of money supply and inflation on economic growth in Nigeria for the period 1973-2013. The empirical study adopted VAR model and Granger causality tests for the estimation. The results show that money supply has positive impact on economic growth while inflation and interest rate exhibit negative impact on economic growth respectively. The results also reveal that none of the explanatory variables Granger causes economic growth. [5] analysed the influence of money supply on inflation in Nigeria using data for the period 1970-2016. The study ascertained both the long run and short run dynamic relationship between the variables. The empirical result indicates that money supply does not considerably influence inflation in Nigeria. Similarly, the result of Granger causality test shows that there is no causality between money supply and inflation during the period covered by the study. Also in Nigeria, [12] investigated the missing link between money supply and inflation in Nigeria for the period 2010-2018. In the study, Granger causality test and VEC model were applied to estimate the monthly data collected for the analysis. The causality test result shows a unidirectional causality flow from inflation to money supply. The conclusion drawn is that inflation is caused by non-monetary factors such as political instability, corruption, among other. Thus, the general finding of the study disagrees with the quantity theory of money (QTM).

[15] analysed the impact of monetary policy changes on inflationary pressure in Nigeria for the period 1985-2018. The aim was to identify whether inflation is a monetary phenomenon or not. Using ARDL model in the estimation, the empirical results show that broad money supply (M_2), Net domestic credit and

monetary policy rate have insignificant impact on inflation rate both in the short run and long run respectively. Real output, on the other hand, has negative and significant impact on inflation rate both in the short run and long run respectively. The conclusion draw by the scholars is that inflation is more of output than monetary phenomenon in Nigeria during the period covered by the study. However, no attempt was made in their study to test for causality among the variables. From the empirical studies reviewed above, it is evident that the causality tests between the variables (Money supply, inflation and real GDP) produced mixed results. While some studies are in congruence with the quantity theory of money [19, 21,26] other studies contradict the QTM [2,9,15,19]. Furthermore, some empirical studies established no pairwise causality between the variables [6,9].

METHODOLOGY

This study adopted Autoregressive Distributed Lag (ARDL) model developed by [22] to test for the long run relationship between the variables (Inflation, Money Supply and real GDP). This Model was chosen because it is applied to series that are not integrated of the same order, provider that no series is integrated of order two, 1(2). Furthermore, the model has the advantage of generating short run and long run results simultaneously. To test for the causality relationship among the variables, [24] Vector Auto Regression (VAR) Granger causality was adopted. This version of Granger causality is more reliable because it is applied when the variables are not co-integrated or co-integrated at different orders of I (0) and I (I).

Data, Definition of Variables and Sources

The data collected for this study are annual time series data covering the period 1985 – 2020 on the following variables. Inflation Rate (INF). This is proxied by percentage change in consumer price index (CPI). CPI best represents inflation of the country due to less developed nature of the economy, where the largest share of spending goes to consumption of final goods and services. Broad Money Supply (BMS). Growth in broad money supply (M_2) was used. In Nigeria, the CBN has always relied on M_2 as an intermediate target and also to capture shocks from the monetary sector outside control of the monetary authorities. Also, M_2 is estimated to have the highest correlation with inflation compared to other monetary aggregates [3].Real GDP Growth Rate (RGDP). This is used as a measure of changes in real income or real output. Data used for estimation were collected from CBN statistical Bulletin, 2020 edition.

Model Specification:

The long run relationship between changes in inflation rate, growth in broad money supply and real GDP is specific below:

$$INF_t = \beta_0 + \beta_1 BMS_t + \beta_2 RGDP_t + \mu_t \ldots\ldots 3$$

Where, INF, BMS, and RGDP are as defined in section 3.1 above.

β_0 is the constant intercept while β_1 - β_2 are the coefficients of the variables respectively. μ is the error term and t is the period.

Economic a priori of the variables.

The relationship between broad money supply and inflation is expected to be positive ($\beta_1 > 0$); a growth in money supply will increase inflation and vice versa. Similarly, the relationship between money supply and real GDP is expected to be positive; a growth in M_2 will increase real output and vice verse. Conversely, the relationship between real output (RGDP) and inflation is expected to be negative; an increase in real output will reduce inflation and vice verse.

Estimation Techniques

Unit Root and Cointegration Tests.

To examine the stationarity status of the variables, Augmented Dickery and Fuller (ADF, 1979) and Philips and Perron (PP, 1988) unit root tests were conducted

before the application of ARDL approach to cointegration. This is to ensure that none of the variables is integrated into order two, I(2), which is the condition for the application of ARDL model. Following Persaran et al (2001), the ARDL format of equation 3 above becomes:

$$\Delta INF_t = \beta_0 + \sum_{i=1}^{P} \beta_1 \Delta INF_{t-i} + \sum_{i=1}^{P} \beta_2 \Delta BMS_{t-i} + \sum_{i=1}^{P} \beta_3 \Delta RGDP_{t-i} + \lambda_1 INF_t + \lambda_2 BMS_t + \lambda_3 RGDP_t + \varepsilon_t \quad \text{..... 4}$$

Where, Δ is the first difference operator, β_0 is the constant, $\beta_1 - \beta_3$, with the summation signs represent the short run dynamics, while $\lambda_1 - \lambda_3$ represent the long run coefficients respectively. P_s are the optimum lag orders selected by Akaike information criteria and ε is the error term.When cointegration among the variables exists, the error correction model (ECM), which measures the short run dynamics or adjustment of the integrated variables towards their equilibrium values has to be estimated. The general error correction representation of equation 4 becomes:

$$\Delta INF_t = \beta_0 + \sum_{i=1}^{P} \beta_1 \Delta INF_{t-i} + \sum_{i=1}^{P} \beta_2 \Delta BMS_{t-i} + \sum_{i=1}^{P} \Delta RGDP_{t-i} + \theta ECM_t + \varepsilon_t \quad \text{.....5}$$

F test was adopted to test for the existence of cointegration among the variables. The null hypothesis of no cointegration, defined by:

H_o: $\lambda_1 = \lambda_2 = \lambda_3 = 0$ is tested against the alternative:

H_1 : $\lambda_1 = \lambda_2 = \lambda_3 \neq 0$

The F test has two sets of critical values; one set assumes that all variables are of order I (0), and the other set assumes that they are I (1). If the computed F statistic falls above the upper bound critical value, which corresponds to I (1), the null hypothesis of no cointegration is rejected. If it falls below the lower bound, which corresponds to I (0), the null hypothesis is not rejected. If it falls between the two bounds, the result is inconclusive. The order of lag was selected using Akaike information criteria (AIC).

Causality Test

This study adopted [24] VAR based Granger causality to test for the direction of causality among the variables. To conduct this test, the VAR (k + dmax) model using suitable lags for every equation of the system was obtained. Then, Granger causality test for non-causality using pair-wise equations and modified Wald test for the significance of the parameters on examined equations on number of time lags (K + dmax) was applied.This test follows Chi-square (χ^2) distribution asymptotically and the degrees of freedom are equal to the number of time lags (K + dmax). In this test, rejection of null hypothesis entails rejection of Granger causality. If two or more series are co-integrated then there is one causal relationship (unidirectional or bidirectional) but not vice versa. The VAR model of Toda and Yamamoto (1995) causality is specified as follows:

$$INF_t = \alpha_0 + \sum_{i=1}^{K} \alpha_{1i} INF_{t-i} + \sum_{j=k+1}^{dmax} \alpha_{2i} INF_{t-j} + \sum_{i=1}^{K} \beta_{1i} BMS_{t-i} + \sum_{j=k+1}^{dmax} \beta_{2i} BMS_{t-j} + \sum_{i=1}^{K} \gamma_{1i} RGDP_{t-i} + \sum_{j=k+1}^{dmax} \gamma_{2i} RGDP_{t-j+\varepsilon_{it}} \quad \text{.....6}$$

$$BMS_t = \alpha_0 + \sum_{i=1}^{K} \beta_{1i} \beta MS_{t-i} + \sum_{j=k+1}^{dmaz} \beta_{2i} BMS_{t-j} + \sum_{i=1}^{K} \alpha_{1i} INF_{t-i} + \sum_{j=k+1}^{dmax} \alpha_{2i} INF_{t-i} + \sum_{t=1}^{K} \gamma_{1i} RGDP_{t-i} + \sum_{j=k+1}^{dmax} \gamma_{2i} RGDP_{t-j} + \varepsilon_{it} \quad \text{..... 7}$$

$$RGDP_t = \alpha_0 + \sum_{i=1}^{K} \gamma_{1i}\, RGDP_{t-i} + \sum_{j=k+1}^{dmax} \gamma_{2i} RGDP_{t-i} + \sum_{i=1}^{K} \alpha_{1i}\, INF_{t-i} + \sum_{j=k+1}^{dmax} \alpha_{2i} INF_{t-j} + \sum_{i=1}^{K} \beta_{1i} BMS_{t-i} + \sum_{j=k+1}^{dmax} \beta_{2i} BMS_{t-j+\varepsilon_{st}}$$

.....8

8. where, K is the optimal time lag and dmax is the maximum integration order of the variables of the VAR model.

Diagnostic Check

To check for the dynamic stability of the model, the inverse roots of AR characteristics polynomial was adopted.

Presentation and Discussion of Results

This section presents and discusses the results of descriptive statistics, unit root, cointegration and causality tests.

Descriptive Statistics.

Table 1: Result of descriptive Statistics.

Variables	Means	Standard deviation	Skewness	Kurtosis	Observations
INF	19.375	18.428	1.760	5.023	36
BMS	23.105	15.870	0.494	2.351	36
RGDP	4.689	3.897	0.377	2.631	36

Source: Author's computation from E-view9.0

The result of the descriptive statistics presented in Table 1 shows that money supply has the highest mean of 23.105, followed by inflation, which has the mean 19.375. Real output has the least mean of 4.689. With respect to the variability of the series, inflation is more variable because it has the highest standard deviation of 18.428. This is followed by money supply, which has the standard deviation of 15.870. Real output, on the other hand, is less variable; its standard deviation is 3.877. All the variables are positively skewed, implying that they are rising. However, inflation is rising faster that money supply and real output. The values of the skewness and kurtosis for all the variables are different from 0 and 3 respectively, indicating non-normal distribution in some of the series.

Unit Root Tests

Unit root tests were carried out to avoid the problem of spurious regression, which is associated with time series data. Augmented Dickey and Fuller (ADF) and Phillips and Perron (PP) statistics were adopted for the tests. The results of these tests are presented in Table 2

Table 2 Results of ADF and PP Unit Root Tests.

	ADF		PP	
Variables	Constant	Constant & Trend	Constant	Constant & Trend
Level INF	-2.943430(0.0505)**	-3.494207(0.0556)	-3.074072(0.0379)**	-3.369905(0.0720)
BMS	-3.510174(0.0136)**	-3.775061(0.0301)**	-3.474453(0.0148)**	-3.736237(0.0329)**
RGDP	-3.040496(0.0408)**	-2.2994789(0.1479)	-3.140215(0.0326)**	-3.092058(0.1238)
First Difference INF	-5.405943(0.00000)*	-5.482306(0.0007)*	-7.814426(0.0000)*	-7.330635(0.0000)*
BMS	-7.705937(0.0000)*	-7.606786(0.0000)*	-9.142840(0.0000)*	-9.114147(0.0000)*
RGDP	-7.729988(0.0000)*	-4.988819(0.0017)*	-12.12751(0.0000)*	-17.67078(0.0000)*

Source: Author's computation from E-View 9.0
Note: The figures in parentheses ( ) are the P-values of the variables respectively.
*, ** Imply rejection of the null hypothesis @ 1% and 5% respectively.

The results of unit root tests presented in Table 2 reveal that all the variables (inflation, money supply and real output) are stationary at levels at 5percent level of significance. Similarly, the result of both ADF and PP Unit root tests show that all the variables are stationary at first difference, I(1) at 1 percent level of significances. Having established the stationary status of the variables, it is useful to determine if the variables are cointegrated. This test was conducted using the ARDL bounds test procedure.

ARDL Bounds Test

Table 3: Result of ARDL bound test.
ARDL Bounds Test
Date: 07/12/22 Time: 09:31
Sample: 1987 2020
Included observations: 34
Null Hypothesis: No long-run relationships exist

Test Statistic	Value	K
F-statistic	5.893446	2

Critical Value Bounds

Significance	I0 Bound	I1 Bound
10%	3.17	4.14
5%	3.79	4.85
2.5%	4.41	5.52
1%	5.15	6.36

Source: Author's computation from E-View 9.0.

The ARDL Form adopted, using Akaike (1974) criterion is (2, 1, 0).

The result of bounds test shows that the value of F statistic is 5.893446. Since this value is greater than the upper bound, which is 4.85, at 5 percent level of significance, the null hypothesis of no cointsgration is rejected. This implies that there is long run relationship among inflation, money supply and real output in Nigeria during the period covered by the study. The existence of cointegration among the variables necessitates further test on the short run and long run relationship among the variables.

ARDL Short run and Long run Results

Table 4: ARDL Short run result

Cointegrating Form

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INF)	0.218143	0.154727	1.409858	0.1696
D(BMS)	0.177541	0.163853	1.083536	0.2878
D(RGDP)	-1.211645	0.587228	-2.063330	0.0485
CointEq(-1)	-0.569479	0.139158	-4.092318	0.0003

Cointeq = INF - (0.8636*BMS -2.1276*RGDP + 9.6397)

Source: Author's computation from E-View 9.0

The ARDL short run result shows that the estimated coefficient of the error correction terms is -0.569479. It is correctly signed (negative), fractional and significant at 1percent level. This implies that the short term deviations converge to long run equilibrium at an annual speed of 56.95 percent. The result shows that money supply has the expected positive sign; increase in money supply increases inflation. However, its effect is insignificant in the short run. On the other hand, real output has the expected negative sign; increase in real output leads to a reduction in inflation. The effect of real output on inflation is significant in the short run.

Table 5: ARDL long run result.

Long Run Coefficients

Variable	Coefficient	Std. Error	t-Statistic	Prob.
BMS	0.863646	0.340022	2.539969	0.0169
RGDP	-2.127639	1.114502	-1.909049	0.0666
C	9.639697	9.272183	1.039636	0.3074

Source: Author's computation from E-View 9.0

The ARDL long run result shows that money supply has positive and significant effect on inflation at 5 percent level in the long run. On the other hand, real output has the expected negative effect on inflation but its effect is insignificant. This implies that money supply has more long run effect on inflation in Nigerian during the period covered by the study.

Causality Analysis

Toda and Yamamoto Granger causality test was conducted to identify the direction of causality between pairs of inflation, money supply and real output. To conduct this test, VAR lag order selection criteria was determined as presented in Table 6 below.

Table 6.VAR lag order selection criteria

Included observations: 34

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-380.7773	NA	1278959.	22.57514	22.70982	22.62107
1	-358.3552	39.56841*	582599.5*	21.78560*	22.32432*	21.96932*
2	-349.4071	14.21177	592989.9	21.78865	22.73140	22.11016

* indicates lag order selected by the criterion

The optimal lag order, as indicated by asterix (*), is 1. At this lag, Akaike information criterion (AIC), Schwarz information criterion (SC) and Hannan-Quinn information criterion (HQ) have their minimum value respectively.Having determined the optimal lag, Toda and Yamamoto no-causality test was conducted. The result is presented in Table 7.

Table 7: Toda and Yamamoto non-causality VAR model result

Excluded	Chi-Square	Prob. Value	Direction of Causality
Dependent Variable: INF			
BMS	19.39013	0.0000	BMS ⟶ INF
RGDP	0.964545	0.3260	RGDP # INF
Dependent Variable: BMS			
INF	4.698531	0.0302	INF ⟶ BMS
RGDP	0.0285281	0.8659	RGDP # BMS
Dependent Variable: RGDP			
INF	14.378872	0.0001	INF ⟶ RGDP

BMS	0.141868	0.7064	BMS # RGDP

Source: Author's computations from E-VIEW 9.0

Note: → denotes direction of causality while # denotes no causality.

The result of Toda and Yamamoto no-causality indicates that there is bidirectional causality relationship between money supply and inflation. This is because; the probability values of causality running from money supply to inflation and from inflation to money supply are less than 0.05 significance levels respectively. None of the empirical studies reviewed found bidirectional relationship between money supply and inflation. The result of causality test also shows that here is a unidirectional causality between inflation and real output, where causality runs from inflation to real output. This finding is not in congruence with any of the empirical studies reviewed above. Some empirical studies found causaltity flow from real output to inflation (long, Hein & Ngoc, 2021; Ahmed Suliman, 2011; Yigermal, 2016). With respect to money supply and real output, this study found that there is no causality between the two variables. This finding is in line with the empirical studies by Gatawa et al (2017), and Amassoma et al (2018) for Nigeria respectively. The implication of the findings from the causality analysis is that money supply and inflation are the major variables of interest in designing monetary policy targeting by the monetary authority in Nigeria. Diagnostic checks. The inverse root AR characteristic polynomial was adopted to check the dynamic stability of the model. The result is presented in figure 1.

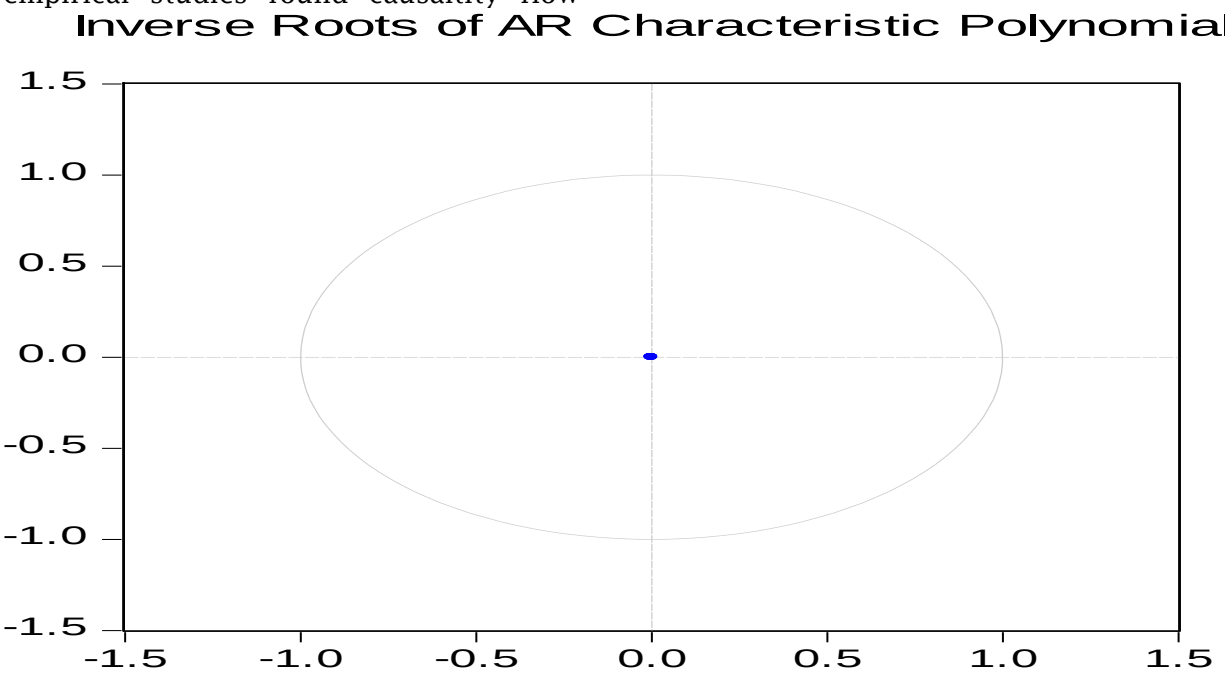

Fig.1. inverse root of AR characteristic polynomial

In the result presented in figure 1, all roots are inside the unit circle. This implies that the model is characterized as dynamically stable.

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary and Conclusion

This study examines the causality relationship among money supply growth, inflation and real output growth in Nigeria for the period 1985-2020. Annual time series data on percentage changes in broad money supply (M_2), inflation rate

and real output (proxied by real GDP) were collected from CBN statistical bulletin, 2020 edition. Autoregressive distributive lag (ARDL) model was adopted to test for the long run relationship and short run dynamics of the variables. Similarly, Toda-Yamamoto VAR causality was adopted to test for the causality relationship among the variables. The empirical results indicate that money supply growth has positive but insignificant effect on inflation in the short run. However, its effect on inflation is positive and significant in the long run, which implies that growth in money supply significantly increases inflation in the long run. On the other hand, growth in real output has negative and significant effect on inflation in the short run; however its effect on inflation in the long run is negative and insignificant. The result of Toda-Yamamoto Causality test reveals a bidirectional causality between money supply growth and inflation, a unidirectional causality between inflation and real output, where causality runs from inflation to real output. The result also reveals that no causality relationship exists between money supply growth and real output growth. The conclusion drawn is that growth in money supply has the tendency to increase inflation more in the long run than in the short run.

RECOMMENDATIONS

Based on the findings, the following, recommendations are made. It is found that growth in money supply Granger causes inflation with feedback effect. It is recommended that monetary authorities in Nigeria, with CBN as the apex regulatory authority, should adopt money supply targeting as an intermediate target in order to control inflation. Furthermore, the effect of real output on reductions of inflation is significant in the short run but insignificant in the long run. There should be massive investment in agriculture in order to reduce food price inflation. This will help in price stabilization and growth in general.

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