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MODELING THE RELATIONSHIP BETWEEN MONETARY POLICY AND ECONOMIC GROWTH IN NIGERIA: AN APPLICATION OF THE ARDL APPROACH IN THE PRESENCE OF STRUCTURAL BREAKS.

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ABSTRACT

The role of monetary policy in sustaining economic growth has been a highly researched subject. The aim of this study is to examine the relationship between monetary policy and economic growth when there is evidence of structural break. Quarterly time series data was collected from the Central Bank of Nigeria Statistical Bulletin and Website from 1981 to 2021. Motivated by the prevalence of misleading inference in time series occasioned by failure to account for structural breaks in series as volatile as macroeconomic variables in Nigerian specific studies, this study sought to find out whether structural breaks matter in studying the response of Economic growth due to monetary policy shocks. The study employed Zivot-Andrews unit root test with structural break to compare the unit root result with the conventional ADF result while the Autoregressive Distributed Lag (ARDL) bounds testing approach is used to investigate the co-integration among the variables in the presence of structural breaks. The unit root test shows that failure to account for structural break in unit root of a volatile series can produce wrong inference. After allowing for structural breaks, the study finds no evidence of co-integration relationship between economic growth and monetary policy. Thus it can be argued that there exists only a short run relationship between the variables of study. The estimates of the ARDL short run model suggest that Money Supply (M2) has a significant positive impact on economic growth in the short run at the selected lag length. However, the estimates show that Net Credit to Government (NCG) has a negative significant impact on economic growth in Nigeria. More also, Exchange Rate (EXR), Inflation (INFL) and Maximum Lending Rate (MLRC) have a positive but insignificant effect on Economic Growth in the short run. This study reveals that broad money supply lead to economic growth in the short run. Structural change is persistent in macroeconomic time series data, and it can be quite hazardous to ignore as inferences about economic relationships can go off track and policy recommendations can be deceptive or worse, therefore Researchers working with macroeconomic time series data are recommended not to use only unit root tests such as ADF, DF-GLS, and PP that do not account for structural breaks, but unit root tests that account for structural change, such as the Zivot Andrews test, the Chow test, and the Bai Perron multiple structural break test, should also be employed.

Introduction

Monetary policy is a deliberate action taken by the monetary authority to affect the amount, cost, and accessibility of money credit in order to attain the desired macroeconomic goals of internal and external balances [1]. To control the amount of money in the economy, the activity is carried out by altering the money supply and/or interest rates. Thus, nations have sought to use monetary policy as a tool for managing the economy in order to achieve long-term economic growth and development. Adams Smith was the first to formally articulate

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this relationship between money and economic aggregates, and monetary economists later championed it. Because of the explanations of how monetary policy affects macroeconomic goals like economic growth, price stability, balance of payments equilibrium, and a host of other goals, monetary authorities are now charged with utilizing monetary policy to expand their economies.

The expansion of products and services in a nation at a specific point in time is referred to as economic growth. This naturally shows that economic growth occurs when a nation's actual per capita income rises over time. A rising economy generates commodities and services across successive time periods, indicating a rise in the economy's production potential. In general, economic growth entails a rise in average living standards and a decrease in income distribution disparities [2].

Since the Central Bank of Nigeria was given the duty of creating and carrying out monetary policy by the Central Bank Act of 1958, monetary policy has been utilized in Nigeria. Treasury bills, a financial instrument used for open market operations and raising debt for the government, have grown in volume and value as a result of this role, becoming a significant earning asset for investors and a source of market-balancing liquidity.

Monetary policy in Nigeria has been primarily characterized by the post-1986 and pre-1986 periods. Prior to 1986, Nigeria maintained direct monetary management to maintain price stability; however, after the market was liberalized in 1986, the focus moved to market mechanisms. In order to fight inflation and maintain price stability prior to 1986, direct monetary instruments were used, such as selective credit controls, administered interest and exchange rates, credit ceilings; cash reserve requirements, and special deposits. Interest rates were set at relatively low levels primarily to encourage investment and economic growth. Occasionally, special deposits were enforced to limit the banks' ability to provide credit and their excess reserves [3]

In Nigeria, there have been numerous monetary policy regimes. Monetary policy, which is primarily employed to stabilize prices, can be lax or tight at different times. The economy has had periods of expansion and contraction, but it is clear that the growth that has been reported has not been sustainable given that there are signs of rising poverty in the population. The question is, can sound monetary policy be credited with the current expansion? And could causes other than weak monetary policy be held responsible for periods of economic downturn? What measures need to be considered if monetary policy is to be effective in bringing about sustainable economic growth and development? These are the concerns that remain unsolved in Nigeria, which this study would aim to answer.

Despite the efforts made by the Central Bank of Nigeria (CBN) through the implementation of monetary policy measures, the Nigerian economy continues to experience a myriad of issues that are related to the amount of money in circulation.

However, there is conflicting evidence in empirical literatures about the effect of monetary policy on economic growth in Nigeria and elsewhere. While some studies contend that monetary policy has a favourable and considerable impact on economic growth, others hold the opposite view.

This empirical literature outcome demonstrates inclusiveness. Therefore, there is a need to identify the actual influence monetary policy tools have on economic growth in Nigeria.

The aim of the study is to evaluate the long-run and short-run causation between monetary policy variables and economic growth as measured by real gross domestic product (RGDP) when the series is characterized with structural breaks as evidence in Nigeria. Specifically, this paper will investigate whether there is stability or a break in the mean level of the variables over the periods under review while considering the long-run and short run relationship between Monetary Policy Variables and Economic Growth.

This research work considered monetary policy indicators and the economic growth of Nigeria. Quarterly secondary time series data on economic growth proxied by Gross Domestic Product (GDP), Broad Money Supply (M2), Exchange Rate (EXR), Inflation Rate (INF), Maximum Lending Rate of Commercial Banks (MLRC), and Net Credit to the Government Sector (NCG) for a period of 40 years from 1981 to 2021 provided by Central Bank of Nigeria.

LITERATURE REVIEW

[4] studied the impact of monetary policy management on inflation in Nigeria during the decades of 1985–2019. Autoregressive distributed lag analysis was employed. Findings of the study showed that while monetary policy rate and foreign exchange rate influenced negatively, broad money supply had a positive impact on it.
The impact of the money supply on savings and investment in developing nations between the years of 1999 and 2016 was examined by [5]. The multiple regression technique was used in the investigation. The study's conclusions showed that the amount of money in circulation has a big impact on investments and savings.

In order to determine the influence of monetary policy on sustainable output growth and price stability in Nigeria from 1986 to 2016, [6] looked at the asymmetric effect of positive and negative monetary policy shocks on output and prices in Nigeria. Nonlinear autoregressive distributive lag (NARL), was used. The findings of the study demonstrated that monetary policy shocks in Nigeria have asymmetric impacts on output and prices in both the short- and long-term.

[7] looked at how Nigeria's monetary policies affected economic growth between 1981 and 2016. The Johansen Co-integration test and the Vector Error Correction Mechanism (VECM) were used in the investigation. The study's findings showed that the money supply and exchange rate had a small but favorable influence on economic growth. On the other hand, the interest rate and liquidity ratio both significantly and negatively affect economic growth.

[8] evaluated the impact of interest rate, inflation, exchange rate, money supply, and credit on GDP to see how monetary policy affects Nigerian economic growth. Techniques such as the Augmented Dickey-Fuller (ADF) test, the Philips– Perron Unit Test, the Co-integration test, and the Error Correction Model (ECM) were utilized. The results revealed that monetary policy tools have a long-run equilibrium relationship with economic growth.

[9] studied the short and long run impact of macroeconomic determinants of economic growth in Nigeria and found that there is no consistence in the causal relationship of the variables considered.

[10] examine the role of monetary policy in promoting economic growth in the South African economy between the period of 2000 and 2010. The study employed Johansen co-integration and the Error Correction Mechanism. Findings of the study reveal that a long run relationship exists among the variables. Furthermore, findings of this study show that money supply, and exchange rates are insignificant monetary policy instruments that drive growth in South Africa whilst inflation is significant.

Using OLS regression analysis, [11] investigated the effects of monetary policy on a number of macroeconomic variables in Nigeria, including the gross domestic product, inflation, and balance of payments. The outcome indicates that creating an environment in Nigeria that is conducive to investment can accelerate GDP development.

Although there is a lot of empirical literature on economic growth and monetary policy, most of the work done in Nigeria on macroeconomic variables using linear (ARDL) model as documented in literature, ignores the fact that macroeconomic variable are affected by structural breaks, thereby estimating a linear (ARDL) model that does not capture structural breaks. This work sees that as a gap and it is this gap in literature that this work seeks to bridge, while critically modeling the relationship between monetary policy indicators and economic growth in Nigeria using Autoregressive Distributed Lag Model corrected with dummy variables.

RESEARCH METHODOLOGY

This research is designed to investigate the relationship between monetary policy indicators and economic growth in Nigeria using Autoregressive Distributed Lag Model corrected with dummy variables.

The data sets used for this research work consist of quarterly time series data for the selected variables from 1981q1 to 2021q4. The data was extracted from the Central Bank of Nigeria (CBN) website. The variables considered are Economic Growth proxied by Gross Domestic Product (GDP), Broad Money Supply (M2), Exchange Rate (EXR), Inflation Rate (INF), Maximum Lending Rate of Commercial Banks (MLRC) and Net Credit to Government Sector (NCG).

The tools employed in this research include: the Augmented Dickey Fuller (ADF) test, the Zivot-Andrews Unit Root Structural Break Test, the ARDL Bound Test, and the Impulse Response Function.

Augmented Dickey-Fuller (ADF) or Said-Dickey test:

Augmented Dickey-Fuller test is an augmented version of the Dickey-Fuller test to accommodate some forms of serial correlation and used for a larger and more complicated set of time series models.

If there is higher order correlation then ADF test is used but DF is used for AR (*1*) process.

The testing procedure for the ADF test is the same as for the Dickey-Fuller test but we consider the AR (*p*) equation:

$$y_t = \alpha + \rho t + \sum_{i=1}^{p} \beta_t \Delta y_{t-i} + \varepsilon_t \qquad (1)$$

Assume that there is at most one unit root, thus the process is unit root non-stationary. After reparameterize this equation, we get equation for AR (*p*):

$$y_t = \mu + \rho y_t + \alpha y_{t-1} + \sum_{i=1}^{p} \beta_t \Delta y_{t-i} + \varepsilon_t \qquad (2)$$

Each version of the test has its own critical value which depends on the size of the sample. In each case, the null hypothesis is that there is a unit root, $\rho = 0$. In both tests, critical values are calculated by Dickey and Fuller and depends on whether there is an intercept and, or deterministic trend, whether it is a DF or ADF test.

The null hypothesis will be rejected if t-statistics value exceeds the critical value or if the p-value is less than the level of significance under consideration.

Zivot and Andrews Test

[12] extended a difference of [13] original model, which the time of the break is estimated. [12] included the endogenous break in the model and it was referred to as a sequential trend break model. [13] is a predetermined break, but [12] is an estimated break. The alternative hypothesis is that the series is a trend stationary process with any breakpoint. Meanwhile, the null hypothesis in this

procedure is that the variable under analysis is not stationary with a drift that excludes any breakpoint.

The Zivot Andrews model endogenous one structural break in a series as the following: Model A allows a one-time change in the intercept of the series:

$$y_t = \mu + \alpha y_{t-1} + \beta_t + \theta Du_t + \sum_{i=1}^{k} c_j \Delta y_{t-j} + e_t \quad (3)$$

Where Du_t represents the intercept dummy Du_t=1, when t>TB (breakpoint) and zero otherwise.
Model B allows a one-time change in the slope of the series:

$$\Delta y_t = \mu + \alpha y_{t-1} + \beta_t + \gamma DT_t + \sum_{i=1}^{k} c_j \Delta y_{t-j} + e_t \quad (4)$$

Where: DT represents the slope dummy DTt = t – TB, when t > TB (breakpoint) and zero otherwise.
Model C allows a one-time change in both slope and intercept of the trend function of the series:

$$\Delta y_t = \mu + \alpha y_{t-1} + \beta_t + \theta DU_t + \gamma DT_t + \sum_{i=1}^{k} c_j \Delta y_{t-j} + e_t \quad (5)$$

Based on the above equations, DU_t is indicator dummy variable for a mean shift in the intercept and DT_t is another dummy variable representing a shift in the trend occurring at time. The null hypothesis in equations (1), (2) and (3) was that which indicates that there is a unit root. The alternative hypothesis is that which indicates that was breakpoint.

A major issue with traditional unit root tests is that they do not account for the potential for a structural break. A conventional unit root test done alone is insufficient and problematic because it is likely that the time-series data may have major structural fractures. Applying the unit root theory in the presence of a potential structural break has two benefits. First of all, it prevents biased test results in favor of non-rejection [13]. It would also provide useful information for determining whether a structural break in a particular variable is related to government policy, a financial crisis, regime shifts, or other issues since this method can determine when the presence of a structural break may have occurred.

This study demonstrated how bias in the traditional unit root tests and the endogenous timing of structural fractures might be decreased. [12] model, which in turn reflects the reaction of monetary policy and economic growth in Nigeria, was utilized in this study to determine if the data series in question is influenced by a structural break.

Model Specification

The ARDL (p,q1,q2,...,qk) model approach to Cointegration testing;

$$\Delta Y_t = \delta_{0i} + \sum_{i=1}^{k} \alpha_i \Delta Y_{t-1} + \sum_{i=1}^{k} \alpha_2 \Delta X_{t-i} + \delta_1 Y_{t-1} + \delta_2 X_{t-1} + v_{1t} \quad (6)$$

k is the ARDL model maximum lag order and chosen by the user. The F-statistic is carried out on the joint null hypothesis that the coefficients of the lagged variables ($\delta_1 X_{t-1}$ $\delta_1 Y_{t-1}$ *or* $\delta_1 Y_{t-1}$ $\delta_1 X_{t-1}$) are zero. (δ_1 – δ_2) correspond to the long-run relationship, while (α_1 – α_2) represent the short-run dynamics of the model. The hypothesis that the coefficients of the lag level variables are zero is to be tested.

The null of non-existence of the long-run relationship is defined by;

H_o: $\delta_1 = \delta_2 = 0$ (null, i.e. the long run relationship does not exist)
H_1: $\delta_1 \neq \delta_2 \neq 0$ (Alternative, i.e. the long run relationship exists)

The model to capture the impact of monetary policy on economic growth are stated below with the dependent variable as Gross Domestic Product (GDP) while independent variables as Broad Money Supply (M2), Exchange Rate (EXR), Inflation Rate (INF), Maximum Lending Rate of Commercial Banks (MLRC) and Net Credit to Government Sector (NCG).

Thus the estimated ARDL representation takes the form:

$$\Delta \mathrm{GDP}t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i}\,\Delta GDP_{t-1} + \sum_{i=1}^{q1} \alpha_{2i}\Delta M2_{t-i} + \sum_{i=1}^{q3} \alpha_{3i}\Delta EXR_{t-i} + \sum_{i=1}^{q4} \alpha_{4i}\Delta INF_{t-i} + \sum_{i=1}^{q6} \alpha_{5i}\Delta MPR_{t-i} + \sum_{i=1}^{q5} \alpha_{6i} GSC_{t-i} + \beta_1 GDP_{t-1} + \beta_2 M2_{t-1} + \beta_3 EXR_{t-1} + \beta_4 INF_{t-1} + \beta_5 MPR_{t-1} + \beta_6 GSC_{t-1} + \varepsilon_t \qquad (7)$$

Once the presence of structural breaks is confirmed within the underlying variables, it cannot be ignored while estimating the co-integration relationships. Therefore, taking into account the nature of the variables (that is, a mix of I(1) and I(0)) and the presence of structural breaks, this study also used the ARDL approach to co-integration corrected with the dummy variables to account for the structural breaks to estimate the short-run and long-run relationship between economic growth and monetary policy. Because ARDL itself does not take the issue of potential structural breaks into the system, a dummy intervention variable is introduced in the model to represent the break point in series. Thus the estimated ARDL representation takes the form:

$$\Delta \mathrm{GDP}t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i}\,\Delta GDP_{t-1} + \sum_{i=1}^{q1} \alpha_{2i}\Delta M2_{t-i} + \sum_{i=1}^{q3} \alpha_{3i}\Delta EXR_{t-i} + \sum_{i=1}^{q4} \alpha_{4i}\Delta INF_{t-i} + \sum_{i=1}^{q6} \alpha_{5i}\Delta MPR_{t-i} + \sum_{i=1}^{q5} \alpha_{6i} GSC_{t-i} + \beta_1 GDP_{t-1} + \beta_2 M2_{t-1} + \beta_3 EXR_{t-1} + \beta_4 INF_{t-1} + \beta_5 MPR_{t-1} + \beta_6 GSC_{t-1} + \beta_7 D_{GDP} + \varepsilon_t \qquad (8)$$

The dummy variable DGDP is added to equation (8) to reflect the structural break if the ZA test result indicates that the dependent variable Economic Growth (proxied by GDP) experiences a structural break at a given time period, the GDP dummy variable (D_GDP) had a value of 0, and then it had a value of 1.

In this research we will be comparing the results of the ARDL model without accounting for structural break with that of the ARDL model corrected by a dummy, which captures structural breaks to see which of the models is well stated.

Unit Root and Structural Break Test

Verifying the stationarity of the variables under analysis is the initial step in most modeling investigations of time series.

The Augmented Dickey Fuller (ADF) test will be run on all the variables to confirm the information above. To address the issue of potential structural breaks in the series, the Zivot and Andrew 1992 pretest was also be applied to all variables.

The null hypothesis for ADF and Zivot-Andrews test are that the variables under consideration have a unit root against the alternative that it does not. The decision rule is to reject the null hypothesis if the t-statistic value is less than the critical value at a chosen level of significance.

From the Augmented Dickey Fuller (ADF) unit root test results in Table 1, the Null hypothesis of presence of unit root for the variables GDP, M2, EXR, MLRC and NCG in their levels cannot be rejected since their ADF Statistics greater than the critical value of 5% which implies non-stationarity of the said series. But INF is stationary at 5% significant level. However, at first difference, the variables become stationary.

Overall, the unit root test indicates that the variables are integrated in the mixed order, but none are integrated of order two. These results determined a favourable context to the application of an ARDL Bounds test for co-integration.

Table 1: Result of Augmented Dickey Fuller (ADF) Unit Root Test & Zivot Andrew Unit Root Test with Structural Break

Augmented Dickey Fuller (ADF) Unit Root Test				**Zivot Andrews (ZA) Unit Root Test with Structural Breaks**			
Variables	**ADF t-Stat**	**Critical Value (5%)**	**Order of Integration**	**ADF t-Stat**	**Critical Value (5%)**	**Order of Integration**	**Break Date**
GDP	-1.785220	-3.437977	I(1)	-3.733322	-5.08	I(1)	2005 Q2
M2	-2.868231	-3.437629	I(1)	-6.240037	-5.08	I(0)	2005 Q4
EXR	-0.494204	-3.437977	I(1)	-3.413321	-5.08	I(1)	2012 Q1
INF	-4.481972	-3.437977	I(0)	-6.123117	-5.08	I(0)	1995 Q3
NCG	-0.775822	-3.437629	I(1)	-4.102753	-5.08	I(1)	2006 Q4
MLRC	-3.029882	-3.437629	I(1)	-5.190402	-5.08	I(0)	1993 Q3

Source: Authors' Computation (2022) with Eview 9

In contrast to the ADF test, the Zivot Andrews (ZA) test for unit roots indicates that, for the variables M2, INF, and MLRC, the null hypothesis of the absence of a unit root is rejected at the 5% level of statistical significance. The variables are integrated to order zero or level, and this is confirmed. The unit root null hypothesis is not rejected at the 5% level of significance for the variables GDP, EXR, and NCG. This implies that the variables GDP, EXR, and NCG are integrated of order one, although with structural breaks occurring at different time periods. This result clearly contradicts the results obtained from the unit root test without a structural break for these series. The last column of the table includes the identified structural breaks.

Table 1 show that the structural change in Maximum lending rate for commercial bank (MLRC) and Inflation (INFL) took place in 1993 and 1995 respectively, which was as a result of regime shift from control to indirect monetary policy implementation techniques witnessed within 1991 to 1993 and thereafter. Also the result recorded a structural change in GDP, Money Supply and Exchange rate which took place within 2002 to 2013 when Nigeria witnessed a series of policy changes both structural and institutional. The banking crises which Nigeria financial institutions witnessed in the late 60's between 1997 to 1998 and also between 2005 to 2010 causes a serious break in the money supply and consequently a rise in interest rate.

AUTOREGRESSIVE DISTRIBUTED LAG (ARDL) MODEL ESTIMATION

The ARDL Bound Co-integration Test

Table 2: Results of ARDL Bound Test.

Dependent Variable	Independent Variables	ARDL Model	F-Stat.	5% Lower Bound Crit. Value	5% Upper Bound Crit. Value	Outcome
Model 1: GDP	M2, EXR, INF, NCG & MLRC	(5,5,1,0,2,0)	2.69	3.12	4.25	No Cointegration
Model 2: GDP	M2, EXR, INF, NCG, MLRC & D_GDP	(5,5,1,0,2,0,0)	2.44	2.87	4.00	No Cointegration

Source: Authors' Computation (2022) with Eview 9

The findings demonstrated that the F-statistics from ARDL model 1 (which does not account for structural break) and model 2 (which accounts for structural break by incorporating a dummy intervention variable into the system) are subpar or less than the critical values of the lower bound at 5% levels of significance. According to the aforementioned findings, the null hypothesis cannot be disproved, proving that the variables in models 1 and 2 do not co-integrate. It follows that there are only short-term correlations between GDP and the other variables taken into consideration. The short-run ARDL model is utilized in the modeling of these interactions.

ARDL (5,5,1,0,2,0) short run model1 and ARDL (5,5,1,0,2,0) short run model 2 (adjusted by dummy intervention variables) was selected by the lowest Akaike Information Criteria (AIC).

Presentation and interpretation of ARDL Short Run Econometric Model of the Economic Growth in Nigeria Results.

Table 3 presents the results of ARDL(5,5,1,0,2,0) and ARDL(5,5,1,0,2,0,0) models, respectively. The R-squared value of 99% for both models implies the two models are at their best fit. The adjusted coefficient of determination (Adj R^2) for both model shows that about 99% of the changes in economic growth can be explained by monetary policy. This implies that monetary policy can be effectively used to control Nigeria economy. Additionally, the F-statistic (1650.272) for model 1 and F-statistic (1563.733) for model 2 both has probability value (0.0000) less than 5% and which indicates that monetary policy variables included in both models has combined significant effect on Economic Growth in Nigeria. This supports the result of the Adj R^2 and further confirms that monetary policy is a veritable tool for price stability and improved output.

However, the contributions and significance of the individual coefficients of the model are used to test the hypothesis that monetary policy indicators have no significant effect on economic growth in the short run using a t-test. Each of the hypotheses is tested with the coefficient and the t-values.
From model 2 (that is, ARDL[5,5,1,0,2,0,0] which accounts for structural breaks), at the selected lag length of 5, the coefficient of money supply (M2) is 0.465904, which means that money supply (M2) has a positive relationship with gross domestic product (GDP). This implies that a unit increase in money supply (M2) will lead to a 5% increase in gross domestic product (GDP) in the short run. The t-value is 2.564949 with a probability value of 0.0114 less than 5% (see Appendix iv), so we may

reject the null hypothesis of no short-run effect and conclude that money supply has a significant effect on economic growth in Nigeria. But at lags 1 and 5, money supply (M2) has a significant negative relationship with economic growth.
A coefficient of 13569.71 implies positive relationship between Exchange rate (EXR) and Gross domestic product (GDP). A t-value of 1.627818 and P-value of 0.1058 is insignificant (see Appendix iv), so we conclude that Exchange rate has insignificant effect on Nigeria Economic Growth.
From the result in Table 4.3.2, Inflation (INFL) has a positive relationship with RGDP but insignificant at the selected lag since the p-value (0.8309) > 0.05.
The coefficient of Net credit to government (NCG) at the selected lag is negative and significant with p-value of 0.0044. This implies that NCG has a negative but significant effect on Economic Growth in the short run.

A coefficient of 10676.55 for Maximum Lending Rate (MLRC) implies positive relationship between MLRC and GDP. Since the P-value of 0.5739 is greater than the 5% significant level; hence we conclude that MLRC has no significant effect on GDP in the short run.

For model 1, the results of the individual coefficient effects show that money supply has a significant positive effect on economic growth while other monetary policy indicators has insignificant effect on economic growth. These result do not corresponds with the results of model 2 (ARDL[5,5,1,0,2,0,0]).

Table 3: Estimation of Short Run Relationship
Dependent Variable: GDP

Model 1: ARDL(5,5,1,0,2,0) Estimates			**Model 2: ARDL(5,5,1,0,2,0,0) Estimates**		
Variables	**Coefficient**	**Prob***	**Variables**	**Coefficient**	**Prob***
M2	1.129779	0.0000	**M2**	1.131754	0.0000
M2(-1)	-1.377098	0.0000	**M2(-1)**	-1.358743	0.0000
M2(-2)	0.660155	0.0039	**M2(-2)**	0.652662	0.0044
M2(-3)	0.238015	0.3007	**M2(-3)**	0.239647	0.2981
M2(-4)	-0.918313	0.0001	**M2(-4)**	-0.912671	0.0002
M2(-5)	0.471195	0.0104	**M2(-5)**	0.465904	0.0114
EXR	-10835.61	0.2013	**EXR**	-11475.13	0.1786
EXR(-1)	13047.96	0.1182	**EXR(-1)**	13569.71	0.1058
INF	721.1986	0.8698	**INF**	942.4865	0.8309
NCG	111.1208	0.4004	**NCG**	83.81442	0.5395
NCG(-1)	185.1849	0.2982	**NCG(-1)**	180.5378	0.3113
NCG(-2)	-39211.4833	0.4812	**NCG(-2)**	-397.3450	0.0044
MLRC	16989.05	0.3250	**MLRC**	10676.55	0.5739
C	-173993.3	0.5947	**DUM_GDP**	-356022.7	0.4250
@TREND	-5332.104	0.3712	**C**	-124526.7	0.7086
			@TREND	-3533.798	0.5794
R-squared	0.995586		**R-squared**	0.995607	
Adjusted R-squared	0.994983		**Adjusted R-squared**	0.994970	
S.E. of regression	870636.3		**S.E. of regression**	871765.0	
Sum squared resid	1.05E+14		**Sum squared resid**	1.05E+14	
Log likelihood	-2389.564		**Log likelihood**	-2389.196	
F-statistic	1650.272		**F-statistic**	1563.733	
Prob(F-statistic)	0.000000		**Prob(F-statistic)**	0.000000	

Source: Authors' Computation (2022) with Eview 9

Diagnostic Test

To do this, it will be necessary to confirm the accuracy of the estimations from the ARDL(5,5,1,0,2,0) and ARDL(5,5,1,0,2,0,0) models. The Ramsey RESET Test, homoscedasticity, serial correlation (using the LM Test), normality test (using the Jarque-Bera Test), and stability test (using the CUSUM Test) are the most pertinent post-estimation tests for dynamic models. To determine which of the two models performs better or is better specified, we run all of these residual-based tests on our estimated models.

Table 4: ARDL estimation residual diagnostic results for ARDL(5,5,1,0,2,0) and ARDL(5,5,1,0,2,0,0) model

Equations/Model	χ^2 **BG − LM**	χ^2 **ARCH**	χ^2 **J − BERA**	**RAMSEY RESET**
ARDL(5,5,1,0,2,0)	7.932995 (0.0189)	10.80889 (0.0553)	848.875 (0.0000)	2.514293 (0.0445)
ARDL(5,5,1,0,2,0,0)	8.451360 (0.0764)	10.63797 (0.0590)	874.734 (0.0000)	1.763556 (0.0800)

Source: Authors’ Computation (2022) with Eview 9

The estimated ARDL model (5,5,1,0,2,0), which does not take into account the structural break in the system, has issues with autocorrelation, hetroskedasticity, and model specification, according to the results of the aforementioned residual test. The residual test reveals that the estimated model for the ARDL(5,5,1,0,2,0,0) model, which reflects structural breaks into the system through dummy variable intervention, has no autocorrelation or hetroskedasticity issues and has the correct functional form. Accordingly, the estimated ARDL model (5,5,1,0,2,0,0) in this study performed very well based on the residual diagnostic test findings. As a result, ARDL (5,5,1,0,2,0,0) fits well and is suitable for analysis.

In summary, from our results, it is obvious that structural breaks, once found, should not be ignored but should be accounted for while modeling linear relationships, as ignorance of that may lead to biased inference. The outcomes of this study demonstrated that structural breaks can be accounted for or incorporated into an ARDL model via dummy variable intervention.

Conclusion

This paper has examined the relationship between monetary policy and economic growth in Nigeria between 1981 and 2021 using the Auto-distributive Lag Model approach to co-integration corrected with dummy variables attached to the structural breaks to estimate the short-run and long-run relationships that exist between our variables of study. The findings of this study could be summarized below.

The report has so far proven that all of the variables used in this analysis have structural breakdowns. However, structural change is pervasive in macroeconomic time series relationships and can be dangerous to overlook. Forecasts can be inaccurate, and policy recommendations can be misleading or worse. The new tools created in recent years are beneficial aids in the specification, analysis, and evaluation of econometric models. A more realistic model would ideally have time-varying parameters. This study examines six macroeconomic indicators of the Nigerian economy using quarterly data to identify the most significant quarters of the year when structural breaks occurred and tests the unit root hypothesis in the presence of these breaks. In order to achieve this, we made use of the test created by Zivot and Andrews. The outcomes of this test are followed by a few important conclusions. First, it can be deduced that for three series, namely M2, INFL, and MLRC, the unit root hypothesis may be rejected at a level of 5% significance with respect to the mean reversion features of these series. Interestingly, two of these series (M2 and MLRC) at level were inferred as containing a unit root when we used the tests that do not account for the breaks in the data; namely the Augmented Dickey Fuller (ADF) test and Phillip Perron test.

Second, the findings of this study demonstrated that economic growth, as measured by GDP, has a short-run relationship with monetary policy (money supply, exchange rate, inflation, net credit to the government, and maximum lending rate), and the best ARDL model that describes this relation is the ARDL(5,5,1,0,2,0,0) short-run model. The model is able to handle series that are integrated from various orders, which solves the issue of mixed stationary and non-stationary series. Additionally, it overcomes the serial correlation, heteroskedasticity and linearity or model specification problems that happened in the least squares regression method. According to our findings, the broad money supply (M2) and economic growth have a substantial positive association in the short run, which suggests that the M2 has a favorable effect on economic growth. However, in the short run, there is a significant and strong negative link between net credit to government (NCG) and economic growth; as a result, NCG has a negative effect on economic growth. Additionally, there is a short-term positive but insignificant correlation between the exchange rate (EXR) and economic growth. In addition, economic growth and Inflation (INFL) have a positive relationship in the short run; the short run relationship is insignificant at 5% level of significant. Economic growth and maximum lending rate (MLRC) have an insignificant positive relationship in the short run. The above results from the estimated ARDL short model support or coincide with the results of the Impulse response function (IRF) and Wald test.

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