The Economics and Finance Letters
2021 Vol. 8, No. 2, pp. 117-129.
ISSN(e): 2312-430X
ISSN(p): 2312-6310
DOI: 10.18488/journal.29.2021.82.117.129

MONEY SUPPLY & GROWTH NEXUS: EVIDENCE FROM NIGERIA

Onipede, Samuel F[1]
Afiemo, Oghenekaro O[2]
Nduka, Kodili N.[3]
Apinran, Martins O[4+]

[1,2,3,4]*Central Bank of Nigeria, Central Business District, Garki, Abuja, Nigeria.*
[1]*Email: sfonipede@cbn.gov.ng Tel: +2347067408881*
[2]*Email: ooafiemo@cbn.gov.ng Tel: +2348027597876*
[3]*Email: knnduka@cbn.gov.ng Tel: +234802f8664338*
[4]*Email: MOAPINRAN@cbn.gov.ng Tel: +2349066376055*


(+ Corresponding author)

Article History
Received: 18 January 2021
Revised: 8 March 2021
Accepted: 30 March 2021
Published: 21 April 2021

Keywords
Economic growth
ERGP
Money supply
Interest rate
Autoregressive distributed lag (ARDL).

JEL Classification:
C01; C32; E31; E43; E51.

ABSTRACT

The study focused on the dynamic impact of the broader money supply (M3) on economic growth (proxied by Purchasing Manager Index) in Nigeria between 2010M1 and 2018M12. The study investigated the long and the short-run relationship between the selected macroeconomics variables including broad money supply (M3); consumer price Index (CPI); Oil price (OIL), external reserves (Rev) and economic growth using, the Autoregressive Distributed lag (ARDL) method. The findings from the study indicate that in the long-run, the relationship between the broad money supply and economic growth is not only significant statistically but also positive in compliance with theory. The error correction coefficient -0.38072 is statistically different from zero and negative in line with a priori expectation. The result shows that deviation from equilibrium between economic growth as proxied by PMI and other predictors is recovered at an average speed of about 38% monthly in the long-term. The implication here is that the Central Bank of Nigeria is encouraged to maintain a steady rate in the growth of its monetary aggregates, in such a way that is consistent with economic growth. This, of course, is to serve as a complementary policy measure to government's Economic Recovery and Growth Plan (ERGP).

Contribution/Originality: This study is adding to the existing literature on the subject matter in Nigeria by deploying a new data on the broader money supply, M3 that was recently introduced in the country. The work is around the first study to investigate the role of M3 on growth in Nigeria with Auto regressive distributed lag (ARDL) technique.

1. INTRODUCTION

Since its inception, the Central Bank of Nigeria (CBN) has pursued objectives of price stability, promotion of a sound financial system, maintenance of balance of payments equilibrium, and promotion of sustainable economic growth and development. In the 1970s when the contribution of oil began to dominate the export basket of Nigeria, the CBN adopted a monetary targeting framework, which has been sustained to date, though with several modifications. The belief was that inflation is a monetary phenomenon; hence, monetary policy should focus on controlling the monetary aggregates (Nnanna, 2001). During the era of direct control from 1974-1992, the monetary authority's instrument for monetary control was to set targets for aggregate credit to the domestic economy. Under the indirect control regime from 1993 till date, the monetary authority uses market instruments to control monetary aggregates, whereby only operating variables such as the monetary base or its components are

targeted. Some of these instruments include open market operations (OMO), reserve requirements, discount window operations and moral suasion.

Thus, policymakers in Nigeria and other countries with monetary targeting framework are keenly interested in investigating the relationship between money supply, interest rates and growth to check if their macroeconomic objectives are being met.

The relationship between money supply, interest rates and growth has been explained by several scholars in the literature. Others have also cited the Classical Fisher's Quantity Theory of Money as well as the Keynesian Theory of Money, which shows different relationships between the variables. In Nigeria, Galadima and Ngada (2017) noted that the issue is still a subject of debate amongst economists; whilst some claim that an increase in money supply will aggravate prices of goods and services and negatively affect growth in the short run, others believe that an increase in money supply goes in tandem with an increase in output though it leads to an increase in price levels in the long run.

The objective of this paper is to determine and analyze the linkages between money supply, interest rate and economic growth in Nigeria. The outcome of which is expected to help improve monetary policy making in the country. Whilst adding to existing body of literature on the subject matter in Nigeria. This study deploys new data on the broader money supply, M3 that was recently introduced in the country. The data consists of monthly series for all the variables and we use the Auto regressive distributed lag (ARDL) technique for the analysis. The choice of the ARDL model is appropriate because it allows for easy identification of long-run relationships among variables, and it also performs better for a small sample size of data.

Following the introduction, section two reviewed relevant literature while section three presented some stylized facts. Data and methodology is contained in section four while section five and six presented the findings and conclusions respectively.

2. REVIEW OF LITERATURE

2.1. Theories of Money and Economic Growth

Opinions on the relationship between money and economic growth had been diverse over time. The classical theory of money developed by Fisher (1911) argued that interest rates had no effect on the demand for money. His famous equation of exchange, $MV = PY$, highlighted the relationship between money supply, the velocity of money, the price level and index of expenditures. The theory assumes that V and Y are constant and prices are flexible and that in the long run, the economy is predisposed to full employment. This suggests that a direct relationship exists between the money supply and price level such that changes in the quantity of money affect changes in the price level. Alternative approach to the classical quantity theory of money is the Cambridge Cash-Balance (CCB) theory which appears with the same equation. In this theory, however, the equation focuses more on money demand rather than money supply. It also differs in explaining the movement of money. In the classical model, money serves only as a medium of exchange and its velocity is fixed while in the Cambridge approach, its movement depends on the desirability of holding cash and money acts as a store of value.

Invariably, a number of criticisms directed at the quantity theory of money necessitated new theories to explain the dynamism of the macro-economy. Subsequently, Keynes (1936) rejected the monetarist's view of the relationship between the quantity of money and prices being direct and proportional. In addition, the assumptions espoused by the classical model were unrealistic in an uncertain world infused with high levels of unemployment. He argued that 'changes' in money supply alone were insufficient to determine changes in the price level and identified the employment of the factors of production as a major contributing factor. He proposed that a non-proportional and indirect relationship effected through the rate of interest, existed between changes in the quantity of money and prices. In this regard, he proffered the Liquidity Preference Theory, which relates the interest rate

with investment and output. Significantly the Keynesian theory is able to integrate the monetary theory and the theory of output and employment through the rate of interest. Consequently, for an increase in the quantum of money, there is an attendant fall in the rate of interest, which leads to an increase in investment, thereby fostering employment and output. The theory presupposes a link between the monetary and real sectors of the economy via equilibrium in the goods and money markets.

Building upon the Keynesian model is the neo-Keynesian theory which combines both aggregate demand and aggregate supply. In the short-run, it adopts a Keynesian approach while in the long run it assumes a classical approach. It considers changes in the nominal money supply and assumes expected inflation is zero. Consequently, with lower levels of prices, real money balances increase, allowing for a greater volume of transactions and increasing aggregate demand. Here, productivity is the main tenet of the model where declining productivity indicates diminishing returns to scale, rising inflationary pressures because overheating of the economy and a widening output gap. A modern view postulated by the Post Keynesian School is the Endogenous money theory which speculates that an economy's supply of money is determined endogenously, due to interactions of other economic variables as compared to exogenously, by a central bank or external authority. This is premised on the position that money comes into existence through the real economy's money demand whereby the banking system reserves expand or contract as needed to accommodate credit demand at prevailing interest rates.

Everything considered, the various schools of thought provide a better understanding of how the money stock affects output and its attendant influence on prices. One critical aspect of this enquiry is the measure of the money stock where several measures of the monetary aggregates that are alternatives exist. The definition and measure of these aggregates differ from country to country and change from time to time. Traditionally, in Nigeria, narrow money (M1) and broad money (M2) have been the most widely used measures of money supply. However, a more robust measure is attainable with M3, which in Nigeria is principally M2 plus OMO bills. Another facet of this study is the link between interest rates and inflation. Typically, expectations that prices will rise in the future prompt firms and businesses to revise their prices upwards to sustain profit levels. This has the effect of increasing the aggregate cost of all goods and services in the economy. The fact that Inflation erodes the value of money supposes that lenders will expect a higher rate of return for parting with their funds, thus increasing market interest rates. Though it is expected that a higher quantum of money will promote investment, the long-term effect of changes in money stock without a concomitant increment in productivity has tended to have a minimal if not negative impact on output as well as a sustained rise in the price level.

2.2. Empirical Review

Early research on the integration of monetary theory with economic growth can be found in the works of Ando and Modigliani (1965), who used a series of equations based on the models proposed by Friedman and Meiselman (1963) to investigate the link between the stock of money, income and expenditure. They observed that the money stock and autonomous expenditure both impacted output although autonomous expenditure was seen to be more effective. Friedman (1969) subsequent analysis of the American monetary system highlighted the direct relationship between money supply and real income albeit with a lag contrary to Keynesian economics which espoused an indirect relationship. Consequently, a number of studies covering a number of countries and using various econometric techniques have attempted to determine whether a long run relationship does exist between money supply and output and if such a relationship could predict output in the near-to-medium term.

Law, Tan, and Baharumshah (1999) using various econometric techniques[1] studied the relationship between money, output and interest rates and prices in Malaysia. The multivariate cointegration tests suggested a stable

[1] Johansen's multivariate cointegration analysis, Vector Error Correction Model (VECM), Granger causality, variance decompositions and impulse response functions

long-run equilibrium relationship between these macroeconomic variables while the vector error-correction short-run model supported the New Keynesians' view of money's non- neutrality in the short-run. With respect to the measure of money supply, M1 was identified as the most effective intermediate monetary target to curb inflation. M3, on the other hand was suggested as the most appropriate intermediate target to promote sustainable economic growth with contained inflation.

El.Seoud (2014) in his study on Bahrain covering the period 2000 to 2013 used cointegration, Error Correction Model and Granger Causality techniques to examine the relationship between the real money supply and real Gross Domestic Product (GDP) as well as the causality between the two variables in both short and long run. The results revealed the existence of long run equilibrium between real GDP and real money supply. In addition, the study highlighted unidirectional causality running from real GDP to real money supply in both the short and long run.

In recent times, Dingela and Khobai (2017) investigated the dynamic impact of broad money supply (m3) on economic growth (GDP) per capita in South Africa using time-series data from 1980 to 2016. The study employed the autoregressive distributed lag (ARDL)-bounds test approach to investigate the impact of money supply (M3) on GDP per capita. They specify the model with four macroeconomics variables, namely, Broad money supply (M3), GDP per capita, interest rate and inflation rate. Their results indicate that there is a statistically significant positive relationship between money supply and economic growth in both the short and long run.

In Nigeria, several studies have been conducted on the influence of money supply on growth. In their research on the impact of money supply on economic growth, Ogunmuyiwa and Ekone (2010) applied OLS, causality test and ECM to time series data covering the period 1980 to 2006. Their findings reveal that aggregate money supply is positively related to growth and development. They however obtained insignificant results in the case of money supply predicting real GDP growth rates. Amassona, Nwosa, and Olaiya (2011) using simplified OLS analysis on annual data from 1986 to 2009 provide further evidence of a relationship between money supply and GDP, though the relationship was observed to be inverse. Taiwo (2012) investigated the impact of injection and withdrawal of money stock on economic growth in Nigeria. He also applied OLS estimation on time series data from 1970 to 2008 and revealed that a direct relationship existed between the variables. He posited that monetary injections had a positive effect on growth while withdrawals were seen to negatively impact output. Also adopting the ordinary least squares (OLS) technique, Chude and Chude (2016) find a positive and significant relationship between money supply and economic growth in the country. The authors conclude that M2 has a dominant influence on output and prices. Likewise, Marshal (2016) identified a short and long run relationship between money supply and economic growth. The author applied a simple regression framework using cointegration and VAR. He concluded that changes in the money supply help to explain changes in real GDP and that monetary policy should be effective in both the short and long run to positively effect growth.

More recent studies show a similar trend in findings. Galadima and Ngada (2017) using annual time series data from 1981 to 2015 and simple regression analysis found a long run positive relationship between money supply and economic growth. However, in the short run, the authors discovered a negative significant relationship between the variables. Oluseyi, Olasehinde, and Eweke (2017)investigated the short and long run relationships between money supply and aggregate output using data from 1981 to 2015. The authors adopted an unrestricted version of Mixed Data Sampling (U-MIDAS) technique and Autoregressive Distributed Lag (ARDL) technique. Their findings based on the U-MIDAS test revealed the existence of a long and short run relationship between yearly GDP and quarterly money supply although the ARDL results suggested that money supply only impacted GDP significantly in the long run. The authors conclude that the growth of money supply should be monitored to avoid inflationary pressures that can impede economic growth. Gbenga, James, and Adeyinka (2019) also utilize simple regression analysis to examine the determinants of private sector credit and its implication for economic growth. Their analysis revealed a significant relationship between total credits to the private sector and money supply. They further identified a significant relationship between private sector credit and economic growth. This led to their

conclusion that there should be a persistent increase in the money supply in order to increase the flow of credit to the real sector of the economy to stimulate production and increase output. Similarly, found a significant relationship between money supply and growth. They utilized a variety of econometric measures including the Augmented Dickey Fuller (ADF) and Philip-perron (PP) unit root test, cointegration test, Granger causality test and Error correction mechanism (ECM) in testing as well as in the estimation of the various selected equations. They posited that to achieve a sustainable level of money supply growth consistent with expected growth, more credit had to be made available to the core private sector. In their study, Emmanuel, Udoh, Prince, Okoh, and Ndu (2019) examine money supply and its effect on inflation. Contrary to the other studies however, they find out that money supply does not influence inflation, contravening the quantity theory of money. It can consequently be inferred that money supply does not impede growth through its inflationary expectation. The authors employ Johansen co-integration, Granger causality tests and Vector Error Correction Model (VECM) in evaluating their models. They furthermore use the novel metric M3, as a measure of money supply.

3. RESEARCH METHODOLOGY

3.1. Data Source and Variable

To analyse the dynamic impact of the broader money supply (M3) on economic growth (proxied by Purchasing Manager Index) in Nigeria, the study adopted monthly series from 2010M1-2018M4.The time series data used for the study were directly sourced from the Central Bank of Nigeria's statistics database. Purchasing Manager Index is the dependent coefficient and a proxy for GDP while Broad Money Supply (M3), Reserves (RES), Consumer Price Index (CPI) and Oil Price (Oil) are the predictor's variables. The source of the data and the variables are summarized as follows:

Table-1. Summary of Data Description and Sources

Variable	Description	Source
CPI	Consumer Price Index	CBN
M3	Broad Money Supply	CBN
RES	Reserves	CBN
OIL	Oil Price	CBN
PMI	Purchasing Manager Index	CBN

The focus of the model adopted in the analysis considers the determinants of economic growth in the literature with special emphasis on money supply. Therefore, the analysis adopts the format as follows in consistent with the work of Dingela and Khobai (2017):

$$\ln(PMI_t) = \delta_0 + \ln(\delta_1 Res_t) + \ln(\delta_2 CPI_t) + In(\delta_3 OIL_t) + In(\delta_4 M3_t) + \varepsilon_t \qquad (1)$$

Where PMI is the log of Purchasing Manager Index (Proxy for GDP) which is used to measure the level of growth; RES is the log of Reserves, CPI is the log of Consumer Price Index; OIL is the log of Oil Price while the M3 represents the log of Broad Money Supply; ε_t *is the error term*.

The parameters in Equation 1 capture the response of PMI to changes in its determinants. While the a priori expectations of M3, Oil Price and Reserves coefficients are to maintain positive relationship with PMI, the CPI is expected to relate negative.

3.2. Modelling Technique

This study adopts the Auto Regressive Distributive Lag (ARDL) Bound testing model devloped by Pesaran and Shin (1998) which is an improvement on the existing literature on the related subject matter. This model is embraced because it's not only appropriate for modelling a time series particularly small samples analysis but boast

of inbuilt mechanism to overcome spurious outcomes using an ordinary least squared (OLS) model. However, according to Pesaran, Shin, and Smith (2001) other methods to cointegration have inbuilt restrictive assumptions. ARDL also has advantage of application regardless of the order of integration of the variables (I *(0)* or *I (1))*, though must not be 1(2) especially in determining the long-run relationships. The use of ARDL approach does not only overcome the shortcomings of unit-root in regression, but also capable of correcting the serial correlation problem in time series data Laurenceson and Chai (2003) and Pesaran (1997). Moreover, in cases where some parameters are endogenous, the use of ARDL also provides unbiased estimates of the long- run model.

To establish the long-run relationship (i.e. cointegration) between variables, the null hypothesis is tested against the alternative. As contained in Pesaran et al. (2001) decision is made when the critical value is compared with the calculated F-statistic. According to the principle, if the critical value falls below the computed F-statistics, null hypothesis of no cointegration is rejected, hence a conclusion that there is long-run relationship between the variables under investigation. On the flip, if the critical value has higher value than the computed F-statistic, the null hypothesis of no cointegration is affirmed. Meanwhile, inconclusive scenario is reached when the value falls between the lower and upper bounds.

In accordance with work of Pesaran and Shin (1998) the ARDL error correction version is modelled follows:

$$\Delta y_t = \varpi + \sum_{i=1}^{b-1} \Lambda_1 \Delta y_{t-i} + \sum_{i=0}^{b-1} \Pi_1 \Delta x_{t-i} + \Omega_1 y_{t-b} + \Omega_2 x_{t-b} + \varepsilon_t \qquad (2)$$

From the Equation 2 ϖ represents parameter of constant vector, Λ and Π are the short-run variables; y_t represents variables of endogenous vector, x_t is a vector of the other explanatory variables as outlined above and Ω_1 *and* Ω_2 are the parameters of the long-run relationship, ε_t is error term, assumed to be serially uncorrelated and homoscedastic. All the variables must be stationary, either at level or in their first difference. To check this property before proceeding to the full ARDL model, we used the Augmented Dickey Fuller (ADF) and Phillip Perron tests. The essence of ascertaining the stationarity status of the variables is to ensure that none of the variables turns out to be I(2), which could render the use of ARDL invalid.

3.3. ARDL and Bounds Testing Procedure

Accoding to Pesaran and Shin (1998) the ARDL has 2-stage processes of cointegration technique in the estimation of a long-run relationship between two variables. The Fisher F-test or standard Wald test is deployed in the first stage to ascertain the existence of cointegration amongst the variables (bounds testing). In this case, the null hypothesis is defined as the lagged regressors coefficients in the error correction model Equation 2 are zero i.e. $H_0: \Omega_1 = \Omega_2 = 0$. This null is tested against the alternative hypothesis of $H_1: \Omega_1 \neq \Omega_2 \neq 0$. To proceed to the second stage of the estimation, the cointegration of the parameters must have been determined. The short-run and long-run parameters are estimated with the use of the two equations below:

Equation for a long-run model:

$$\hat{\Omega}_1 y_t + \hat{\Omega}_2 x_t = 0;\ y_t = -\frac{\hat{\Omega}_2}{\hat{\Omega}_1} x_t. \qquad (3)$$

The long-run model is extracted from Equation 2 where appropriate lags would have been selected for both the dependent and independent variables. This could have been done with the adoption of the appropriate information criterion upon determining the existence of long-run relationship at the first Stage.

The dynamic of short-run error correction equation for the coefficients is obtained from the following equation:

$$\Delta y_t = c + \sum_{j=1}^{k} \chi_j \Delta y_{t-j} + \sum_{j=0}^{q} \gamma_{1j} \Delta x_{t-k} + \varpi ecm_{t-1} + \nu_t \quad (4)$$

Deriving the error correction Equation 4 we obtained the following:

$$ecm_{t-1} = y_{t-1} - \frac{\hat{\Omega}_2}{\hat{\Omega}_1} x_{t-1} \quad (5)$$

Where y_t and x_t are previously defined; γ_{1j} are the short-run parameters; ϖ measures the speed of adjustment to a new equilibrium whenever there is a shock. It also provides another means of validating the existence of cointegration or long-run relationship among the variables. It is expected to be negative and significant and less than one in absolute value for the model to be stable.

3.4. Stability Checks

In accordance with Brown, Durbin, and Evans (1975) a stability verification check should be carried out on any model to avoid spurious results. They recommended both the cumulative sum (CUSUM) and cumulative sum of square (CUSUMSQ) on recursive regression residual. However, the plots must fall within 5% critical bounds of significance to accept the stability of the model. Based on the first set of n observations which is updated recursively and plotted against the breakpoints, the test is based on the cumulative sum of recursive residual, and CUSUMSQ also follows the same procedure.

4. RESULTS AND DISCUSSION

As the Table 2 demonstrates, compared to other parameters, Reserves has the maximum value on the average. The standard deviation also indicates that all the series display substantial deviation from their mean value.

Table-2. Summary Statistic.

	PMI	RESERVES	OIL	M3	CPI
Mean	53.74400	35876.49	82.51664	20143432	170.1194
Median	55.36254	35197.44	79.18000	20474855	158.6200
Maximum	63.60000	47903.09	128.0000	33421742	274.5700
Minimum	40.18265	23689.87	30.66000	10478417	103.1300
Std. Dev.	6.181577	6555.914	28.01641	6482851.	48.61794
Skewness	-0.712721	0.204586	-0.076122	0.201155	0.596193
Kurtosis	2.448394	2.007602	1.534516	1.889659	2.206555
Jarque-Bera	10.41535	5.137228	9.678248	6.218082	9.145564
Probability	0.005474	0.076642	0.007914	0.044644	0.010329
Sum	5750.608	3838785.	8829.280	2.16E+09	18202.78
Sum Sq. Dev.	4050.461	4.56E+09	83201.46	4.45E+15	250552.6
Observations	107	107	107	107	107

However, M3, Reserves and CPI are positively skewed, while the Oil Price and PMI are skewed negatively. Kurtosis figures for all the variables are below 3 as captured in the table which indicates a light tails or lack of outliers. The result also discovered uneven normal distribution in the series.

4.2. Graphical Analysis

For an initial visual preview of all the parameters meant for evaluation, the graphical analysis is necessary which is referred to as eye ball test in time series. The graphical plot offers early information about the behavior of the parameters under investigation.

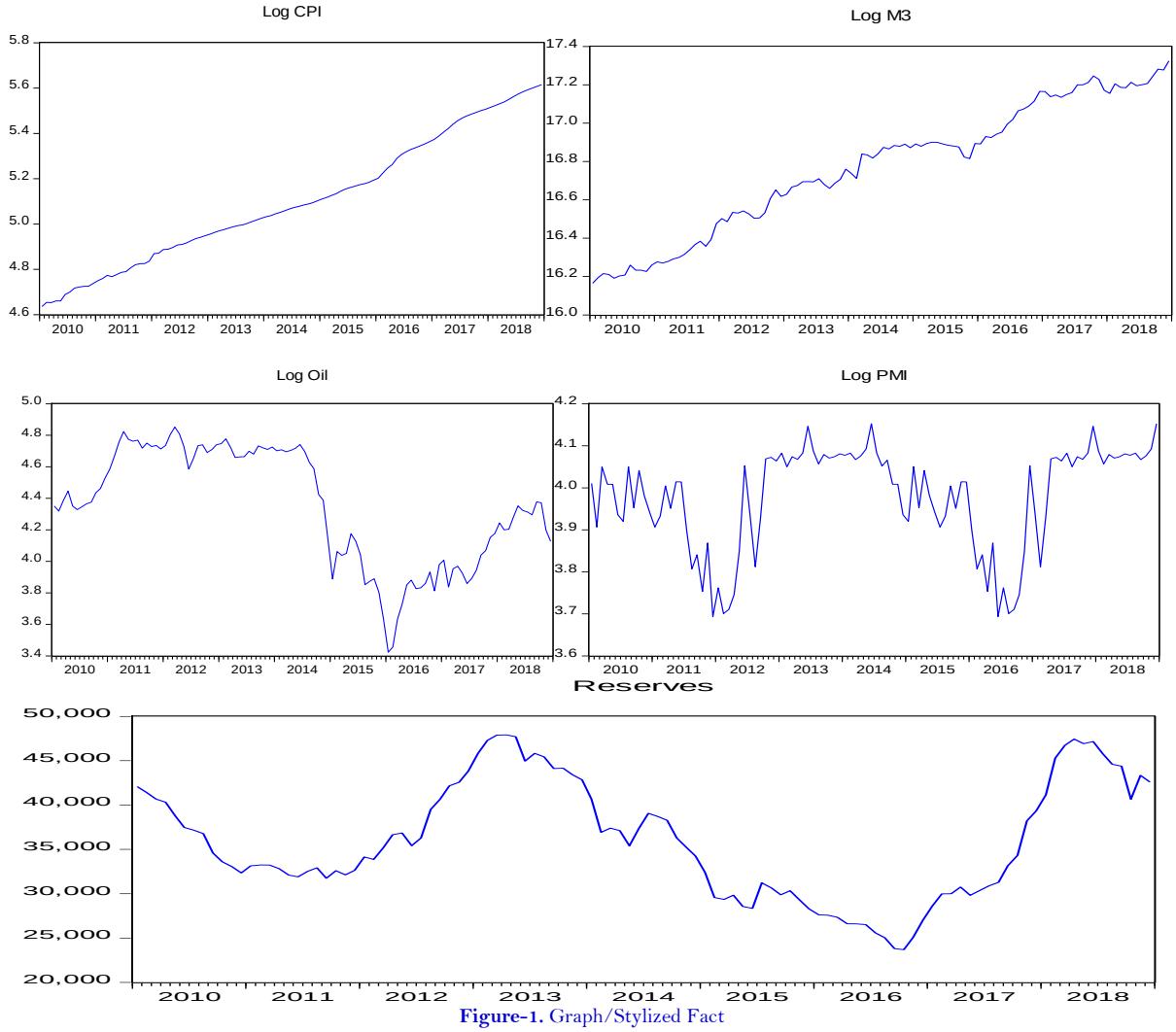

Figure-1. Graph/Stylized Fact

The graphical representations above show that the variables contain trend and also volatile, and in order to ensure a valid and reasonable econometric analysis, it is necessary to conduct further test so as to ascertain the stationarity status of the parameters. It is on this premise that the study adopted the widely used Augmented Dicky Fuller (ADF) and Phillip Parron (PP) tests to establish the stationarity of the parameters.

4.3. Unit Root Test

The first step to undertake in any time series analysis is to check whether the coefficients have unit root or not. Unit root examinations was necessary to avoid spurious outcomes and this was done with the aid of Augmented Dickey Fuller Test (ADF test) and Phillip Perron (PP). The null hypothesis in a u nit root test is that the variables contain unit root as against the alternative. The results are illustrated below

Table-3. Unit Root Test.

	Levels		First Difference		
Coefficients	**ADF**	**PP**	**ADF**	**PP**	**Order of Integration**
lnCPI	-0.305075	0.265540	-6.750708***	-6.948540***	I(1)
lnM3	0.527974	-2.779857	-10.25413***	-10.26293***	I(1)

lnPMI	-0.125699	-3.051491	-12.90961***	-13.93701***	I(1)
lnOIL	-2.242175	-1.959657	-7.873034***	-7.807906***	I(1)
lnReserves	-2.373021	-1.206289	-6.743605***	-7.115549***	I(1)

Note: *, **, *** depict 1%, 5%, 10% levels significance, respectively.

The above Table 3 demonstrates that all the variables are stationary at first difference, i.e they are of order I(1). It implies that the null hypothesis is rejected at first difference as supported by both the ADF and PP tests, the establishment of which is expected to give way for the use of the ARDL bounds testing procedure to ascertain the long-run relationship in accordance with the principle.

4.4. ARDL-Bound Test Approach to Cointegration

The implementation of ARDL model approach practically involves two stages in the estimation of a long-run relationship between two variables as earlier mentioned. Meanwhile, it is pertinent to establish the optimal lag length of the model before examining the cointegrating characteristics of the variables. In this case, Akaike information criterion is chosen as the most efficient lag length as depicted in the graph below which is P*=3. However, the better model among all the models is the one that has the minimum AIC.

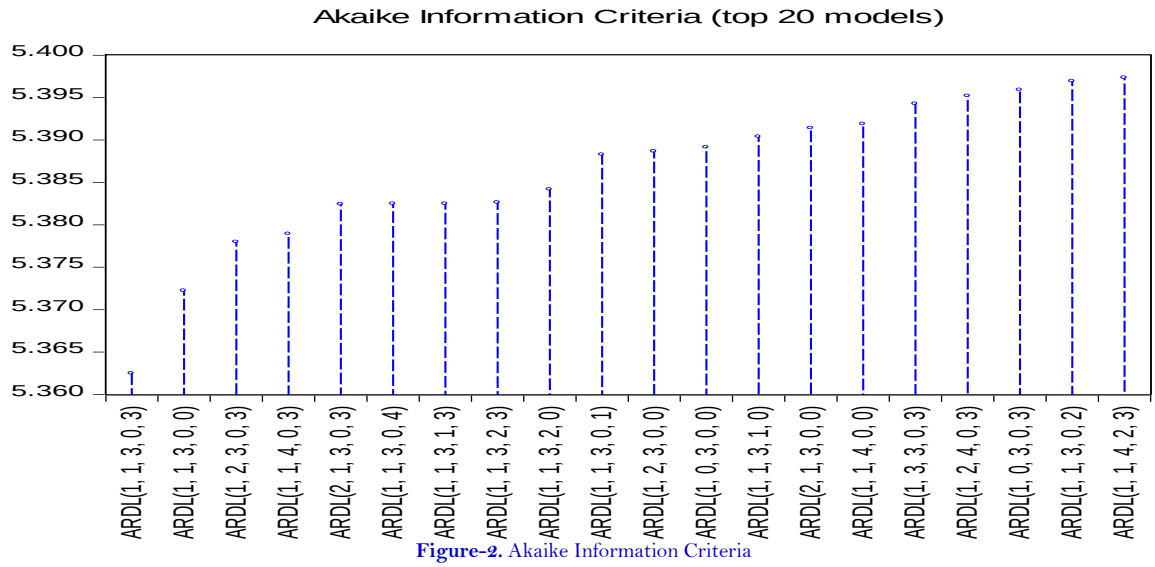

Figure-2. Akaike Information Criteria

Table-4. Bound F test for cointegration.

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	**Value**	**Signif.**	**I(0)**	**I(1)**
F-statistic	4.710538	10%	2.2	3.09
k	4	5%	2.56	3.49
		2.5%	2.88	3.87
		1%	3.29	4.37

From the Table 4, the F-statistic results confirm that there exist a long –run equilibrium. The result reveals that F-statistics value of 4.7 falls above the upper bound at 90%, 95% and 99% respectively. We can then infer that the economic progress in Nigeria has a unique long-run relationship with broad money supply in the year under review.

The results in Table 5 suggest that the estimated coefficient of long-run broader money supply (M3) indicates that it is statistically significant and exert impact on economic growth. The result is a further confirmation of the theoretical argument that the supply of money enhances economic growth. With the long-term value of the elasticity of broad supply of money at 2.00, it implies that economic growth will rise astronomically by 200% if the

supply of money rises by 1% which could be regarded as explosive. The result is consistent with the findings of Maitra (2011); Aslam (2016). Chaitip, Chokethaworn, Chaiboonsri, and Khounkhalax (2015); Hameed (2010); Zapodeanu and Cociuba (2010); Ogunmuyiwa and Ekone (2010).

Table-5. Long-run coefficients.

Dependent Variable = Purchasing Manager Index (PMI)			
Long-Run Coefficients			
Regressor	**Coefficients**	**Std. Error**	**T-statistics**
Constant	25.45367	7.476112	3.404668
CPI	-0.202725	0.105802	-1.916076
M3	2.00E-06	7.83E-07	2.557351
Reserves	0.000648	0.000201	3.226267
Oil	0.007254	0.062212	0.116600
R- Squared	0.75		
Durbin Watson	2.0		

Note: *, **, *** represent 1%, 5%, 10% significant levels, respectively.

Table-6. Variables in the Sort-run.

Parameters in the Short-run			
Variables	**Coefficients**	**Standard Error**	**T-statistics**
CPI	-0.077152	0.041785	-1.846379
M3	2.34E-08	7.90E-07	0.029584
Reserves	0.000572	0.000282	2.030220
Oil	0.286112	0.102457	2.792498
CointEq(-1)*	-0.380572	0.069676	-5.461996
R- Squared	0.75		
Durbin Watson	2.0		

Note: *, **, *** represent 1%, 5%, 10% significant levels, respectively.

In Table 6 the short-run variable of money supply indicates that it is statistically insignificant but has positive impact on economic growth. Meanwhile, both Reserves and Oil Prices are positive in compliance with the apriori criteria and statistically different from zero based on the rule of tomb. The Consumer Price Index also has the right sign and statistically significant at 10% with a negative impact on growth.

In line with the results displayed above, the estimated coefficient of Error Correction Term which stood at -0.38072 is significant statistically based on the t-statistic and negative in tandem with Error Correction principle.

This implies that the short-run disequilibrium in the economic growth in Nigeria occasioned by the interactions of Money Supply, Reserves, CPI, and OIL in the review period is adjusted for with the speed of about 38% to its long-run equilibrium every month.

4.5. Stability Test

The cumulative sum of recursive residuals of both CUSUM (CUSUM) and the CUSUM of recursive squares (CUSUMQ) were adopted to ascertain the stability of the coefficients as developed by Brown et al. (1975). The results are presented below.

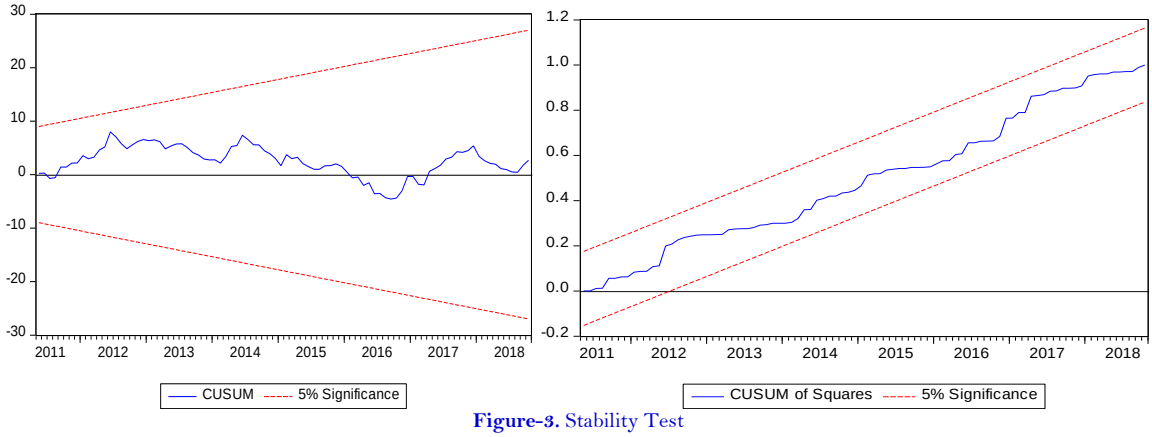

Figure-3. Stability Test

As observed above in the Table, both the graph of CUSUMSQ and CUSUM statistics fall within the accepted 5% critical limits. This outcome implies that the null hypothesis of no stability is rejected at 5 percent level of significance. Overall, it means that the model is stable and its outcomes are valid.

4.5. Diagnostic test

The F-statistics of both serial correlation and heteroscedasticity tests (Table 7 and 8) are not statistically significant which means that we reject the null hypothesis of presence of serial correlation and heteroscedasticity and that the model is free from serial correlation problem and at the same time homoscedastic

Table-7. Diagnostic Test (Breusch-Godfrey Serial Correlation LM Test)

F-statistic	0.022344	Prob. F(2,88)	0.9779
Obs*R-squared	0.052279	Prob. Chi-Square(2)	0.9742

Table-8. Diagnostic Test (Heteroscedasticity Test: Breusch-Pagan-Godfrey)

F-statistic	0.625359	Prob. F(12,90)	0.8155
Obs*R-squared	7.927274	Prob. Chi-Square(12)	0.7908
Scaled explained SS	7.799055	Prob. Chi-Square(12)	0.8006

5. CONCLUSION AND POLICY IMPLICATIONS

The research work focused on the dynamic impact of broad money supply (M3) on economic growth (proxied by Purchasing Manager Index) in Nigeria between 2010M1 and 2018M12. The study investigated both the long and the short-run relationship between the selected macroeconomics variables including broad money supply (M3); consumer price Index (CPI); Oil price (OIL), external reserves (Rev) and economic growth using the Autoregressive Distributed lag (ARDL) method. All the coefficients were confirmed stable at their first difference with the aid of ADF and PP tests and both the stability and diagnostic tests carried out also validated that the model is stable, well specified and free from both serial correlation and heteroscedasticity problems.

The findings from the study indicate that in the long-run, the relationship between the broad money supply and economic growth is not only significant statistically but also positive in compliance with the theory. The error correction figure which stood at -0.38072 is statistically different from zero and negative in agreement with error correction principle. The result shows that deviation from equilibrium between economic growth as proxied by PMI and other predictors is recovered at an average speed of about 38% monthly in the long-run. It is worthy of note that these outcomes are consistence with several other studies in the literature (see above).

The study's findings further emphasize the important contributory role of money to economic growth in Nigeria, hence a veritable monetary policy tool in the hand of the monetary authority to support the government's growth agenda. While there remains disagreement between different schools of economic thought, especially, as

regards the role money plays in supporting growth – while the Keynesians were of the view that money played little to no role in economic growth, those from the classical and monetarist school emphasized its importance. In recent years, argument in favor of finance-led growth hypothesis has gained considerable ground, especially, among the neo-Keynesians, see (Lee, 2005; Schumpeter, 1991; Yoga, 2015) etc. The implication here is that the Central Bank of Nigeria is encouraged to maintain a steady rate in the growth of its monetary aggregates, in such a way that is consistent with economic growth. This, of course, is to serve as a complementary policy measure to government's Economic Recovery and Growth Plan (ERGP). In it's own part, government should revew its business related policies with the view to expunge those that have thus far contributed to a hostile business environment. It is also pertinent to emphasize the role of enduring infrastructure, for the purpose of attracting foreign direct invetment into the country.

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

REFERENCES

Amassona, D., Nwosa, P. I., & Olaiya, S. A. (2011). An appraisal of monetary policy and its effect on macroeconomic stabilization in Nigeria. *Journal of Emerging Trends in Economics and Management Sciences (JETEMS), 2*(3), 232-237.

Ando, A., & Modigliani, F. (1965). The relative stability of monetary velocity and the investment multiplier. *The American Economic Review, 55*(4), 693-728.

Aslam, A. L. M. (2016). Impact of money supply on Sri Lankan economy: An econometric analysis. *International Letters of Social and Humanistic Sciences, 67*, 11-17. Available at: https://doi.org/10.18052/www.scipress.com/ilshs.67.11.

Brown, R. L., Durbin, J., & Evans, J. M. (1975). Techniques for testing the constancy of regression relationships over time. *Journal of the Royal Statistical Society: Series B (Methodological), 37*(2), 149-163. Available at: https://doi.org/10.1111/j.2517-6161.1975.tb01532.x.

Chaitip, P., Chokethaworn, K., Chaiboonsri, C., & Khounkhalax, M. (2015). Money supply influencing on economic growth-wide phenomena of AEC open region. *Procedia Economics and Finance, 24*, 108-115. Available at: https://doi.org/10.1016/s2212-5671(15)00626-7.

Chude, N. P., & Chude, D. I. (2016). Impact of broad money supply on Nigerian economic growth. *IIARD International Journal of Banking and Finance Research, 2*(1), 46-52.

Dingela, S., & Khobai, H. (2017). Dynamic impact of money supply on economic growth in South Africa. An ARDL approach.

El.Seoud, M. S. A. (2014). Testing the relationship between money supply and GDP in Bahrain. *International Journal of Economics, Commerce and Management United Kingdom, 1*(5), 1-16.

Emmanuel, U., Udoh, B. E., Prince, A. I., Okoh, J., & Ndu, O. M. (2019). Money supply and inflation rate in Nigeria: The missing link. *Humanities, 7*(3), 156-166. Available at: https://doi.org/10.18488/journal.73.2019.73.156.166.

Fisher, I. (1911). Recent changes in price levels and their causes. *The American Economic Review, 1*(2), 37-45.

Friedman, M. (1969). The optimum quantity of money, and other essays (No. HG538 F866).

Friedman, M., & Meiselman, D. (1963). *The relative stability of monetary velocity and the investment multiplier in the United States, 1897-1958.*

Galadima, M. D., & Ngada, M. H. (2017). Impact of money supply on economic growth in Nigeria (1981–2015). *Dutse Journal of Economics and Development Studies, 3*(1), 133-144.

Gbenga, O., James, S. O., & Adeyinka, A. J. (2019). Determinant of private sector credit and its implication on economic growth in Nigeria: 2000-2017. *American Economic & Social Review, 5*(1), 10-20. Available at: https://doi.org/10.46281/aesr.v5i1.242.

Hameed, D. (2010). Impact of monetary policy on gross domestic product (GDP). *Interdisciplinary Journal of Contemporary Research in Business*, *3*(1), 1348-1361.

Keynes, J. M. (1936). The supply of gold. *The Economic Journal*, *46*(183), 412-418.

Laurenceson, J., & Chai, J. C. (2003). *Financial reform and economic development in China*: Edward Elgar Publishing.

Law, S. H., Tan, H. B., & Baharumshah, A. Z. (1999). Financial liberalization in ASEAN and the fisher hyphothesis. *Journal of Indonesian Economics*, *33*, 65-86.

Lee, J. M. (2005). *Financial intermediation and economic growth: Evidence from Canada*. New York: Eastern Economic Association.

Maitra, B. (2011). Anticipated money, unanticipated money and output variations in Singapore. *Journal of Quantitative Economics*, *9*(1), 118-133.

Marshal, I. (2016). The link between money supply and economic growth in Nigeria: An econometric investigation. *International Journal of Economics and Business Management*, *2*(3), 42-51.

Nnanna, O. J. (2001). *Monetary policy framework in Africa: The Nigerian experience*. Paper presented at the 2001 South African Reserve Bank Conference.

Ogunmuyiwa, M., & Ekone, A. F. (2010). Money supply-economic growth nexus in Nigeria. *Journal of Social Sciences*, *22*(3), 199-204.

Oluseyi, A. S., Olasehinde, T. J., & Eweke, G. O. (2017). The impact of money supply on Nigeria economy: A comparison of mixed data sampling (MIDAS) and ARDL approach. *EuroEconomica*, *36*(2), 123-134.

Pesaran, H. H., & Shin, Y. (1998). Generalized impulse response analysis in linear multivariate models. *Economics Letters*, *58*(1), 17-29.

Pesaran, M. H. (1997). The role of economic theory in modelling the long run. *The Economic Journal*, *107*(440), 178-191. Available at: https://doi.org/10.1111/1468-0297.00151.

Pesaran, M. H., & Shin, Y. (1998). An autoregressive distributed-lag modelling approach to cointegration analysis. *Econometric Society Monographs*, *31*, 371-413.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289-326. Available at: https://doi.org/10.1002/jae.616.

Schumpeter, J. (1991). *The theory of economic development*. Cambridge: Havard University Press.

Taiwo, M. (2012). Impact of injection and withdrawal of money stock on economic growth in Nigeria. *European Journal of Business and Management Sciences*, *4*(2), 33-42.

Yoga, A. (2015). The dynamic relationship between money supply and economic growth. *Economic Journal of Emerging Market*, *7*(2), 78-92. Available at: https://doi.org/10.20885/ejem.vol7.iss2.art2.

Zapodeanu, D., & Cociuba, M. I. (2010). Linking money supply with the gross domestic product in Romania. *Annales Universitatis Apulensis Series Oeconomica*, *1*(12), 1-50. Available at: https://doi.org/10.29302/oeconomica.2010.12.1.50.