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## **Monetary Growth and Inflation Dynamics in Nigeria**

*Moses, K. Tule, E.C. Obioma, U.M. Okpanachi, S.O. Odeniran, and O.J. Olaoye*

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**Monetary Growth and Inflation Dynamics in Nigeria**

By

Moses, K. Tule<sup>1</sup>, E.C. Obioma, U.M. Okpanachi, S.O. Odeniran, and O.J. Olaoye<sup>2</sup>

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Abstract

**Disclaimer**

**This paper is a product of research. Consequently, the views presented here do not represent in any way, the official position or thinking of the Central Bank of Nigeria on the subject matter.** The views expressed herein are strictly those of the author(s) and not necessarily that of the Central Bank of Nigeria and its Management.

*The study examines a key relationship (money/inflation) underpinning the conduct of monetary policy in Nigeria. The motivation for the study is derived from the perceived weakening relationship between money and inflation in recent times. The methodology was a Vector Auto regressive (VAR) model. Three variants of OLS - ordinary least square, fully modify OLS, and dynamic OLS – techniques were used in estimating the data. Results from these estimates showed that the coefficients of money supply were positive and significant at 1, 5, and 10 per cent, respectively in the inflation equation for the full sample period, suggesting that money supply bears a long run positive relationship with inflation. Based on the coefficient stability results obtained from the Chow test, the entire sample was divided into two sub samples with the first one covering the period 1982q1 to 1996q4 while the second sub sample covered the period 1996q1 to 2012q4. The equation was re-estimated for the two sub-samples. The coefficient of money supply was significant in the first sub sample but insignificant in the second sub sample, buttressing the point made earlier in the trend analysis that the relationship between inflation and money supply might have weakened in recent years. Overall, the study confirms the existence of some relationship between growth in monetary aggregates and inflation, but this relationship has weakened in recent years. The diminishing strength of the relationship between money and prices could be explained in part by recent developments in the Nigerian Financial System including new products and assets classes which may affect demand for money. The key policy implication is that the Bank need to begin to look beyond the monetary aggregates in its configuration as the economy becomes more sophisticated.*

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## 1.0 Introduction

The Central Bank of Nigeria (CBN) 2007 Act requires the Bank to achieve monetary and price stability in consonance with the general consensus that price stability (low and stable inflation) aids growth, while inflation creates uncertainty and is inimical to economic growth. Most central banks aim to achieve price stability as a key objective of monetary policy, whether explicitly stated in their enabling laws or not.

The CBN has employed two monetary policy frameworks: exchange rate targeting up to 1973 and monetary targeting subsequently in pursuit of the price stability mandate. In principle, monetary targeting remains the framework for monetary policy in Nigeria, though, actual implementation has in recent times paid increased attention to short term interest rate (CBN 2012). The increased focus on short-term interest rates gained traction with the implementation of an interest rate corridor in 2006, when the CBN introduced the Standing Lending/Deposit Facilities to address liquidity issues in the short term money market.

In many countries, the reliability of the monetary aggregates as the main signal for the conduct of monetary policy has become increasingly questionable due in part to the phenomenon of a weakening relationship between money and inflation. In Nigeria, it has been observed that moderation in inflation has not kept pace with the slowdown in growth of the monetary aggregates, particularly since the global financial crisis; raising concerns about the stability of the underlying assumption of the theoretical relationship between the intermediate target of monetary policy, broad money supply, and prices. It is in this context that this paper re-visits the thesis (money/inflation) underpinning the conduct of monetary policy in Nigeria.

Following this introduction, Section 2 reviews the relevant literature while Section 3 presents a trend analysis of the data. Empirical analysis and discussion of key findings are presented in Section 4. The paper is concluded with a brief discussion of policy implications in Section 5.

## 2.0 Literature Review

The relationship between the monetary aggregates and the level of economic activities has received much attention in the literature. In one of the earliest contributions, the Quantity Theory of Money (QTM) provided a fundamental basis for monitoring and targeting the monetary aggregates in controlling inflation. In the QTM, it was shown mathematically that since  $MV = PT$ , there was a direct relationship between money supply and price level. Thus, a product of the quantity of money (M) in circulation and the number of times the money changes hand (V) must be equal to the product of the price level (P) and volume of transactions (T) carried out in a particular period. Friedman (1956) noted:

...any interpretation of short-term movements in economic activity is likely to be seriously at fault if it neglects monetary changes and repercussions and if it leaves unexplained why people are willing to hold the particular nominal quantity of money in existence.

Accordingly, central banks have used the monetary aggregates principally as indicators of monetary conditions and, invariably, as predictor of inflation in the economy for several years. The proponents of *monetarism* have tried to show that the velocity of money (V) is stable over time. The volume of transactions (T) which reflects the real output of the economy is also assumed stable in the short run. The assumption of the stable V and T allows changes in the money supply to directly impact on the price level. Thus, central banks could target growth in money supply in order to achieve a desired level of price. This proposition underpinned the conduct of monetary policy by most central banks up to the early 1990s as the monetary aggregates were used as nominal anchors.

Opinions, based on empirical evidence, have however differed markedly about the signalling ability or efficiency of the monetary aggregates as monetary policy anchors. Using evidence from the United States, Friedman and Schwartz (1963) noted that nominal income responds to movement in the money stock. However, there are contradictory arguments in the literature on the nexus between the monetary aggregates and real economic activities. While Sims (1980) found a weak relationship between the monetary aggregates and inflation, Stock and Watson (1989) showed that money supply was a significant predictor of the future of economic activity. Darrat (1985) empirically examined the inflation levels in Nigeria, Libya and Saudi Arabia and found that money played a critical role in achieving the inflation objective. For the three countries, he concluded that

higher money supply coupled with real income growth were associated with higher inflation. Taint (1989), on the other hand, argued that movements in the monetary aggregates did not provide reliable signals about movement in either consumer demand or inflation. In New Zealand, he noted, changes in the monetary aggregates proved unreliable in providing signals for developments in inflation.

Generally, instances of disconnect between the monetary aggregates and inflation were associated with market developments including financial innovation, deregulation as well as changes in interest and taxation rates which provide increased demand for various categories of money and credit, thereby changing the money supply landscape significantly. Of particular importance is the resulting instability of the money multiplier, a situation that complicates or limits the usability of a monetary aggregate as an intermediate target of monetary policy (Taint 1989).

In recent times, the relationship between money supply (Ms) and price has proved to be less robust. Contrary to the assumption of the QTM, the velocity of money has become increasingly unstable in many countries leading to a breakdown in the relationship between changes in money supply and inflation. Goodhart's law, explains that as the monetary authorities attempt to reduce inflation by targeting a particular monetary aggregate, the empirical relationship between that aggregate and inflation tends to break down, especially in the short-term (Goodhart 1998).

Recent studies have found that rapid innovations in the financial system might have altered this relationship. Friedman (1996) reported a decreasing predictive role of money supply in the 1990s. According to Astley and Haldane (1997), the strict relationship between money supply and output as enunciated by the QTM, which provides a fundamental background for monetary targeting, seems to have broken down apparently. They reported that the monetary aggregates in the 1990s, failed to provide early-warning signals for the economy. Tallman and Chandra (1996) using Australian data also reported that the monetary aggregates contained no significant information for explaining subsequent fluctuations in output in that country. Katafano (2000) using a simple correlation co-efficient and Granger Causality tests under a Vector Auto-Regression (VAR) framework, similarly showed the absence of a robust relationship between the monetary aggregates and the economic activity variables. This development has tended to undermine the attractiveness of

monetary targeting as a framework for monetary policy implementation among central banks. Indeed, Friedman (1996) wrote:

...whether the central bank makes money growth a target or uses it as an information variable, however, the whole concept is senseless unless observed fluctuations in money do anticipate movements of prices, or output, or whatever constitutes the ultimate objective of monetary policy...

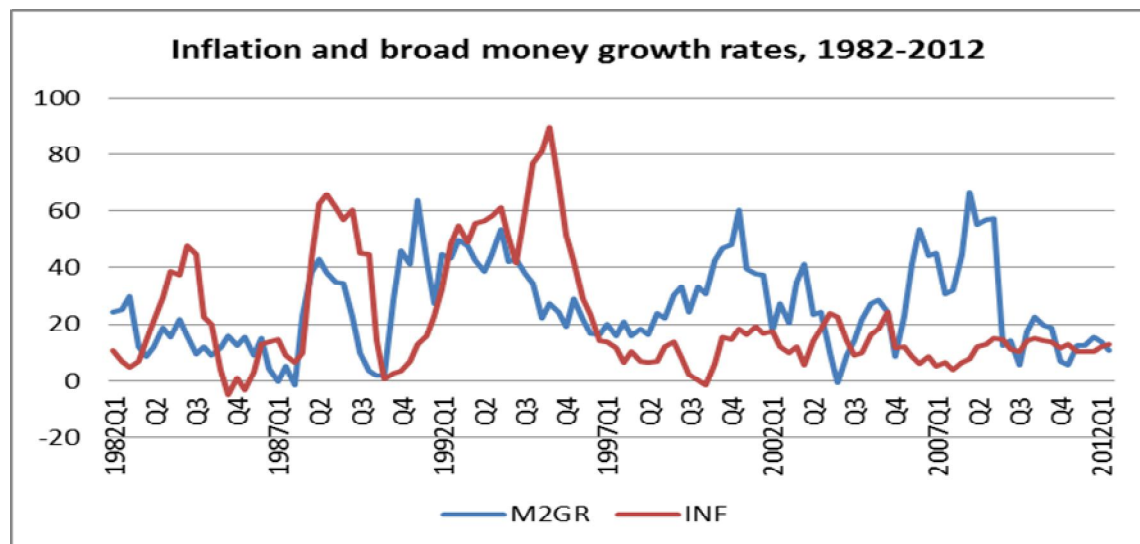
Thus far, in the literature, we can infer that the key sources of disconnect between money supply and inflation include institutional changes, financial innovations and market based policies. These developments have tended generally to affect the form in which economic agents hold money balances.

### 3.0 Trend in the Monetary Aggregates and Inflation in Nigeria

A cursory examination of Figures 1 to 3 offers some preliminary insights about the relationship between inflation and the monetary aggregates in Nigeria. The figures show quarterly percentage changes in the monetary aggregates (broad money, narrow money and base money) and inflation. We note that the variables appear to fairly track each other, which suggests some relationship between them.

Figure 1 shows inflation and growth in broad money (M2GR) generally moving in the same direction during most of the period up to the late 1990s.

**Figure 1: Inflation and Broad Money, 1982-2012**



Similarly, Figure 2 indicates a stronger symmetry of movements in inflation and growth in narrow money (M1GR) in the 1980s and 1990s. In the 2000s, the relationship changed,

accompanied by an apparent weakening of the symmetric movement observed in the 1980s and 1990s. This may be interpreted as suggesting that the relationship between the two variables weakened during this latter period. In effect, a cursory look at figures 1 and 2 indicates that any examination that is exclusively focused on these latter years is likely to show a relatively weaker relationship between inflation and the monetary aggregates.

**Figure 2: Inflation and Narrow Money, 1982-2012**

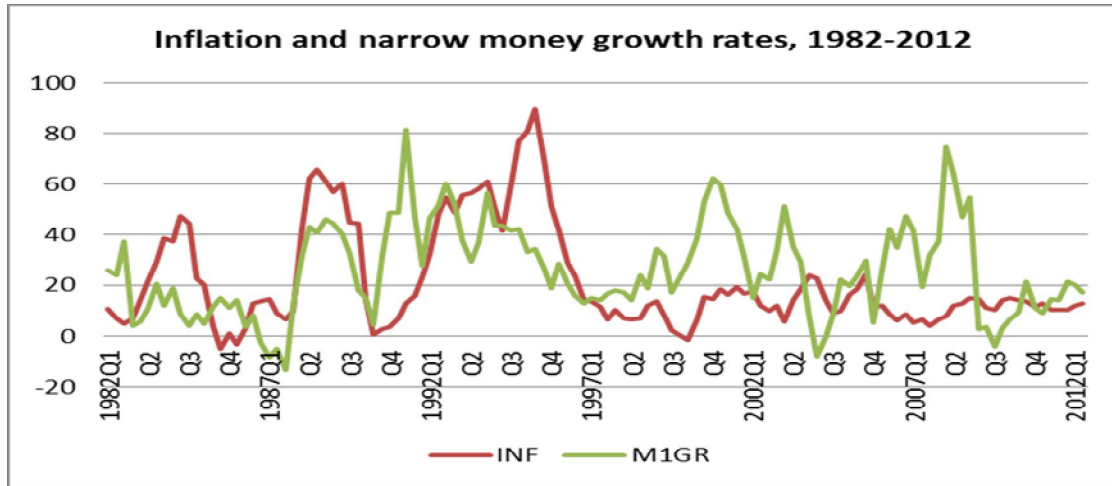
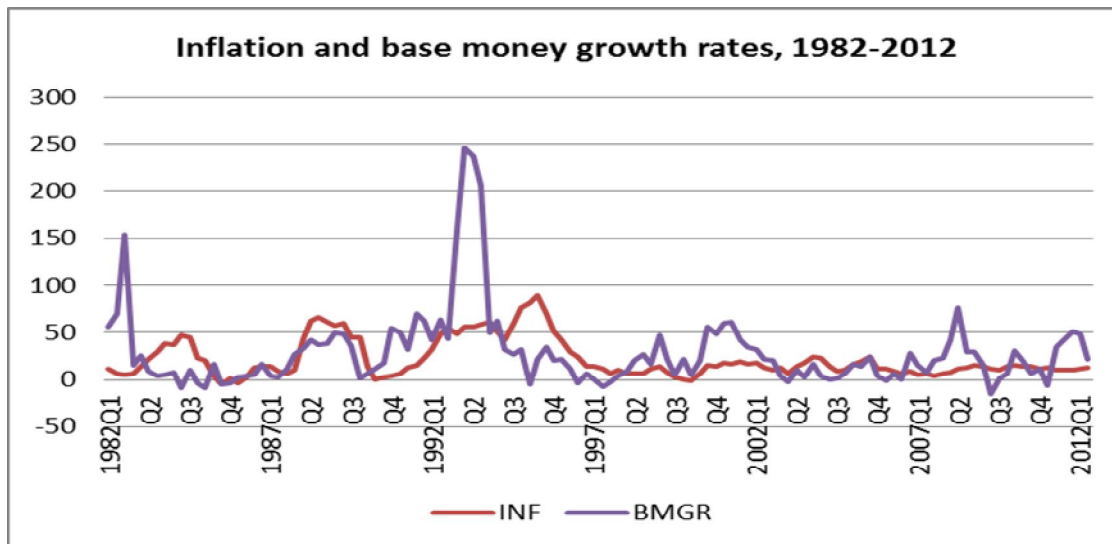


Figure 3, which shows the trend in inflation and base money, indicates that both variables generally trended together up to the early 2000s.

**Figure 3: Inflation and Base Money, 1982-2012**



In summary, the trend analysis suggests some relationship between inflation and the monetary aggregates. An empirical analysis is carried out in the following section to confirm and find out the exact nature of this relationship.



## 4.0 Empirical Analysis

### 4.1 Methodology

The empirical investigation of the nexus between inflation and the monetary aggregates is based on two important assumptions of the Quantity Theory of Money (QTM), namely the proportionality and the orthogonality assumptions. The proportionality assumption posits that a permanent growth in money supply would translate to an equal increase in the level of inflation in the long run. From estimation perspective, it implies that when inflation is regressed on the growth rate of money supply, the estimated coefficient of money should be one (1). The orthogonality assumption, on the other hand, suggests that output and changes in velocity are orthogonal to the growth rate of money supply over a long period of time. The import of this assumption is that a permanent increase in money supply would have no impact on output in the long run.

The analysis is complemented by an examination of impulse responses and variance decomposition from a VAR model. As stated by De and Neogi (2011), VAR is commonly used for forecasting systems of interrelated time series and for analysing the dynamic impact of random disturbances on the system of variables. The VAR approach treats every endogenous variable in the system as a function of the lagged values of all the endogenous variables in the system, thereby bypassing the need for structural modelling. The approach is, therefore used to identify leading or lagging relationships among the data.

### 4.2 Data Examination

#### 4.2.1 Unit Root Test

Quarterly data covering the period, 1982 – 2012, on inflation (inf.), growths in broad money supply (M2GR) and output (Y) were used in the analysis. The order of integration of the variables employed in the model was investigated with the aid of Augmented Dickey Fuller (ADF) and Phillips-Peron (PP) test statistics. The results are presented in Table 1 below.

**Table 1: Unit Root Test**

Variables	ADF				PP			
	Level without Intercept and Trend	Level with Intercept and Trend	1 <sup>st</sup> Difference without Intercept and Trend	1 <sup>st</sup> Difference with Intercept and Trend	Level without Intercept and Trend	Level with Intercept and Trend	1 <sup>st</sup> Difference without Intercept and Trend	1 <sup>st</sup> Difference with Intercept and Trend
M2GR	0.2394	0.0220	0.0000	0.0000	0.0753	0.0257	0.0000	0.0000
Inf	0.0266	0.0250	0.0000	0.0000	0.0747	0.1970	0.0000	0.0000
lnY	0.0337	0.0242	0.0000	0.0000	0.0036	0.0021	0.0000	0.0000

We may infer from these results that both inflation (inf) and growth in broad money supply (M2GR) are trend stationary. This is conventionally addressed by the introduction of trend in the regression equation which effectively removes the stochastic trend, making the parameter estimates realistic.

### 4.3 Analysis of Results based on the QTM

#### 4.3.1 Test of Proportionality Assumption

In testing for the proportionality assumption, we estimated a univariate regression equation relating the inflation rate to money supply over a long-term period of 31 years (1982-2012). The result of the proportionality regression estimate for the full sample (1982q1-2012q4) is presented in Table 2 below.

Table 2: OLS Static Estimates of Money Supply and Inflation

Dependent Variable: INF  
 Method: Least Squares  
 Sample: 1982Q1 2012Q4  
 Included observations: 124

Variable	Coefficient	Std. Error	t-Statistic	Prob.
M2GR	0.307024	0.111094	2.763650	0.0066
C	24.64352	4.238842	5.813739	0.0000
@TREND	-0.178636	0.047837	-3.734266	0.0003
R-squared	0.138957	Mean dependent var	21.62134	
Adjusted R-squared	0.124725	S.D. dependent var	20.25404	
S.E. of regression	18.94890	Akaike info criterion	8.745265	
Sum squared resid	43446.36	Schwarz criterion	8.813498	
Log likelihood	-539.2064	Hannan-Quinn criter.	8.772983	
F-statistic	9.763627	Durbin-Watson stat	0.196075	
Prob(F-statistic)	0.000117			

We observe from the result that the sign of the coefficient of money supply is consistent with a priori expectations of the QTM and is equally significant. The coefficient is, however, less than one (1). But to be sure we have avoided a spurious regression by the inclusion of trend, we test the residuals from this model for unit root. According to Engle and Granger (1987), the regression above is reliable if this residual series is  $I(0)$ . This implies that inflation and money supply have a long-run relationship though there may be disequilibrium in the short-run. The result of unit root test performed on the residuals of the above equation is presented in Table 3.

Table 3: Result of Unit Root Test of the Residual Series

Null Hypothesis: RESID10 has a unit root  
 Exogenous: None  
 Lag Length: 2 (Automatic - based on SIC, maxlag=12)

	t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic	-4.374527	0.0000
Test critical values:		
1% level	-2.584214	
5% level	-1.943494	
10% level	-1.614970	

\*MacKinnon (1996) one-sided p-values.

The test showed that the residual series is stationary, implying that the results above are valid. An alternative way of dealing with non-stationary time series is to examine them explicitly for co-integration which, if established, would enable estimation of a co-integrating regression. The premise is that where two individually non-stationary variables are co-integrated, a linear combination of both could be stationary (Engle and Granger (1987), Gujarati (2003)). The presence of long-run equilibrium relationship, which co-integration entails, implies that neither of the variables will drift away permanently. Table 4 below presents the results of co-integration test performed on inflation and growth in broad money supply.

Table 4: Results of Co-integration Test

Date: 07/04/13 Time: 18:31  
 Sample (adjusted): 1982Q4 2012Q4  
 Included observations: 121 after adjustments  
 Trend assumption: Linear deterministic trend (restricted)  
 Series: INF M2GR  
 Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.151348	31.43456	25.87211	0.0091
At most 1	0.091249	11.57773	12.51798	0.0714

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.151348	19.85683	19.38704	0.0427
At most 1	0.091249	11.57773	12.51798	0.0714

Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level

\* denotes rejection of the hypothesis at the 0.05 level

\*\*MacKinnon-Haug-Michelis (1999) p-values

Unrestricted Cointegrating Coefficients (normalized by b\*S11\*b=I):

INF	M2GR	@TREND(82Q2)

-0.048505	0.063096	-0.014126
-0.033254	-0.050352	-0.005218

---

Unrestricted Adjustment Coefficients (alpha):

D(INF)	2.472851	1.152328
D(M2GR)	-1.454574	2.762034

---

1 Cointegrating Equation(s):    Log likelihood    -851.5732

Normalized cointegrating coefficients (standard error in parentheses)

INF	M2GR	@TREND(82Q2)
1.000000	-1.300817	0.291226
	(0.35200)	(0.13271)

Adjustment coefficients (standard error in parentheses)

D(INF)	-0.119945
	(0.03161)
D(M2GR)	0.070554
	(0.04419)

---

The Trace statistics from the co-integration results above suggest that we cannot accept the absence of co-integration between money supply and inflation at one (1) per cent level of significance, while the maximum Engel Value Statistics confirmed the same result though at 5 per cent level of significance. It could therefore be inferred that there is a long-run relationship between money supply and inflation.

As part of the confirmatory tests to establish whether there is a relationship between money supply and inflation, we perform Engle Granger (1987) granger causality test on the two variables.

Table 5: Pairwise Granger Causality Tests between Money supply and Inflation

Null Hypothesis:	Obs	F-Statistic	Prob.
INF does not Granger Cause M2GR	123	1.64968	0.2015
M2GR does not Granger Cause INF		9.65316	0.0024

The result of the granger causality test in Table 5 above suggests that we cannot accept the null hypothesis that broad money supply does not granger cause inflation at one per cent level of significance. With respect to inflation, however, the result does not support the reverse causality hypothesis that inflation granger causes money supply. Based on this result, we tend to infer that there is a long-run relationship between money supply and inflation.

Table 6: Chow Breakpoint Test: 1996Q1  
 Null Hypothesis: No breaks at specified breakpoints  
 Varying regressors: All equation variables  
 Equation Sample: 1982Q1 2012Q4

F-statistic	29.01222	Prob. F(3,118)	0.0000
Log likelihood ratio	68.51052	Prob. Chi-Square(3)	0.0000
Wald Statistic	87.03667	Prob. Chi-Square(3)	0.0000

The investigation was extended further by testing for structural breaks in the period of the sample. The result of F-statistic, Log likelihood ratio and Wald Statistic tests in table 6 above suggest that we cannot accept the null hypothesis of absence of breakpoints in 1996. The result tends to confirm the finding under the trend analysis that the nature of the relationship between the variables changed from the late 1990s.

With co-integration established between inflation and monetary supply, a co-integrating regression equation is estimated using Ordinary Least Square (OLS), Fully Modified OLS (FMOLS) and Dynamic OLS (DOLS) techniques. Table 7 below summarizes the results of the regressions of Inflation on Money Supply using the three separate estimation techniques.

Table 7: Summary of Results of the OLS, FMOLS and DOLS

PARAMETERS	OLS	FMOLS	DOLS	
Constant	24.64 (0.00)	23.05 (0.00)	22.64 (0.01)	FULL-SAMPLE ( 1982Q1 – 2012Q4)
Money Supply	0.31 (0.00)	0.42 (0.04)	0.48 (0.06)	
Trend	-0.18 (0.00)	-0.20 (0.03)	-0.22 (0.02)	
R Square	14	13	25	
WITH AR PROCESS				
Constant	0.02 (0.99)			
Money Supply	0.17 (0.00)			
Trend	-0.03 (0.09)			
Lagged Inflation	0.89 (0.00)			
R Square	86			
Constant	6.23 (0.29)	-1.15 (0.73)	-	SUB-SAMPLE (1982Q1- 1996Q4)
Money Supply	0.38 (0.06)	0.31 (0.01)	-	
Inf(-1)	0.56 (0.00)	0.80 (0.80)	-	
Constant	0.23 (0.94)	3.28 (0.02)	-	SUB-SAMPLE (1996Q1 – 2012Q4)
Money Supply	0.04 (0.25)	0.02 (0.63)	-	
Inf (-1)	0.71 (0.00)	0.67 (0.00)	-	

The Table presents the results in three panels: the topmost panel features results based on the entire sample period (1982 – 2012) estimated by Ordinary Least Square (OLS), the Fully-modified OLS (FMOLS) and the Dynamic OLS (DOLS). The FMOLS and DOLS are special variants of OLS suited for the estimation of co-integrating (non-stationary) regression equations. Both estimation techniques have the advantage of optimizing the parameters of the class of regressions. The results reported in the panel indicate unambiguously that money supply bears positive long-run relationship with inflation. Note

that the coefficients reported are static (equilibrium) values. Using all the three methods of estimation, we found that the parameters were statistically significant. The lower segment of the panel presents OLS estimates with AR process, which conforms with the earlier results but with, expectedly, higher co-efficient of determination.

Panel 2 presents results for sub-sample 1 (1982Q1 – 1996Q4). The delineation of the sub-samples was based on the result of the Chow Test reported earlier which indicated a breakpoint in the data in 1996. Two estimation techniques (OLS and FMOLS) were used, both of which returned statistically significant positive relationship between inflation and money supply. The third panel presents results using the same techniques for the second sub-sample (1996Q1 – 2012Q4). The reported coefficients of money supply were both statistically insignificant, buttressing the point made in the trend analysis that the relationship between the variables might have weakened in recent years.

#### **4.3.2 Test of the Orthogonality Assumption**

As noted earlier, the orthogonality assumption states that growth in money supply would have no effect on real output growth in the long run. The procedure for testing this assumption involves examination of the coefficient of money supply growth rate in a static regression. Indirectly, this may be checked through a formal test of co-integration. The absence of co-integration offers some indication about the validity of the assumption.

We employed the Johansen Procedure in examining the co-integration between growth in money supply and real GDP growth. The estimation result in Table 4 shows that there is no co-integration between the two variables, suggesting that there is no long run or equilibrium relationship between them. In addition, the conventional test of orthogonality was conducted, the result of which is presented in Table 8. The estimation result shows that the coefficient of growth in money supply was insignificant even at the 10 per cent level, indicating also that growth in money supply does not have effect on real output growth in the long run. This is in consonance with the Orthogonality assumption.

**Table 8: Result of Orthogonality Test**

Dependent Variable: RGDP  
 Method: Least Squares  
 Date: 07/11/13 Time: 11:41  
 Sample (adjusted): 1982Q2 2012Q4  
 Included observations: 123 after adjustments  
 HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 5.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.706950	0.873113	0.809690	0.4197
M2GR	-0.013043	0.018920	-0.689394	0.4919
RGDP(-1)	0.717762	0.104487	6.869379	0.0000
@TREND	0.017984	0.010152	1.771545	0.0790
R-squared	0.610369	Mean dependent var		5.028823
Adjusted R-squared	0.600546	S.D. dependent var		5.659175
S.E. of regression	3.576732	Akaike info criterion		5.418756
Sum squared resid	1522.368	Schwarz criterion		5.510209
Log likelihood	-329.2535	Hannan-Quinn criter.		5.455904
F-statistic	62.13900	Durbin-Watson stat		1.737764
Prob(F-statistic)	0.000000			

This result does not however rule out the possibility that, in the short run, monetary expansion or contraction could have effect on real economic activity, which is the premise for employing expansionary monetary policy to boost economic activity as part of the usual trade-off between output and inflation objectives.

In summary, we found that, in the long run, money growth has a significant effect on inflation but not on real output growth. A key implication of these findings is that inflation remains a major risk with any policy orientation that involves rapid monetary expansion.

#### 4.4 Results of VAR Analysis

VAR analysis is employed to reinforce the findings in the previous section. The result of block exogeneity test presented in Table 9 shows that whereas money supply does affect inflation, real GDP growth does not. Jointly, the two variables exert weak influence on inflation. With respect to real output growth, the result show that both money supply and inflation do not significantly influence real GDP.

**Table 9**

Dependent variable: INF

Excluded	Chi-sq	Df	Prob.
M2GR	5.684645	2	0.0583
RGDP	3.330820	2	0.1891
All	8.311137	4	0.0808

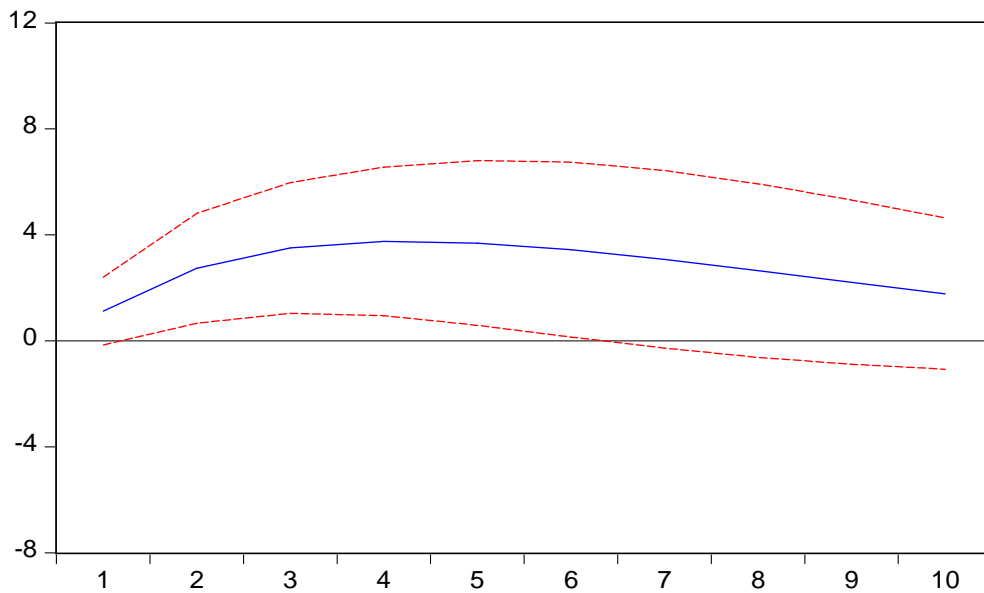
Dependent variable: RGDP

Excluded	Chi-sq	Df	Prob.
M2GR	0.050111	2	0.9753
INF	3.738906	2	0.1542
All	4.378220	4	0.3572

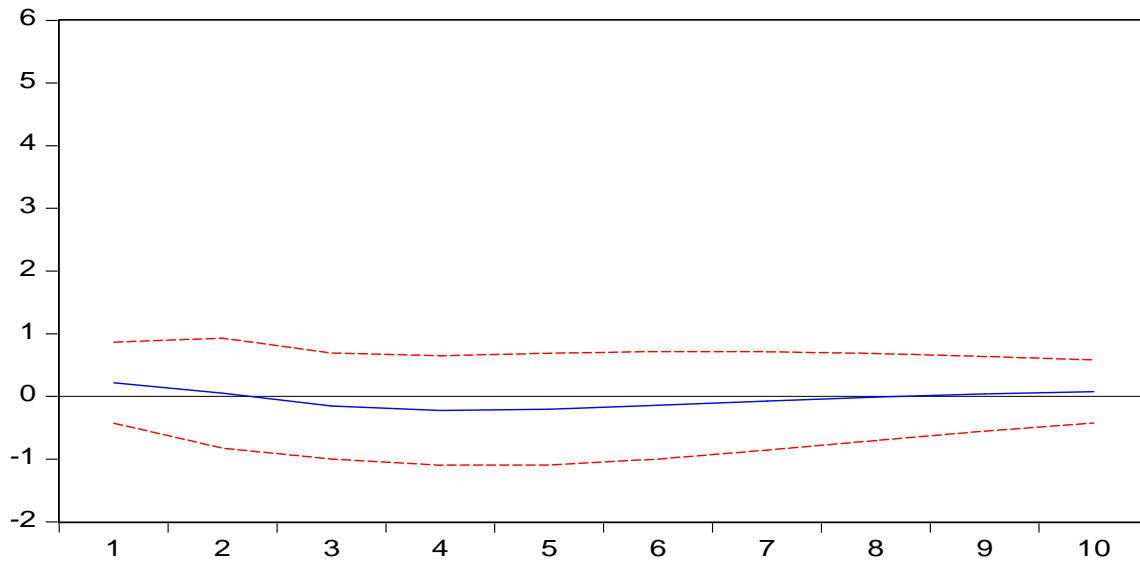
The impulse response analysis shows that inflation responds to money supply shocks (Figure 4) while real GDP does not (Figure 5). These results agree broadly with our earlier analysis of the proportionality and orthogonality propositions. In other words, monetary expansion could complicate the inflation environment without necessarily aiding output expansion on a sustained basis.

**Figure 4**

Response of INF to M2GR





**Figure 5****Response of RGDP to M2GR**

The analysis of variance decomposition also lends credence to the finding that inflation responds to money supply. Using a 10-period lag scheme, we found money supply exerting influence on inflation right from the first period. The effect, measured in terms percentage variation, continues to rise through to the tenth period, and cumulating to approximately 20 per cent (See Table 10).

**Table 10**

Variance Decomposition of INF:				
Period	S.E.	M2GR	INF	RGDP
1	7.140515	2.477801	97.52220	0.000000
2	11.52130	6.587770	93.27151	0.140718
3	14.60387	9.869127	89.22880	0.902070
4	16.76957	12.49004	85.36469	2.145268
5	18.27513	14.59317	81.90504	3.501782
6	19.29375	16.27084	79.01427	4.714895
7	19.95623	17.58248	76.74316	5.674366
8	20.36696	18.57371	75.06143	6.364860
9	20.60823	19.28879	73.89154	6.819673
10	20.74192	19.77532	73.13301	7.091667

With respect to output, the 10-period variance decomposition on Table 11 shows very insignificant contribution of inflation and money supply to growth in real GDP. At the end of the tenth period, the cumulative contributions of inflation and money supply to variations in real GDP amounted to 0.61 and 4.72 per cent, respectively.

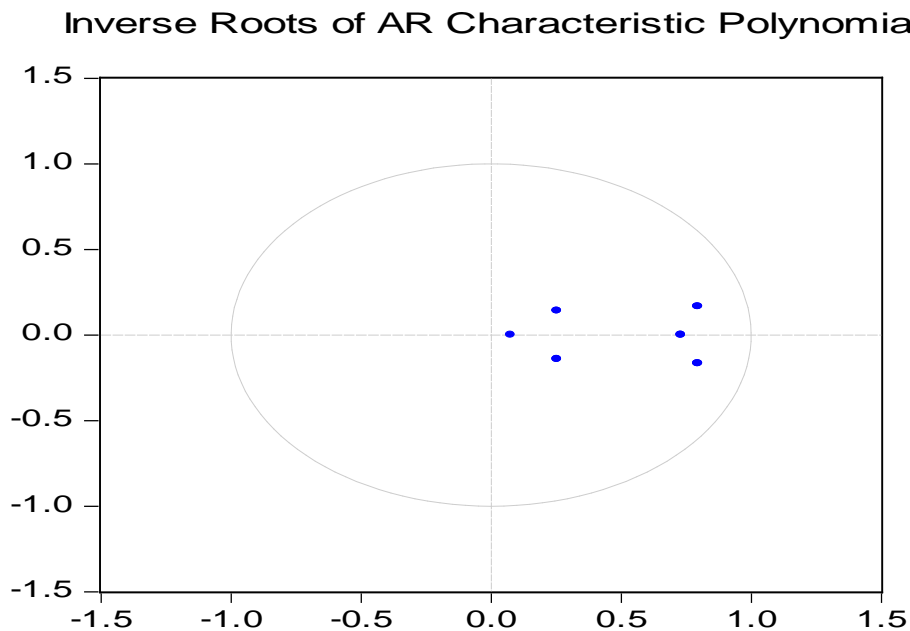
**Table 11**

Variance Decomposition of RGDP

Period	S.E.	M2GR	INF	RGDP
1	3.576167	0.375617	0.251746	99.37264
2	4.774561	0.221885	2.397060	97.38105
3	5.294409	0.264696	3.685689	96.04962
4	5.522923	0.408090	4.008297	95.58361
5	5.622647	0.524023	3.947161	95.52882
6	5.666050	0.579402	3.895874	95.52472
7	5.686313	0.592129	3.982814	95.42506
8	5.698172	0.590038	4.190403	95.21956
9	5.707453	0.592969	4.454361	94.95267
10	5.715871	0.609172	4.715299	94.67553

Cholesky Ordering: M2GR INF RGDP

The VAR, which results were described above, was evaluated and found to be stable (See Figure 6).

**Figure 6**

## 5.0 Conclusion and Policy Recommendations

The trend analysis shows that money supply and inflation exhibited fairly strong co-movement particularly in the 80s through mid-1990s. The late 1990s and 2000s witnessed gradual divergence in the movement of money growth and inflation. A formal test of structural break confirmed 1996 as the actual break point in the data.

The empirical analysis in this study relied mainly on the examination of the two cardinal assumptions of the quantity theory of money – Proportionality and Orthogonality Assumptions. The results of the proportionality test did not exactly establish the 1 to 1 relationship between money and prices predicted by the QTM. It nonetheless confirmed the existence of positive relationship between the two. Growth in money was found to be a statistically significant predictor of inflation. The estimated co-efficient of 0.31 for entire sample (1982 – 2012) was however lower than the sub-sample coefficient of 0.38 for 1982 to 1996 sub sample. In both periods, growth in money supply was found to have exerted significant influence on inflation. Estimates using both OLS and FMOLS from the second sub-sample period (1996 – 2012) both returned statistically insignificant coefficients for M2 growth rate indicating that the predictive power of money on inflation had substantially waned. The supplementary analysis done using VAR impulse response and variance decomposition yielded results that broadly conformed with those from the examination of proportionality and orthogonality assumptions.

Overall, these results imply the existence of some relationship between the monetary aggregates and inflation, but this relationship has weakened in recent years. The diminishing strength of the relationship between money and prices may be explained in part by recent developments in the Nigerian financial system. New products and asset classes are seemingly starting to affect the demand for both money and traditional asset classes. This is not unexpected judging by the experiences of other countries like Australia and USA as noted in the review of literature.

It needs to be stressed, however, that the absence of a statistically significant relationship in the second sub-sample (1996-2012) does not imply a disconnect between money and prices, giving the long-run equilibrium relationship between them. Rather, it points to some underlying dynamics and complexities arising from recent developments in the economy such as the expansion of e-money and financial products and assets. In which case, the developments have to be seen as transitory or temporary. The key policy implication of the findings is that the CBN should continue to factor growth in monetary aggregates in its monetary policy considerations aimed at achieving price stability while keeping a keen eye on financial innovations and their impact on money supply.

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