IS INFLATION ALWAYS AND EVERYWHERE A MONETARY PHENOMENON? THE CASE OF NIGERIA

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ABSTRACT

In response to shocks, emanating from the global financial crisis of 2007-2008 the Central Bank of Nigeria has continuously used tight monetary policy instrument to check volatility in the general price level. The success of using monetary policy tool to influence the movement of key macroeconomic aggregates in Nigeria rests solely on the question of whether inflation is driven purely by changes in monetary aggregates. Using quarterly time series data for Nigeria over the period 1970 to 2011, we test the quantity theory relationship between money and price movement to establish if inflation is always and everywhere a monetary phenomenon. Using the autoregressive distributed lag (ARDL) modeling approach we obtained a robust estimate for Nigeria. The result of the study shows that inflation is not always and everywhere a monetary phenomenon in the case of Nigeria raising serious doubt on the continuous use of monetary policy tool to achieve price stability in Nigeria.

JEL: C22, E52, E63, G28

KEY WORDS: Money Supply, Monetary Policy, Policy Regulation, Time series Model

INTRODUCTION

The Nobel Prize winning economist Milton Friedman once postulated, "Inflation is always and everywhere a monetary phenomenon" (Friedman, 1956). His argument was anchored on the classical quantity theory of money which establishes the existence of a direct functional relationship between money supply and the general price level with aggregate income and the velocity of transaction remaining constant (Lothian, 2009; Selgin, 2008). Given these perceived relationship, the Central Bank uses monetary policy instrument to influence the availability and cost of credit with the ultimate objectives of achieving price stability, sustainable economic growth, balance of payment equilibrium and full employment level (Mishkin, 2000). In recent years, a growing consensus has emerged for price stability to be the overriding long-run goal of monetary policy (Mishkin, 1998).

However, the effective prediction of the relationships between inflation and money supply depends largely on the existence of a stable and predictable relationship between monetary aggregates, inflation and the output in the economy. If the money market is largely underdeveloped and the relationship between the chosen monetary aggregates and the ultimate policy objective are weak, monetary targeting becomes a very weak instrument (Panzera, 2011; Nachega, 2001). In Nigeria, the focus for monetary policy since the inception of the Central Bank of Nigeria (CBN) in 1959 has been to stamp out incipient inflationary risk and maintain a sustainable growth in output level. To achieve these intermediate and broad policy frameworks, the country has experimented two different regimes of monetary policy-the exchange rate targeting regime (1959-1973) and the monetary targeting regime (1974-to date) (CBN, 2008). The shift from exchange rate targeting to monetary targeting regime in 1974 was done with the aim of mitigating inflationary pressures arising from increased public expenditures. This was anchored on the premise that inflation is a monetary phenomenon. Evidences from monetary targeting in Nigeria has however shown that monetary policy had always encountered problems and the ultimate target of low and stable price levels enacted by successive administrations may be driven by some forms of structural rigidities inherent in the Nigerian economy (CBN 2008). Consequently, this brings to focus the issue of

whether inflation is always and everywhere a monetary phenomenon in Nigeria and the rational of pursuing stability in the general price level with the use of purely monetary aggregates.

The aim of this study is to test the quantity theory relationship between money and prices in Nigeria with a view of establishing whether the notion that inflation is always and everywhere a monetary phenomenon holds true for Nigeria. Following the introductory section, the other parts of the paper is structured into four sections; section two is the literature review while section three is expressed views on the data set and methodology of the study. In section four, we present the empirical analysis while section five is the conclusion and policy implications of the study.

LITERATURE REVIEW

The quantity theory of money holds that an expansion of the money stock does not increase output in the long run with a focus on average inflation and money growth over successive time intervals (Friedman, 1984). Consequently, it has been confirmed that price increase in the short run due to scarcity in the supply of some essential products may not have an influence on the rates of inflation in the long run. This is because such rates of inflation is controlled by contractionary monetary policies (Barro and Sala-i-Martin, 1995; Rolnick and Weber, 1998; Kermal, 2006). Some scholars are of the opinion that inflation is a monetary phenomenon, taking into consideration longer run studies and that it is greatly encouraged by structural policy issues (Khan, 1980; Grauwe and Polan, 2005; Khan and Schimmelpfennig, 2006).

Kermal (2006) stated that long run money supply impact the inflation rates and that the quantity theory of money holds in the long run, emphasizing that inflation is a monetary phenomenon. In the short run, he noticed that the tendencies for money to influence inflation is not quick, he disclosed that it takes approximately three quarters. He noticed that it occurs with persistent rates of inflation and consistent shocks emanating from gross domestic product, money supply and price in the economy. Cecchetti (2000) revealed that high and persistent inflation in most economies, act as a repressive tax, with impending consequences for those who are asset-poor and hold their entire savings only in cash. In addition, inflation was to be harmful to economic and financial sector growth, impede resource allocation and societal welfare (Whitehead, 1976). While Aisen and Jose'Veiga (2006) evidences showed the effect of inflation on the economy may be politically costly for the government due to its socio-economic impact in the country. To effectively evaluate the impact of inflation and put in place policies to guide its effect on the economy, it is necessary to disclose, if inflation everywhere is a monetary phenomenon (Friedman, 1956). To justify this fact, it is essential to first analyze if constraints in supply side factors cause inflation to increase and persist without any form of monetary accumulation (Bernanke, 2005).

To analyze the link between inflation, the growth rate of money and the inflationary experiences of a stated set of economies, they used the panel-data technique to test for the quantity theory relationship between money and inflation in accordance to the Friedman's principle (Friedman, 1956). This principle stated changes in money supply growth lead to equal proportional changes in the inflation rate, through the forces of the Fisher effect, in the nominal interest rate (Grauwe and Polan, 2005). Subsequently, long run money affected the price level and not the level of output. Thus, inflation in these economies was a monetary phenomenon. The most appropriate solution to redeem this situation will be controlling the supply of money in circulation (King, 2001). Subsequently, they resolved that there is a strong positive relationship between long run inflation and the growth rate of money, such that when money growth increases by distinct percentage, the rates of inflation also raise by the same proportion. Hence, in the long run, there is neutrality between money growth and output growth from one perspective and the velocity of changes from another perspective (Grauwe and Polan, 2005). This strong link was due to the levels of hyperinflation in the data set of countries used in the model. In addition, they disclosed that inflation and money growth for low-inflation countries is weak.

Examining core inflation as the component of measured inflation that has no medium and long run impact on real output, in accordance with the Phillips curve analysis of co-movement in inflation and output. Quah and Vahey (1995) introduced the vector auto-regression model with restriction on the dynamic process. Goodfriend (2000), King (1999), Blejer and Leon (2000), and Blejer, Ize, Leone and Werlang (2000) supported the view that this study method is important because it will analyze the efficiency of monetary policies to stabilize prices.

They disclosed that monetary factors are the main determinants of recent surge in inflation. In addition, the economic growth variable (GDP growth) and the prices of major consumables matters while exchange rate appreciation play very little roles. In the long run, movement in the rates of inflation and the growth in money supply, follow a one to one relationship, relative to real income. This relationship was also same for growth in real income and the velocity of money. From their analysis, it stands sure, that increases in money supply are the main cause of inflation. Since the proportional relationship between the excess money supply is over that of the output growth and the velocity growth. Therefore, these studies proposed that for policy makers to control for this situation, they should put in place tight monetary policy measures. Consequently, such monetary policy formulation must strictly take into consideration activities in the real and financial sectors and treat them as constraints on policy.

METHODOLOGY

Data Source

The data used for this study cover 42 years period (166) quarterly observations. It begins in the first quarter of 1970 and ends in the second quarter of 2011. The source of the data is from the Central Bank of Nigeria Statistical Bulletin and the Published bulletin of the National Bureau of Statistics Nigeria. The two major variables used in the study are the money supply variable (Broad Money M2) and the Price variable represented by CPI (consumer price index).

Model Specification

We link the theoretical base of the views that inflation is always and everywhere a monetary phenomenon to one of the oldest theories in economics-the classical quantity theory of money and the work of Friedman (1963). In its simplest form, the quantity theory of money states that there is a direct proportional relationship between changes in money supply growth and inflation. This presupposes that growth in money supply follows an equal change in inflation and the force of the Fisher effect, in the nominal interest rate. Using the quantity theory of money, we will attempt to explain the extent to which monetary forces trigger changes in price movement in the economy.
Equation 3.1 below expresses the famous equation of exchange

$$MV=PY \qquad (3.1)$$

Where M is a suitable measure of money supply (in the case of Nigeria, we use M2-broad money supply which is a better measure of the stock of money supply.)

V is the income velocity of money obtained by Y*P/M (See Muskin, 2008; P. 19)

P is the aggregate price level represented by the CPI, which is a measure of the general price level

Y is the real gross domestic product GDP.

Expressing equation 3.1 in growth form, we denote its logarithm for, in lower case as:

$$m + v = p + y \tag{3.2}$$

From equation 3.2, we derive the inflation equation as:

$$p = m - y + v \tag{3.3}$$

From equation 3.3, we can obtain three basic elements of the quantity theory of money. That;

(i) There exist a long run proportional relationship between growth in money supply and growth in the general price level.
(ii) A permanent increase in the growth rate of money supply leaves output and velocity unaffected in the long run.
(iii) From the quantity theory of money, we can ascertain the time it takes growth in the general price level to respond to changes in the growth in money supply and output.

To obtain a reliable estimate of the short run and long run relationship between growths in general price level and growth in money supply, we will make use of the autoregressive distributed lag (ARDL) modeling technique. The ARDL statistic approach is much more flexible than the other methods available for conducting co-integration test such as the residual based Engle-Granger (1987) test, the maximum likelihood based Johansen (1991; 1995) test and the Johansen-Juselius (1990) test. This is because it can be applied to variables with different order of integration (Pesaran and Pesaran 1997) and it takes sufficient number of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson and Chai 2003). Therefore, to test the proposed of the inflation-money supply relationship drawn from equation 3.1, under the assumption that velocity of money (V) and income (Y) is constant. We express the linear form of the model as:

$$gP_t = \alpha_0 + \alpha_1 gM2_t + \alpha_2 gY_t + \alpha_3 gV_t + U_t \tag{3.4}$$

Where;

gP_t = Rate of change in the level of consumers price index CPI

$gM2_t$ = Rate of change in broad money supply

gY_t = Rate of change in real GDP

gV_t =Rate of change in velocity of money

U= Stochastic disturbance factor.

On apriori, in the long run $\alpha_1 = 1$, $\alpha_2 < 0$, $\alpha_3 > 0$, while gM2 and gY are uncorrelated.

Theoretically, there is a direct functional relationship between money supply and the general price level. However, the money supply variable may influence the general price level with a time lag. This allows us to incorporate lags of money supply in the regression. Furthermore, the price variable may correlate with its lag, suggesting that the lags of the price variables should be included in the regression model. The inclusion of lags of the dependent variable and lags of the explanatory variables into the regression motivates the commonly used ARDL (p,q) model or the unrestricted ECM model defined as follows:

$$\Delta gP_t = \alpha_1 gP_{t-1} + \alpha_2 gM2_{t-1} + \alpha_3 gY_{t-1} + \alpha_4 gV_{t-1} + \sum_{j=1}^{p-1} \gamma_j \Delta gP_{t-j} + \sum_{j=1}^{q-1} \lambda_j \Delta gM2_{t-j} + \sum_{j=1}^{q-1} \psi_j \Delta gY_{t-j} + \sum_{j=1}^{q-1} \delta_j \Delta gV_{t-j} + u_t \quad (3.5)$$

In equation 3.5, the term in summation signs represents the error correction dynamics while the term with the coefficient α corresponds to the long run relationship. The ARDL method estimates $(P+1)^k$ number of regressions in order to obtain the optimal lag for each variable where p is the maximum number of lags to be used and k is the number of variables in the equation. Given that we are using quarterly data, we select the fourth lag as our maximum lag (P) following Pesaran and Pesaran (1997) to test the robustness and reliability of the regression estimate.

Empirical Analysis

Before estimating the ARDL model, we tested for the presence of unit roots among the variables with the aid of the Augmented Dickey-Fuller test of unit roots. Table 1 reports the results of the unit root test. The result shows the growth in price level, growth in money supply; output growth and growth in velocity of transaction were all stationary at levels. Therefore, there is no need to difference the variables in the model. Although, cointegration test methods based on Johansen (1991; 1995) and Johansen and Juselius (1990), requires that all the variables be of equal degree of integration, this is however not a requirement for the ARDL approach which combines variables irrespective of their order of integration (Pesaran and Pesaran 1997).

Table 1: Unit Root Test on Variables with Intercept and a Linear Trend

Augmented Dickey-Fuller (ADF) Test		
Variables	Levels	Status
gP	-4.958*	I(1)
gY	-12.905*	I(1)
gM2	-14.262*	I(1)
gY	-14.288*	I(1)

Note This table shows the results of the Augmented Dickey-Fuller (ADF) Unit Root test, which indicate that the level of each variables are integrated or stationary at their individual levels. Given these results, each variable satisfies the requirement to be included in the long-run co integration model. * indicates the significance at 1 percent level.*

Table 2 display the short run dynamic model. The coefficient of money supply is not statistically significant at the second and third quarter lags but is significant at the first lag at the 10 percent levels. However, the variable has the wrong sign indicating that a change in money supply in the previous quarter has a statistically significant negative impact on change in the current price level. In the third lag, the growth in money supply exhibit a positive impact on changes in the current price level but it was not statistically significantly. Subsequently, changes in output growth had a negative and insignificant impact on current price level in the first, second and third lag respectively. The variable had the right sign. Recall that the quantity theory of money predicts that over a significantly long period, changes in the growth of money do not affect output growth. The velocity variable had the right sign in the second and third lag and passed the test of statistical significance at the 5 percent levels only in the second lag. The lag price variable is the most statistically significant variable in the model affecting current change in the price level. The variable had a negative but statistically significant impact on current changes in price level, passed the test of statistics significance at the 1 percent level in the first, second, and third lags respectively.

Table 2: Estimated Short Run Coefficients

Dependent Variables gP n=166 after Adjustment (1970Q2-2011Q3)				
Regressors	Coefficients	Standard Error	T-Statistic	Prob.
C	-0.0054	1.1119	-0.0048	0.9961
ΔgP(-1)	-0.5424	0.1172	-4.635***	0.0000
ΔgP(-2)	-0.6442	0.1217	-5.292***	0.0000
ΔgP(-3)	-0.5261	0.1136	-4.630***	0.0000
ΔgM2(-1)	-0.1598	0.0817	-1.956*	0.0524
ΔgM2(-2)	-0.1116	0.0833	-1.339	0.1826
ΔgM2(-3)	0.0163	0.0172	0.9485	0.3444
ΔgY(-1)	-0.0076	0.0262	-0.2930	0.7699
ΔgY(-2)	-0.0553	0.0351	-1.576	0.1172
ΔgY(-3)	-0.0437	0.0315	-1.387	0.1677
ΔgV(-1)	-0.0113	0.0169	-0.669	0.5044
ΔgV(-2)	0.1395	0.0681	2.047***	0.0425
ΔgV(-3)	0.1160	0.0744	1.560	0.1209
ΔgV(-3)	0.1160	0.0744	-3.689***	0.0003
Ecm(-1)	-0.5189	0.1406	-3.689***	0.0003
R-Squared 0.57		R-Bar-Squared 0.54		
F-Stat. 15.36***		DW-Statistic 1.97		

Note: $\Delta gP_t = \alpha_0 + \alpha_1 \Delta gP_{t-1} + \alpha_2 \Delta gP_{t-2} + \alpha_3 \Delta gP_{t-3} + \beta_1 \Delta gM2_{t-1} + \beta_2 \Delta gM2_{t-2} + \beta_3 \Delta gM2_{t-3} + \phi_1 \Delta gY_{t-1} + \phi_2 \Delta gY_{t-2} + \phi_3 \Delta gY_{t-3} + \gamma_1 \Delta gV_{t-1} + \gamma_2 \Delta gV_{t-2} + \gamma_3 \Delta V_{t-3} + \delta_1 ECM_{t-1}$ *This table shows the short-run ARDL (p, q) regression estimates of the model over the adjusted sample period of 1970:Q2-2011:Q3. The independent variables are lag growth in price level (gP), lag change in money supply (gM2), lag change in real GDP (gY) and lag change in velocity (gV). The table displays the outcome of the estimated Short-run coefficients of variable in the model expressed in section three. The figures in each cell in column four are the t-statistics, ***, and * indicate significance at 1 and 10 percent levels respectively.*

The coefficient of ECM_{t-1} is relatively large in magnitude and is statistically significant at the 1 percent level. It demonstrates the existence of long run relationship between the variables, with the coefficient term -0.5189, suggesting a fast adjustment process. Approximately 51 percent of disequilibrium of the previous quarter's shock adjusts back to equilibrium in the current quarter. Overall, the result shows that changes in lag past price levels and the velocity of transaction are the most significant variable influencing the current price movement in the short run negating the monetarist claim that inflation is always and everywhere a monetary phenomenon.The result of the long run relationship displayed in Table 3 shows that the growth in money supply had the wrong sign and is not statistically significant as shown by the probability value of 0.9013. The coefficient value of –0.0017 is close to 1 as indicated by the quantity theory of money specification but the negative sign is at variance with the long run proportionality relationship between growth in money supply and growth in price level.

Table 3: Estimated Long Run Coefficients

Dependent Variable gP n=166 after Adjustment (1970Q2-2011Q3)				
Regressors (1)	Coefficients (2)	Standard Error (3)	T-Statistic (4)	Prob. (5)
gM2	-0.0017	0.0138	-0.1242	0.9013
gY	-0.1858	0.0194	-9.580***	0.0000
gV	0.0141	0.0123	1.1469	0.2531
C	4.699	0.9053	5.191***	0.0000
R-Squared 0.36		R-Bar-Squared 0.35		
F-Stat. 30.70***		DW-Statistic 2.17		

Note: $gP_t = \alpha_0 + \alpha_1 gM2 + \alpha_2 gY + \alpha_3 gV + u$ *This table shows the Long-run regression estimates over the adjusted sample period of 1970:Q2-2011:Q3. The independent variables are change in money supply (gM2), change in real GDP (gY) and change in velocity (gV). The table displays the outcome of the estimated long-run coefficients of the equation expressed in section three. The figures in each cell in column 4 and column 5 are the t-statistics and their respective probabilities. *** indicate significance at 1 percent level.*

The coefficient of output growth had the expected sign; it is low in value and is statistically significant at the 1 percent level indicating that changes in output in the long run has a significant negative effect on growth in the general price level. The velocity variable had the right sign but failed the test of significance at the 1 percent and 5 percent levels of significance The R square value and the adjusted R square values of 0.36 and 0.35 show the model had a poor fit. This implies that over 65 percent systematic changes in price level unaccounted for by the model. The F-statistic value of 30.7 shows the overall model has a good fit and the Durbin-Watson value of 2.17 shows the likely absence of serial correlation in the model.

Recall that, the quantity theory predicts that over a sufficiently long period, changes in growth rate of money supply do not affect output growth. This is the neutrality position. To test this position, we estimated output growth as a linear function of growth rate of money supply. Table 4 is the OLS result of money supply output growth relationship.

Table 4: OLS estimation of Output Growth on Money Supply

Dependent Variable gP n=166 after Adjustment (1970Q2-2011Q3)				
Regressors	Coefficients	Standard Error	T-Statistic	Prob.
gM2	-0.0171	0.0545	-0.3135	0.754
C	6.590	3.595	1.833***	0.068
R-Squared 0.00059	R-Bar-Squared -0.0054			
F-Stat. 0.098	DW-Statistic 2.009			

*Note: $gP = \alpha_0 + \alpha_1 gM2 + u$ This table displays the OLS estimate of output growth and money supply in Nigeria over the adjusted sample period of 1970:Q2-2011:Q3. The figures in each cell in columns 4 and 5 are the t-statistics and their respective probabilities. *** indicate significance at 1 percent level.*

The result shows the effect of higher money growth on output growth is negative and not statistically significant. This confirms the quantity theory of money prediction that an expansion of money stock does not increase output in the long run and the findings is in line with the conclusion of Barrow and Sala-i-Martin (1995).

CONCLUSION

This study originally set out to address the monetarist claim that inflation is always and everywhere a monetary phenomenon. Using quarterly data obtained from the Central Bank of Nigeria Statistical Bulletin over the period (1970Q1-2011Q2), we tested the quantity theory of money proposition that there exists a long run proportional relationship between money growth and inflation and neutral relationship between money growth, output growth and velocity. From the regression results obtained, we find a weak negative and statistically insignificant relationship between long run money supply growth and inflation negating the quantity theory of money proposition that the relationship is one of proportionality. This is in line with earlier studies for low inflation countries and EMU countries (Grauwe and Polan 2005). Secondly, we find money growth and income growth to be weakly linked in the long run suggesting that monetary policy tools may not be effective in controlling and influencing macroeconomic aggregates in Nigeria. Finally, we found that there exist a long run relationship between money growth, inflation, output growth and velocity of transaction. The adjustment process between the short run and long run period is fast. Specifically, nearly 51 percent of disequilibrium of the previous quarter's shock adjusts back to equilibrium in the current quarter. This study has serious policy implications for policy makers in Nigeria and other low-income countries that have continuously based their monetary policy strategy on the premise that "inflation is always and everywhere a monetary phenomenon". Our result indicates that this is not true for Nigeria and that the continuous use of monetary policy tool to maintain price stability is not likely to yield the desired medium to long-term monetary policy goals.

Limitations

In this study, we carried out a dynamic modeling of price movement to determine whether inflation is purely a monetary phenomenon in Nigeria. This is to ascertain if the theoretical concept as proposed could be justified for the case of Nigeria. We noticed that an in-depth study, which will consider money market operations, issuance of government securities in primary market, repurchase agreement, interest payment of government domestic debt and sales of foreign exchange, is necessary in order to clarify pending issues on inflation and monetary policy in Nigeria. However, subsequent studies will address these shortcomings.

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