MONEY SUPPLY, INFLATION AND ECONOMIC GROWTH IN NIGERIA

Musibau Adetunji Babatunde* and Muhammed Isa Shuaibu*

ABSTRACT
This paper estimates a monetary growth model for Nigeria by examining the existence of a significant long run relationship between money supply, capital stock, inflation and economic growth between 1975 and 2008. It makes use of error correction mechanism in the bounds testing approach to cointegration within an autoregressive distributed lag framework. The empirical estimates reveal a positive and significant relationship between money supply and capital stock while a negative relationship was found between inflation and growth.

Keywords: Money supply, Inflation, Growth, Cointegration, Nigeria.

JEL Classification: E31, E51, C22

I. INTRODUCTION
Economic growth can be regarded as an important macroeconomic objective of the government given the fact that it visibly impacts on the standard of living. Inflation has been an issue of concern to policymakers in Nigeria in recent years given the need to stimulate domestic demand and to meet government’s huge fiscal obligations in a post-recessionary period. Nevertheless, price level in Nigeria has witnessed profound fluctuations since 1970. Persistent inflation and limited bank credit have been held responsible for the systemic crisis in the banking sector, slow growth of manufacturing and agricultural sectors, reduced productivity and generally low and slow economic progress.

However, there have been divergent views on the determinants of growth in Nigeria and other countries. Several studies have tried to examine the implication of inflation and money supply as part of a group of independent variables or their individual effect on growth. This linkage has been observed in a number of studies (See Odedokun (1997), Levine (1997), Ghosh and Philips (1998), Moosa (1982), Teriba (2006), Moser (1995), Balakrishnan (1991), Grauwe and Polan (2005), Lucas (2000), Ireland (1994), Kaldor (1959), Bessler (1984), Morooney (2002) among others). While some suggest the existence of a negative relationship between money supply, inflation and growth, others have found a positive relationship at different significance level in both cases. While much explanation has been offered on the determinants of growth in Nigeria and/or its implication for the country’s long term economic development, quite a little is known about the impact of money supply and inflation on the

* Department of Economics, University of Ibadan, Ibadan, Nigeria, E-mail: tunjiyusuf19@yahoo.com, mohammed_shuaibu@yahoo.com
economic progression of the country. Consequently, the major objective of this paper is to examine the possible impact, if any, of money supply and inflation on growth and the existence of a long run relationship amongst the variables in addition to some other determinants of growth predicated by the Tobin’s model of money in Nigeria observed from the literature.

Reliable estimates of the linkage between money supply, inflation and growth in Nigeria are important pieces of information in formulating public policies on financial sector reforms and restructuring, particularly given the need for diversification of the economy from an oil dependent to a non-oil sector driven one which has been a major component of reforms over the years. This information is also important to the monetary and fiscal authorities in formulating appropriate and well coordinated monetary and fiscal policies via the monetary policy transmission mechanism. Although, there have been numerous empirical studies on growth determinants as well as its implications for aggregate macroeconomic activities and vice versa in high-, low-, and middle-income countries, the econometric model from a developing economy’s perspective like Nigeria may however require a different framework. One potential difference is that the level of economic growth, magnitude of exposure and strength of banking systems, intensity of productivities, degree of independence of monetary authorities as well as factor intensities and structural change associated with rapid development induced by sound macroeconomic fundamentals suggest differences in the nature of the relationship. This study intends to add to the pool of existing literature on growth determinants in Nigeria by empirically analyzing the drivers of growth within the Tobin’s model of money framework in Nigeria. In addition, this paper differs from previous work in that earlier research has not been based on a Tobin’s model of money growth with respect to theoretically grounded regression model. Thus, this study attempts to add to the vast pool of literature by specifying a model based on the Tobin’s money growth theory as a regression model whose theoretical implications are tested explicitly.

The empirical analysis is for the period 1975–2008, employing annual data. The choice of this period is due to the availability of data. Money supply and inflation as well as other growth drivers’ sensitivity of both the long- and the short-run are examined. The study uses the bounds testing approach to cointegration, developed by Pesaran et al. (2001), within an autoregressive distributed lag (ARDL) framework, to test for a long-run level relationship between money supply, inflation and growth. In addition, error correction model is used to knot the long and short run results. The sequence of the study is clear. Following this introductory part, section two presents the stylized facts about money supply, inflation and growth in Nigeria while section three discusses the related literature and the theoretical framework. Modeling issues and estimation techniques are explored in section four while section five highlights the empirical analysis and expounds the results. Section six summarizes and concludes.

II. STYLIZED FACTS ON MONEY SUPPLY, INFLATION AND GROWTH IN NIGERIA

The Nigerian economy has witnessed substantial growth since the country’s attainment of political independence in 1960. The real value of gross domestic product (GDP) jumped from N2, 489 million in 1960 to N4, 219 million in 1970 and therefore heaved to record about N31, 546
million in 1980. Following the foreign exchange crisis of 1981–1986, accompanied by the downfall of international crude oil prices, the magnitude of growth skewed from the path it would have otherwise taken (see Figure 1). Economic growth witnessed a steady fall between 1980 and 1984 for thereafter regained momentum taking an upward trend there from. Thus, the growth rate of the Nigerian economy, which had averaged 2.5 per cent annually in the 1960s, climbed to an annual average of 10 per cent between 1970 and 1989.

Industrial development is attributable to several factors and these includes amongst others, the rate of capital accumulation and saving, volume of trade, research and development, volume of external trade (exports) and so on. The enormous fiscal expansion overtime is a key factor cannot be overemphasized. Monetary expansion, which reflects either demand for credit by the domestic economy or government fiscal expansion is a major determinant of inflation. Although with a lag, aggregate demand and inflation move in tandem. However an increase in real output, particularly food output, has a dampening effect on the general price level. It is pertinent to note that monetary and fiscal policy in Nigeria is conducted in an environment characterized by uncertainty and frequent economic policy somersaults. Also the development of an adequate framework for sustainable growth and development is complicated by inconsistent policies, bureaucracy and variations in environmental conditions either of a climatic nature or crises.

Growth in money supply was substantial as broad and narrow money have exhibited upward trend overtime. Money supply, M1 and M2 grew rapidly from 16.3 and 19.4 per cent in 1995 to 48.1 and 62.2 per cent in 2000, respectively. The growth in monetary aggregates was due to factors such as: rapid monetization of oil inflows, minimum wage adjustments, and the financing of government’s fiscal deficits through the banking system. Credit to the private sector, by contrast, declined sharply from 48.0 per cent in 1995 to 23.9 per cent in 1997 and thereafter increased gradually to 30.9 per cent in 2000. However, it stayed within the prescribed limits in only three (3) out of the six-year time frame (1995-2000). Overall, the major source of liquidity was growth in credit to government in most of the years. Generally, inflationary pressure induced by high money supply has been one of the major factors that have consistently undermined the attainment of sustainable growth in Nigeria, even amidst persistent and robust economic reform packages.

It will be recalled that amongst the major macroeconomic objectives of Nigeria and other economies is the pursuit of growth and maintenance of price stability. Using this yardstick, the outcome of inflation and money growth in Nigeria has been generally mixed. By definition, price stability in Nigeria refers to the achievement of a single-digit inflation rate on an annual basis. Indeed, this objective has not been achieved on a sustained basis. For example, in 1995 the rate of inflation was 72.8 per cent while the target of single digit inflation was achieved in only three (3) out of six (6) years, between 1995 and 2000. In fact, the single-digit inflation rate that materialized was attributable to a favourable agricultural harvest. The performance of the real sector improved in 2001, with the real gross domestic product growing by 3.9 per cent. The major sources of growth were agriculture, manufacturing, merchandise, transportation, finance and insurance and government services. However, inflationary pressures accelerated as a result of the liquidity surfeit fuelled by expansionary fiscal operations and the lingering...
structural bottlenecks that increased costs of doing business in the economy while the unemployment level remained high.

The link between economic growth, money supply and inflation is a universal phenomenon and it is peculiar to every government in the world. There have been various studies that examined the possibility of a causal relationship between money supply, the general price level and economic growth. While most of these studies indicate monetary expansion as a spur to growth and inflation as an obstruction that negate growth, a few others have provided evidence to the contrary.

Most researchers of the monetary perspective have argued persuasively that inflation is strictly a monetary phenomenon and that inflation occurs when the rate of growth of money supply is higher than the growth rate of output in the economy. This is the conventional monetarist linkage from the creation of base money to inflation when monetary authorities issue money at a rate that exceeds the demand for cash balances at the existing price level and the increased demand in the goods market pushes up the price level as the public tries to get rid of its excess cash holdings. It is the contention of these economists that the central banks can bridge the gap between growth and inflation by effectively coordinating monetary expansion in a bid to achieve a balanced interplay between them.

<table>
<thead>
<tr>
<th>Table 1</th>
<th>Some Selected Macroeconomic Aggregates (Average)</th>
</tr>
</thead>
<tbody>
<tr>
<td>M2 Money Growth</td>
<td>32.5</td>
</tr>
<tr>
<td>CPI Inflation</td>
<td>6.6</td>
</tr>
<tr>
<td>Real GDP growth</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Source: Authors Computation from CBN Statistical Bulletin (Special Anniversary Edition). na implies not available

Table 1 presents some monetary policy aggregates in the Nigerian economy between 1999 and 2007. For those variables that go in the same direction, high growth rate of M2 prompts high monetization of the economy and thus real GDP growth which in turn causes high inflation. Impressively, however, inflation turned out to be in a single digit in 2006 and 2007 but rose sharply to 15.10 per cent in 2008 which is a hindrance to the proposed inflation targeting.

Figure 1 depicts the movement of real GDP, gross capital formation, money supply and inflation from 1970 to 2008. It is apparent that real GDP had been quite low in the 1970s up to the early 1980s which may be attributable to positive global crude oil price increase which increased the country’s foreign exchange earnings and thus led to a huge fiscal expansion that in turn had a burgeoning effect on the total value of goods and services in the country. Towards the mid 1980s to the end of the decade, gross domestic product took an upward trend albeit slight fluctuations. Furthermore, the chart indicates contrary to theory, a persistent divergence between the two variables up to the mid 1990s when a co-movement between growth in money stock and the rate of inflation is witnessed, as suggested apriori. This is particularly discernible precisely from the periods 1999 to 2003. From the graphic representation, it is also apparent that inflation responds to the growth in the broad money stock with a lag. Visual inspection of
the chart suggests that in the early 1980s, headline inflation responded to changes in money stock after about a quarter. Thereafter, the lag varies ranging usually between two to three quarters between the late 1980s and the mid-1990s. Beginning from 1997, both variables record high frequency changes making co-movement less apparent. Further perusal of the chart reveals that, during this period inflation responded to changes in money stock at different paces.

The Nigerian economy prior to the global economic slowdown in 2007 performed below projection, with an estimated GDP growth of 6.2 per cent\textsuperscript{4}. This figure, below the set target of 10\%, was still higher than the 6.0 per cent recorded in 2006. This growth was driven primarily by the non-oil sector, which grew by 9.6 per cent (CBN, 2008), largely attributable to the agriculture sector, which grew by 7.4 per cent, led by crop production, livestock and fishing. Other drivers of growth in non-oil GDP included wholesale and retail trade, building and construction and services, which recorded growth rates of 15.3 per cent, 13.0 per cent and 9.8 per cent, respectively. Industrial output fell by 3.5 per cent, attributable mainly to the 5.9 per cent drop in crude oil production occasioned by the Niger Delta crisis. By year-end 2007, the crude oil production shut-in stood at 0.9 million barrels a day. Official confirmation from the Nigerian National Petroleum Company (NNPC) showed that the country lost N16.9 billion to petroleum pipeline vandalism.

There is a veritably traceable connect between money and prices. Although this link is known to many central banks, emphasis has remained much more faddishly on other variables as targets rather than money supply itself. It is expected that the focus of monetary policy should be on the management of the primary source of inflation which in itself is unrestricted fiscal, monetary and credit expansion by the government using the instrumentality of the bank. The thinking is a policy that merely suppresses the effects of its own actions. What this means is that the central bank should first of all manage the money creation process which is at the heart of inflation arising primarily from both the financing of government’s fiscal deficits as well as the growing penchant for loosening banks credit creation capacity. The creation of
money out of thin air can only generate inflation. Once this is resolved within the context of the rule of law, efficient justice system for the protection of private property rights, and eradication (or serious reduction) of public sector corruption, inflation will naturally fall to a desired level and the economy is in turn expected to grow strongly.

III. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

Increasing concern in recent literature has been skewed towards the integration of monetary theory with economic growth and on the role of money in growth theories. Most research carried out so far in Nigeria have given little consideration to the theoretical underpinning of a growth model that explicitly takes money growth into consideration. At best these studies have run money demand models and equations for Nigeria based on the quantity theory of money in a bid to ascertain the determinants of inflation, growth, and in other cases money holding.

An enormous body of literature, beginning with the work of Tobin (1965) and Sidrauski (1967), assesses the effects of sustained price inflation on the equilibrium growth path in a neoclassical setting. Subsequent studies have tried to model money demand within the growth framework of Solow. According to Kaldor (1959), the determinant of the money rate of return is the rate of growth of income in money terms, which will exceed or fall short of the real rate of growth accordingly as prices are rising or falling. This he argued is possible if a regime of completely stable prices is only consistent with a steadily growing economy when the real rate of growth in the national income is fairly high (that is, when it exceeds 4-6 per cent per annum).

Moroney (2002) develops a long-run version of the quantity theory of money growth, real GDP growth, and inflation and finds that the cross-section inflation rates are explained almost entirely by average broad money growth rates. The author asserts that countries experiencing high money growth and inflation had estimated coefficients of money supply (M2) growth strikingly close to one, strongly in conformity with the quantity theory. Comparatively, in countries with relatively low money growth and inflation, the estimated money growth coefficient is only 0.69; hence the quantity theory offers a less complete explanation of inflation. Money growth and GDP growth are nearly orthogonal, consistent with long-run monetary super neutrality\(^5\). He concludes that the quantity theory is a reliable model of inflation for most countries, but not those experiencing slow long-run money growths.

Ireland (1994) found that the effects of inflation on growth are small and the effects of growth on the monetary system are substantial. The results are consistent with evidence that money and asset demands vary systematically within economies as they develop. Lucas (2000) in a survey of the welfare cost of inflation found that the gain from reducing the annual inflation rate from 10 per cent to zero is equivalent to an increase in real income of slightly less than one per cent. Stein (1966) on the other hand introduced such concepts of money into his growth model, and tried to analyze equilibrium growth and its stability. Furthermore, he considered the effects of variations in the growth rate of the supply of money and in the composition of money on the long-run equilibrium capital intensity and found a positive relationship between them.

Grauwe and Polan (2005) use a sample of about 160 countries over a sample of 30 years to examine relationship between growth, money and inflation. They find a strong positive but
unproportional relation between long-run inflation and the money growth rate on economic growth. They argue that the strong link between inflation and money growth is almost wholly attributable to the presence of high-(or hyper-) inflation countries in the sample.

Using panel regressions and allowing for a nonlinear specification, Philips and Ghosh (1998) find a statistically and economically significant negative relationship between inflation and growth, which holds robustly at all but the lowest inflation rates. The authors use a “decision-tree” technique to identify inflation as one of the most important determinants of growth. Finally, short-run growth costs of disinflation are only relevant for the most severe disinflations, or when the initial inflation rate is well within the single-digit range. Bessler (1984) analyzes Brazilian agricultural prices, industrial prices, and money supply in a vector autoregression model. The empirical findings show strong, one-way, Granger-type causality from money supply to agricultural prices; while feedback is observed between industrial prices and money supply.

Xie, Tang, Cui (2009) in an empirical analysis on the relationship between money supply, economic growth, and inflation in China from 1998 to 2007 with cointegration and Granger causality test approaches shows that there is no cointegration relationship among money supply, inflation, and economic growth, but there is cointegration relationship between money supply and inflation while there is no long run relationship between money supply and economic growth. Thus, they conclude that there is a contradiction between the goal of economic growth and of price stability in China. There finding and conclusion implies that it may be possible to implement loose monetary policy contemporaneously, there is still the need to explore other sources that can stimulate economic growth other than monetary policy in the long run.

Georgios (1993) use annual post-war data for 32 countries and show that output and the price level are positively related along the aggregate supply and negatively related along the aggregate demand curve. This implies that the negative correlation between inflation and growth simply means that the price level has been countercyclical as aggregate supply shocks dominated aggregate demand shocks. He goes further to show that money growth has positive and permanent effects on inflation, but may affect output only in the short run as in the long run, money is probably neutral.

Contemporary thought on the topic of money and growth has its origins in work by Tobin (1965). Tobin considers the allocation of a fixed flow of savings between two assets, money and physical capital. An increase in the rate of inflation lowers the real return on money, leading agents to substitute out of cash and into capital. This is the Tobin effect: higher rates of inflation are associated with a larger capital stock and a higher level of output per capita. Sidrauski (1967) proposed another version of the monetary growth theory, with his seminal work on the context of an infinitely-lived representative agent model where money is super neutral. The main result in Sidrauski’s study is that an increase in the inflation rate does not affect the steady state capital stock and as such neither output nor economic growth is affected. Savings and money-demand functions are derived from optimizing behavior in this model, rather than postulated and held fixed as in Tobin’s work. The long-run stock of capital depends only on its depreciation rate, the population’s growth rate, and a representative agent’s subjective discount rate. Thus, money in Sidrauski’s model is super
neutral in the sense that changes in the rate of money growth and inflation have no effect on steady-state capital and output.

Subsequent work on money and growth has focused on the distinction between Tobin’s and Sidrauski’s conclusions about the effects of anticipated inflation on capital and output (See Fischer (1983), Bessler (1984), and Moroney (2002)). Each contribution to this literature asks which set of results, Tobin’s or Sidrauski’s, carries over to a new or more general setting. In some cases, the Tobin effect is present. Fischer (1979), for example, discovers that super-neutrality in the Sidrauski model holds only in the long run. The Tobin effect appears along the transition path to the steady state, with higher inflation inducing faster capital accumulation. In other cases, Sidrauski’s results are confirmed. Jean-Pierre Danthine et al. (1987), for instance, present a stochastic money-in-the-utility-function model in which money comes very close to being super-neutral. In still other cases, higher inflation decreases capital and output, so that neither Tobin’s nor Sidrauski’s results apply. In particular, inflation acts as a tax on productive activity and therefore retards capital accumulation in the cash-in-advance models studied by Stockman (1981) and Cooley and Hansen (1989, 1991).

Stockman (1981) developed a model in which an increase in the inflation rate results in a lower steady state level of output and people’s welfare declines. In Stockman’s model, money is a compliment to capital, accounting for a negative relationship between the steady-state level of output and the inflation rate. Stockman’s insight is prompted by the fact that firms put up some cash in financing their investment projects. Stockman models this cash investment as a cash-in-advance restriction on both consumption and capital purchases. Since inflation erodes the purchasing power of money balances, people reduce their purchases of both cash goods and capital when the inflation rate rises. Correspondingly, the steady-state level of output falls in response to an increase in the inflation rate.

Prior to this research, the basic growth model that relates growth to human and material capital and other resources or growth drivers have been the thrust of some empirical investigations examined in Nigeria. But the use of this model has been criticized by several authors on the basis of exclusion of money growth. For instance, Tobin (1965) argued that the role of monetary factors in determining growth cannot be overemphasized with respect to its role in determining the degree of capital intensity and thus growth of an economy. Findings of Iyoha (1969) reveal that there exist a clear relationship between money supply and economic growth. Others in Nigeria who have confirmed a strong relationship between money supply and growth include (Odedokun 1996; Okedokun 1998; Ojo 1993; Owoye and Onafowora 2007). These studies however did not consider the role of prices and capital at least within the Tobin’s model.

The story being developed here indicates that an understanding of the macro-dynamic interlinkages between inflation, capital accumulation and economic growth is imperative. This is because while theoretical literature is quite emphatic about the relationship exiting between inflation, capital accumulation and economic growth, empirical literature is still ambiguous on the impact, direction, and the strength of the relationship across countries, regions and empirical methodology used.
Theoretical Framework

The theoretical underpinning explored in this study leans on the monetary version of growth model proposed by Tobin (1965) and seeks to establish the relationship between money supply, inflation and economic growth. In this model, portfolio proposition is put within a growth context. This framework is chosen based on its applicability and significance of its assumptions to the nature and structure of the Nigerian economy. Conspicuous among the assumptions of the model are that changes in money stock are concocted via lump sum transfers and the assumptions underlying the Solow growth model.

Contemporary thought on the topic of money and growth has its origins in work by Tobin (1965). Tobin considers the allocation of a fixed flow of savings between two assets, money and physical capital. An increase in the rate of inflation lowers the real return on money, leading agents to substitute out of cash and into capital. That is higher rates of inflation are connected with larger capital stock and higher level of output per capita.

In this model the decision is between money and physical assets. The starting point of the model is a production function of the classical type expressed as:

\[ y_t = f(k_{t-1}) \]  

Thus in line with the Solovian growth theory under the assumption of fixed savings rate out of real income, asset accumulation will be equal to savings rate, s, times household income:

\[ \Delta K_t + \Delta M_t = s \left( y_t + \tau_t N_t - \frac{\pi_t M_{t-1}}{1 + \pi_t} P_{t-1} \right) \]  

Expressing equation 2 in per capita quantities yield;

\[ \Delta k_t = k_t - k_{t-1} = \Delta \frac{K_t}{P_t} - \frac{n_t}{1 + n_t} k_{t-1} \]  

\[ \Delta k_t = s \left( f(k_{t-1}) + \tau_t - \frac{\pi_t}{1 + \pi_t} \frac{m_t}{1 + n_t} \right) - \left( \frac{\Delta M_t}{P_t} \right) \left( \frac{1}{N_t} \right) - \frac{n_t}{1 + n_t} k_{t-1} \]  

\[ \Delta k_t = s \left( f(k_{t-1}) + \tau_t - \frac{\pi_t}{1 + \pi_t} \frac{m_t}{1 + n_t} \right) - \left( \frac{\theta_t - \pi_t}{(1 + \pi_t)(1 + n_t)} \right) M_{t-1} - \frac{n_t}{1 + n_t} k_{t-1} \]  

\[ \Delta k_t = s f(k_{t-1}) - (1 - s) \left( \frac{\theta_t - \pi_t}{(1 + \pi_t)(1 + n_t)} \right) M_{t-1} - \frac{n_t}{1 + n_t} k_{t-1} \]  

In the steady state, \( \Delta k^* = \Delta m^* = 0 \)

\[ \Delta m^* = \frac{m^* - \theta m^*}{(1 + \pi_t)(1 + n_t)} - m^* = \left[ \frac{1 + \theta}{(1 + \pi)(1 + n)} - 1 \right] m^* = 0 \]
Since the growth of nominal money and population are constant in the steady state inflation will also be constant thus equation 7 becomes;

\[ f(k^*) = (1 - s) \frac{\theta - \pi^*}{(1 + \pi^*)(1 + n_i)} m^* + n k^* \]  
\[ (1 + n) \]  

(8)

\[ f(k^*) = (1 - s) \frac{\theta - \pi^*}{(1 + \theta)} m^* + nk^* \]  

(9)

\[ f(k^*) = (1 - s) \frac{\theta - \pi}{(1 + \theta)} \psi k^* + nk^* \]  

(10)

\[ f(k^*) = [(1 - s)\psi + 1]nk^* + \pi \]  

(11)

Tobin’s framework shows that a higher inflation rate via money supply permanently raises the level of output. However, the effect on output growth is temporary, occurring during the transition from an initial steady state capital stock to a new steady state capital stock. Inflation induces greater capital accumulation and higher growth, only until the return to capital falls. Thereafter higher investment will cease and only steady state growth will result. Quite simply, the Tobin effect suggests that inflation causes individuals to substitute out of money and into interest earning assets, which leads to greater capital intensity and promotes economic growth. In effect, inflation exhibits a positive relationship to economic growth. Tobin (1972) also argued that, because of the downward rigidity of prices (including wages), the adjustment in relative prices during economic growth could be better achieved by the upward price movement of some individual prices.

IV. THE MODEL AND ESTIMATION TECHNIQUE

The theoretical framework presented above exposed the channels through which money supply and inflation can influence economic growth. The model specified captures the objectives of the study and is based on the outcome of the theoretical framework.

To this end, this study formulates a monetary growth model on the basis of Polan and Grauwe (2005) type model that connects money and growth but with alterations on the right hand variables whilst considering short and long run analyses of balanced growth and stability of the system. The model is specified as follows.

\[ \ln y_t = \phi_0 + \phi_1 \ln M_t + \phi_2 \ln K_t + \phi_3 \ln INF_t + \epsilon_t \]  

\[ \phi_1 > 0, \phi_2 > 0, \phi_3 < 0 \]  

(13)

Where \( \ln y \) is the natural log of real output, \( \ln M \) is the natural log of money supply; \( \ln K \) is the natural log of gross domestic investment and \( \epsilon \) is a random error, which is assumed to be white noise, normally and identically distributed with zero mean and a constant variance.

An increase in money supply makes output to rise by the same proportion as money will leave the real balances unchanged. This will not affect equilibrium condition because money
Money Supply, Inflation and Economic Growth in Nigeria

supply will not change. When this occurs, it implies that the model exhibits neutrality of money. This implies that a change in money supply has no effect on output. The implication of inflation and capital stock on growth is unequivocally captured in equation (12). Equation (13) specifies the apriori theoretical expectations.

Pesaran et al. (2001) developed a new Auto-Regressive Distributed Lag (ARDL) bounds testing approach for testing the existence of a cointegration relationship. The bound testing approach has certain econometric advantages in comparison to other single cointegration procedures (Engle and Granger, 1987; Johansen, 1988; Johansen and Juselius, 1990). Firstly, endogeneity problems and inability to test hypotheses on the estimated coefficients in the long-run associated with the Engle-Granger (1987) method are avoided. Secondly, the long and short-run parameters of the model in question are estimated simultaneously. Thirdly, the econometric methodology is relieved of the burden of establishing the order of integration amongst the variables and of pre-testing for unit roots. The ARDL approach to testing for the existence of a long-run relationship between the variables in levels is applicable irrespective of whether the underlying regressors are purely I(0), purely I(1), or fractionally integrated. Finally, as argued in Narayan (2005), the small sample properties of the bounds testing approach are far superior to that of multivariate cointegration. The approach, therefore, modifies the Auto-Regressive Distributed Lag (ARDL) framework while overcoming the inadequacies associated with the presence of a mixture of I(0) and I(1) regressors in a Johansen-type framework. A priori we expect growth to be significantly influenced by money, domestic prices and capital stock.

The ARDL representation of growth, money supply and capital stock, can be constructed as:

$$
\Delta y_t = \alpha_0 + \sum_{i=1}^{O} \alpha_{i1}\Delta y_{t-i} + \sum_{i=0}^{O} \alpha_{i2}\Delta M_{t-i} + \sum_{i=0}^{O} \alpha_{i3}\Delta K_{t-i} + \sum_{i=0}^{O} \alpha_{i4}\Delta P_{t-i} + \alpha_5 M_{t-1} + \alpha_6 K_{t-1} + \alpha_7 P_{t-1} + \epsilon_t
$$

where the variables are defined in equation (12). The procedure of the bounds testing approach is based on the F or Wald-statistics and is the first stage of the ARDL cointegration method. The null hypothesis is tested by considering the UECM in equation (14) while excluding the lagged variables $\Delta y_t, \Delta M_t, \Delta K_t$ based on the Wald or F-statistic. The asymptotic distribution of the F-statistic is non-standard under the null hypothesis of no cointegration relationship between the examined variables, without recourse to whether the underlying explanatory variables are purely I(0) or I(1). The null hypothesis of no cointegration ($H_0 : \alpha_1 = \alpha_2 = \alpha_3 = 0$) is therefore tested against the alternative hypothesis ($H_1 : \alpha_1 \neq \alpha_2 \neq \alpha_3 \neq 0$). Thus, Pesaran et al. (2001) compute two sets of critical values for a given significance level. One set assumes that all variables are I(0) and the other set assumes they are all I(1). If the computed F-statistic exceeds the upper critical bounds value, then the $H_0$ is rejected. If the F-statistic is below the lower critical bounds value, it implies no cointegration. Lastly, if the F-statistic falls into the bounds then the test becomes inconclusive. Consequently, the order of integration for the underlying explanatory variables must be known before any conclusion can be drawn.

However, the critical values of Pesaran et al. (2001) are generated on sample sizes of 500 and 1000 observations and 20,000 and 40,000 replications, respectively. Narayan and Narayan
Musibau Adetunji Babatunde & Muhammed Isa Shuaibu (2005) argue that such critical values cannot be used for small sample sizes like the one in this study. Given the relatively small sample size in the present study (27 observations), we extract the appropriate critical values from Narayan (2005) which were generated for small sample sizes of between 30 and 80 observations. Data on output growth, money supply and capital stock (proxied by gross fixed capital formation) were sourced from the Central Bank of Nigeria (CBN) statistical bulletin 2008 50 years special edition. The data series starts from 1970 and ends in 2008.

V. EMPIRICAL ANALYSIS AND INTERPRETATION OF RESULTS

In order to ascertain the existence of a long-run relationship among the variables in equation (5), the F-statistic (Wald test) for the bounds test (Pesaran et al., 2001) was computed. The F-statistic and critical bounds values for testing the null of no cointegrating relationship are reported in Table 2. The computed F-Statistics of 4.1619 was found to exceed the lower and upper bounds critical value of 3.03 and 4.06 respectively for a significance level of 10% using the Pesaran et al (2001) critical values. Therefore, the null of no cointegration is rejected. This implies that real income, money supply, inflation, gross fixed, capital formation in Nigeria are cointegrated. Having established the existence of cointegration, we proceed to estimate the long run relationship using an unrestricted error correction model.

Table 2
Bounds Testing for Cointegration Analysis

<table>
<thead>
<tr>
<th>Computed F-statistic: 4.1619 (lag structure, k = 1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical bound’s value at 10% - Lower: 3.03 and Upper: 4.06</td>
</tr>
<tr>
<td>(Three regressors and no trends in the model)</td>
</tr>
<tr>
<td>Table C1.v: Case V with unrestricted Intercept and unrestricted trend</td>
</tr>
</tbody>
</table>

Long Run and Short Run Dynamics

The long run coefficients are presented in Table 3. The estimated long-run elasticities for money supply, inflation and gross fixed capital formation are 0.18767, -0.39582, and 0.70469 respectively. Estimated elasticities have the expected signs and are statistically significant at the 10 per cent level respectively. For example, our results suggest that a 1 per cent increase in money supply induces a 0.187 per cent increase in inflation while a 1 per cent increase in...
inflation leads to a 0.395 per cent decline in real income. Gross fixed capital formation also positively influence real income in the long run and also significant at the 5 per cent level.

In order to see the short run dynamics, the estimates of the error correction model are presented in Table 4 and the results of the long run estimates are supported. The coefficient of money supply and inflation elasticities are 0.14402 and -0.128906 respectively. In the short run, a 1 per cent price increase in money supply will increase real income by 0.144 per cent while a 1 per cent increase in inflation will increase real income by 0.128 per cent in Nigeria. Gross fixed capital formation also positively and significantly induces real income in the short run. While money supply and capital formation influences real income positively while inflation reduces it. The error correction term ECM(t-1), is negative and statistically significant, thus corroborating the results of the cointegration tests of the existence of a long-run relationship between the variables. The error correction term is -0.490 which indicates that 49.0 per cent of the previous year’s deviation from long-run equilibrium will be restored within one year.

Table 4

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficients</th>
<th>Standard Error</th>
<th>T-Ratio</th>
<th>Prob</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>2.3976</td>
<td>1.0197</td>
<td>2.3514</td>
<td>.026</td>
</tr>
<tr>
<td>MS</td>
<td>0.14402</td>
<td>0.13214</td>
<td>3.4359</td>
<td>.002</td>
</tr>
<tr>
<td>INF</td>
<td>-0.128906</td>
<td>0.12326</td>
<td>-0.2345</td>
<td>.106</td>
</tr>
<tr>
<td>INV</td>
<td>0.188444</td>
<td>0.15052</td>
<td>0.5875</td>
<td>.0961</td>
</tr>
<tr>
<td>ECM(t-1)</td>
<td>-0.49028</td>
<td>0.10485</td>
<td>-2.7684</td>
<td>.010</td>
</tr>
<tr>
<td>R-Square</td>
<td>0.53121</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adjusted R-Square</td>
<td>0.44749</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S.E of Regression</td>
<td>0.21291</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DW-statistic</td>
<td>1.9492</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-Stat (3,20)</td>
<td>7.9320</td>
<td>.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diagnostic Tests

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(\chi^2_{jaro})</td>
<td>0.03986</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\chi^2_{norm})</td>
<td>13.7964</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\chi^2_{White})</td>
<td>0.005998</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(\chi^2_{RESET})</td>
<td>5.9237</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: 1.*indicates that a coefficient is significant at the 1 per cent level; **indicates that a coefficient is significant at the 5 per cent level; ***indicates that a coefficient is significant at the 10 per cent level. Dependent Variable is LER (log of real effective exchange rates). DW is the Durbin-Watson statistic; Ser. Cor. is the Lagrange multiplier test of residual serial correlation (see Harvey, 1981); Func. Form is Ramsey’s (1969) RESET test for functional form specification; Normality is the test proposed by Bera and Jarque (1981); Heter. is White’s (1980) test for heteroscedasticity; ARCH is a test for autoregressive conditional heteroscedasticity (Engle, 1982).

In addition, Table 4 presents diagnostic tests of our model. No evidence of autocorrelation in the disturbance of the error term was found. The model passes the Jaque-Bera normality tests suggesting that the errors are normally distributed. The RESET test indicates that the model is correctly specified while the F-forecast tests indicate the predictive power/accuracy of the model. Finally, the R-square of 0.53 indicates that 53 per cent of the variation in import
demand is explained by the variables in the model. Hence, on the basis of these statistical properties, it is reasonable to say that the model is fairly well behaved. Thereafter, it is necessary to check for the stability of the function. The model passes all the diagnostic tests including the cumulative sum of recursive residuals (CUSUM) (Figure 2a) and the cumulative sum of squares of recursive residuals (CUSUMSQ) tests (Figure 2b) of structural stability. This indicates that the parameters are stable during the sample period.
VI. CONCLUDING SUMMARY

This paper estimates a monetary growth model for Nigeria by examining the existence of a significant long run relationship between money supply, inflation and growth as well as to identify the possible determinants of portfolio holdings to identify the main economic fundamentals that influence the relationship between 1975 and 2008. The study makes use of error correction mechanism and the bounds testing approach to cointegration within an autoregressive distributed lag framework. Quantitative evidence reveals that there is a positive relationship between money supply, capital formation and economic growth in Nigeria while there is a negative relationship between inflation and growth. The implication of this result is that the government should effectively control the amount of money supplied to the economy in order not to increase inflation which may retard real income growth.

It follows that to increase growth, it is essential to implement the set of macroeconomic and sector-specific policies that can considerably relax the binding constraint on the availability of capital. Second, the estimated elasticities for inflation and money growth suggests there high sensitivity to growth. In this sense, we can assume that the model does not exhibit neutrality of money, targeting inflation to desired levels and requisite monetary policy can spur growth. The inference that is derivable from this is that the growth of the economy moves in tandem with the growth of money supply and capital accumulation, especially in the absence of persistent inflation and policy inconsistency. Empirical estimates show that while money supply and capital accumulation can spur growth, inflationary pressure retards growth.

However, there is need to investigate further the determinants of growth within Tobin’s monetary growth framework using relatively more sophisticated econometric techniques. This would require the application of such methods as generalized moment of methods and principal components. It is anticipated that such methodologies may reveal the presence of neutrality or even super neutrality of money that could not be established by the unrestricted error correction model.

Notes

1. Real gross domestic product (GDP) serves as a proxy for economic growth
2. Precisely for the case of Nigeria (a resource dependent economy), higher global crude oil prices and expansion of crude oil exports have significantly raised foreign exchange earnings and the over valuation of the domestic currency which artificially cheapened exports relative to imports.
3. The weight of food accounts for 70 per cent in the computation of Nigeria’s consumer price index.
4. The current global financial melt-down has weakened growth considerably in the first quarter of 2009 to 4.85 per cent from 5.75 per cent estimated for 2008 and projections for the future are not encouraging.
5. Orthogonality, in line with the quantity theory of money—also referred to as the (super)neutrality of money—says that a permanent increase in the growth rate of money leaves output and velocity unaffected in the long run. If there is a positive effect of money growth on output, it only holds in the short run.
6. Neutrality holds if the equilibrium values of real variables are independent of the level of the money supply in the long-run while super neutrality holds when real variables - including the rate of growth of GDP - are independent of the rate of growth in the money supply in the long-run.
7. See Orphanides and Solow (1990) for a complete survey of this literature.

8. There are two assets in this model and they are money \( M \) and capital \( K \) denoted as \( y_t = f(\alpha) \) where \( \alpha = k_t + m_t \). In addition, the production function is said to be well behaved and satisfies the inada condition.

9. Where \( n_t = \frac{N_t}{N_{t-1}} \) is the population growth rate and dividing both sides of equation 2 by \( N_t \) and using the result to eliminate \( \Delta \frac{K_t}{P_t} \) from equation 3 yields equation 4.

10. Changes in nominal money stock occur via lump sum transfer, \( \tau \), so that it is equal to the real per capita value of the change in nominal quantity of money. Substituting for \( \tau = \frac{M_t}{(1 + \pi)(1 + n)} \) into equation 6, invoking equation 1 and further simplification yields.

11. This equation is based on the fact that \( n = \frac{p}{1 + n} \) and \( 1 + \theta = (1 + \pi)(1 + n) \). Notice that \( \Psi = \frac{m^*}{k} \) and it represents the ratio of money balance to capital stock. That is it gives the portfolio composition of the individual asset in steady state.

References


Money Supply, Inflation and Economic Growth in Nigeria


