

Bassey, Kufre J.

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MONEY SUPPLY GROWTH AND UNEMPLOYMENT RATE IN NIGERIA: INVESTIGATING A LONG-RUN RELATIONSHIP USING ASYMMETRIC ARDL APPROACH¹

Kufre J. Bassey (PhD)

Abstract

This paper examines the role of money supply in determining unemployment rate in Nigeria. We employ a nonlinear autoregressive distributed lag (NARDL) model to examine the pass-through effect of the growth in money supply into unemployment rate using time series data over the period 1985 – 2015. Our approach allows for simultaneous test of the short- and long-run nonlinearities characterizing many macroeconomic variables through positive and negative partial sum decompositions of the money supply growth. We obtain the asymmetric dynamic multiplier that graphically depicts the traverse between the short- and the long-run responses of unemployment rates to the positive and negative money supply growth shocks. Our result suggests that money supply plays an important role and reveal that there is a significant pass-through effect of the money supply growth to unemployment rate in the long run. This finding infers that imposing a long-run symmetry where the underlying relationship is actually nonlinear will confound efforts to test for the existence of a stable long-run relationship between unemployment and money supply growth in Nigeria, and hence results in spurious dynamic responses. It also underscores the importance of correctly capturing short-run symmetries (asymmetries) in order to illuminate potentially important differences in the response of policy makers to positive and negative shocks.

Keywords: Nonlinear ARDL, Monetary Policy, Money supply, Unemployment

JEL Classification: E24, E51, E52

Kufre J. Bassey (PhD) is a staff of the Statistics Department, Central Bank of Nigeria, Abuja

Email Address: kjbassey@cbn.gov.ng

¹ The views expressed in this paper are those of the author and does not necessarily represent the official views of the Central Bank of Nigeria.

INTRODUCTION

Understanding the link between money supply and unemployment has become paramount for economic agents in Nigeria following the country's economic crisis that started in the last quarter of 2014. It is generally believed that the more liquid money is available in an economy, the more opportunities exist for continued growth. Nevertheless, the recent economic crisis in Nigeria was entwined with dampened output growth despite the relatively stable increase in total monetary liabilities (M2) recorded by the Central Bank of Nigeria (CBN) over the same period. As the crisis persisted, firms cut back on hiring new work force, many consumers lacked income needed to boost economic activities and allow businesses to bounce back, and unemployment rates heightened. According to Nickolas (2015), when business sales and revenues decrease and businesses stop expanding with massive layoffs of workers due to business latency and paucity of job creation, consumers tend to save money, leading to liquidity crunch (tightening of money supply). In other words, lower consumer spending, lower aggregate demand and lower growth rates could be attributed to tightening of money supply. More so, when firms cut back on hiring new work force and unemployment rises, ideally, there is need for governments to grow the economy and for central banks to stimulate aggregate demand. The stimulation could be allied to three factors (Kandil, 2014): (i) the elasticity of money demand with respect to a change in income, (ii) the elasticity of money demand with respect to a change in the interest rate, and (iii) the elasticity of aggregate spending with respect to a change in the interest rate.

When central banks wish to stimulate the economy through increase in the money supply, they do so through appropriate monetary policies that could be used (either singly or in combination). These include: (a) by reducing reserve requirement: so that deposit money banks could be able to loan out more of their deposits and money supply would increase; (b) by reducing interest rates: this would make it cheaper for investors to borrow money, as more borrowing translates to increase in money supply; and (c) by buying government securities in open market operations: this would enable central banks to influence the cost and availability of reserves and bring about desired changes in bank credit and money supply. In principle, increase in money supply is expected to allow more economic activities to occur, and when more economic activities occur, unemployment is expected to decline. In retrospect, the Russian high level unemployment of 2002 was attributed to the 1998 financial crisis and the subsequent tightening of monetary policy (Lakstutiene *et al.*, 2011). Cascio (2001) also opined that monetary shocks influence unemployment significantly but differently across countries in a study on the relationship between monetary policy and unemployment rate in 11 OECD countries.

Under the monetary targeting framework of the CBN, the target variable is the growth in money supply and the aim is to achieve a long-term objective of price stability. The Bank watches growth in the monetary aggregates very closely in order to predict the future size of money supply. If the monetary aggregates grow too quickly, inflationary pressures could be triggered and if it does, the Bank raises interest rates to halt growth in money-supply. The Bank uses expansionary monetary policy to increase the total supply of money in the economy rapidly when there is need to stimulate domestic economic activities, or contractionary policy to decrease the total money supply, or increase it slowly, when the rate of growth of money supply is higher than the growth rate of output in the economy. However, most economists believed that in the long run, output is usually fixed, so that any changes in the money supply only cause prices to change, but in the short run, changes in the money supply can affect the actual production of goods and services, given that prices and wages usually do not adjust immediately. This is the salient feature in the link between growth in money supply and unemployment rate in Nigeria.

The episodes of rising unemployment have inspired numerous studies in recent times. Most of the studies in the literature showed that money supply has been consistently on the increase while employment seems not to be increasing proportionately, thereby resulting in persistent inflation and rising unemployment rates. Some focused on the relationship between unemployment and economic

growth, while others focused on money supply and economic growth or inflation and economic growth. Ogunmuyiwa and Ekone (2010) reported that though money supply is positively related to growth, it is however, not significant in relation to the choice between contractionary and expansionary money supply. Inam (2014) found a strong significant impact of money supply on economic growth in Nigeria using a time series data from 1985 - 2012. On the other hand, Akeju and Olanipekun (2014) showed that there is both short- and long-run relationship between unemployment rate and output growth in Nigeria. Orji and Okafor (2015) posited that unemployment is a significant determinant of inflation with a positive relationship between them, suggesting that the proposition on the Phillips curve hypothesis has been invalidated in Nigeria.

As the surge in unemployment continues, the concern by policy makers becomes paramount due to the associated socio-economic implications. This paper therefore examines the role of money supply in determining unemployment rate in Nigeria. By taking into account the nonlinearities characterizing many macroeconomic variables, the paper employs a nonlinear autoregressive distributed lags (NARDL) model that allows for simultaneous test of the short and long-run asymmetric relationship through positive and negative partial sum decompositions of the explanatory variables (see Shin *et al.*, 2013). It evaluates the pass-through effect of growth in money supply to unemployment rate through the NARDL approach which also allows for description, in an intuitive manner, of a pass-through to a new equilibrium following a perturbation to the system. This is particularly advantageous because it provides reliable long-run inferences by taking into account non-linearity due to contractionary and expansionary monetary policies in the presence of economic changes.

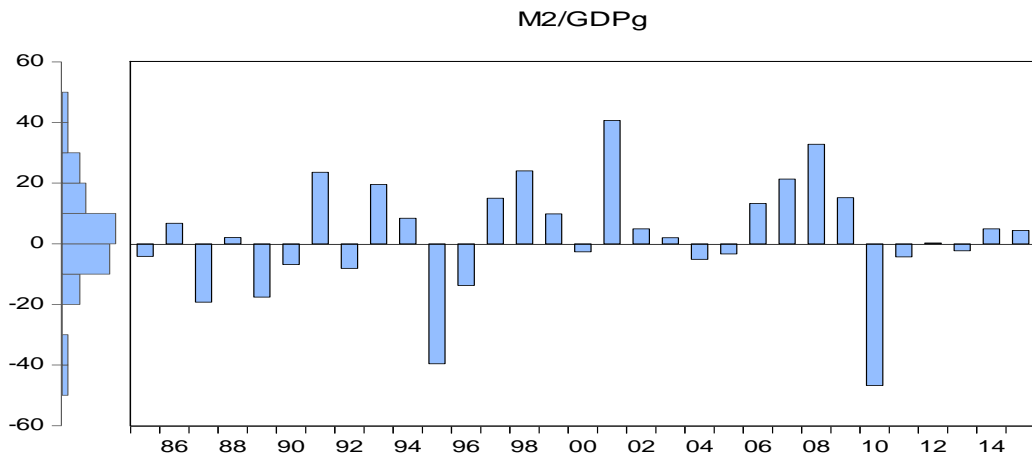
The rest of the paper is organized as follows: Section 2 presents stylized facts on monetary policy and unemployment in Nigeria, as well as the related literature; Section 3 discusses the empirical framework and econometric models; Section 4 presents and interprets the empirical results; while Section 5 concludes and highlights the policy implications.

STYLIZED FACTS AND LITERATURE REVIEW

Stylized Facts on Money Supply and Unemployment in Nigeria

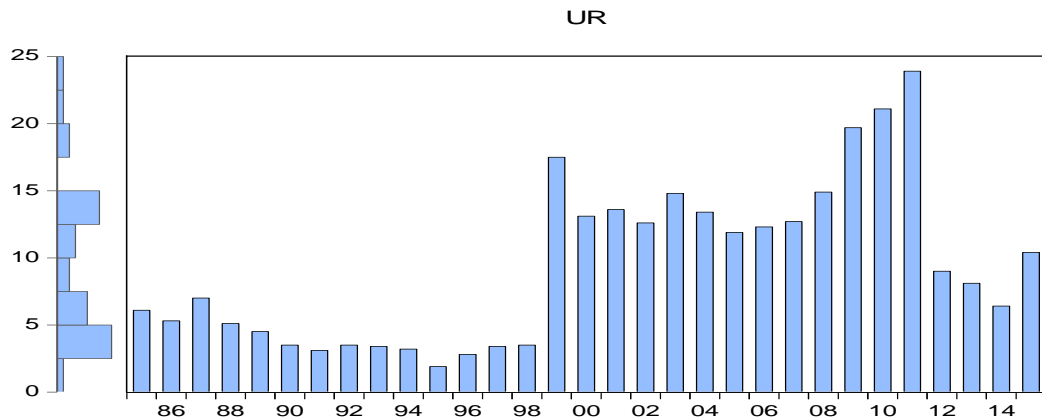
Money supply is often viewed from two perspectives: narrow and broad money. Narrow money (M1) includes currency in circulation in addition to current account deposits with commercial banks. Broad money (M2) measures the total volume of money supply in the economy and is made up of M1 and savings and time deposits with banks including foreign denominated deposits. Once the amount of money in circulation is higher than the level of total output of the economy, it is seen as excess money supply which can lead to inflation or higher prices of goods. When CBN changes the level of money supply, it does so through the control of the base money made up of currency and coins outside the banking system and deposits of banks with the CBN. In essence, the Bank regulates money supply based on the knowledge that there is a stable relationship between the quantity of money supply and economic activity. Figure 1 shows the broad money supply growth as a percentage of gross domestic products (M2/GDP growth) in Nigeria between 1985 and 2015.

Figure 1: Broad Money Supply Growth as a Percentage of GDP



The growth dynamics shows a nonlinear growth over the periods. The choice of M2/GDP² growth is to limit money supply to what is required to support productive activities in order to control for undesirable effects such as high prices or inflation. Figure 2 shows the unemployment rate within the same period.

Figure 2: Nigeria's Unemployment Rate⁵ (1985-2015)



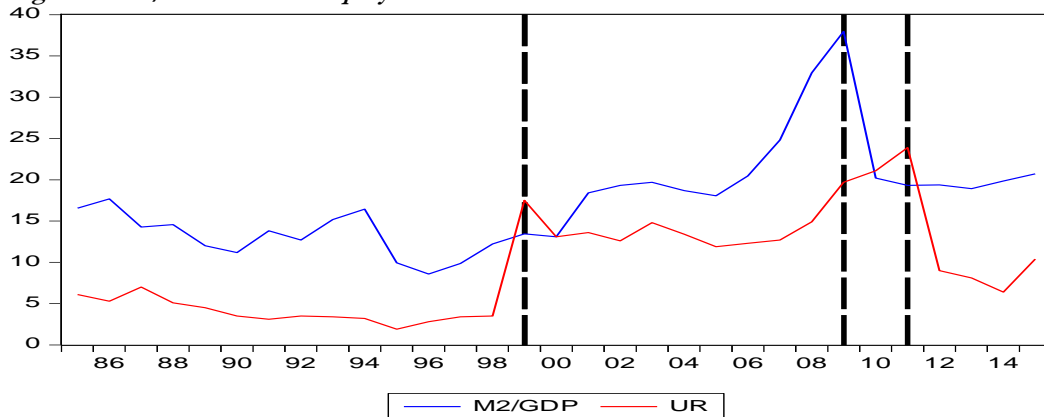
Prior to the 1986 SAP and the financial sector reforms of 1987, the conduct of monetary policy in Nigeria was by direct control. Accordingly, nominal interest rates were lowest during this period, M2 increased but with high inflation, while real interest rates were generally negative leading to low savings, low investment, low growth and dampening of the M2/GDP ratio, as a result of the repressed regime as shown in Figure 1. In other words, the desired policy objective of enhancing investment and growth in the real sector by growing M2 was not achieved. However, in 1986 when the SAP programme was launched, the economy seemed to have responded positively to it with an average growth rate of 5.0 percent at first before crashing thereafter (see also Okunroumu, 1993). In particular, at the start of the SAP, traditional instruments were modified to deal with the excess liquidity in the economy, and the

² M2/GDP is known as financial deepening and is generally assumed that the more liquid money is available in an economy, the more opportunities exist for continued growth.

CBN required banks to deposit in a non-interest bearing deposit account at the Bank, the naira equivalent of all outstanding external payment areas. Also, a 10.0 percent ceiling imposed on the rate of credit expansion by banks in the first quarter of 1986 was reduced to 8.0 percent in the third quarter and maintained until third quarter of 1987 when it was further reduced to 7.4 percent.

As shown in Figures 2 and 3, the reduction in liquidity resulted in increased unemployment rate from 5.3 percent in 1986 to 7.0 percent in 1987. A study that examined whether financial development may be a significant factor for economic growth showed that economic growth has predictive power for financial deepening within the periods 1980-1982, 1985-1986, 1995-1996, 1998, 2000, 2004 and 2008-2011 (Aye, 2015). Several studies also showed that between 1985 and 2012, economic growth had mixed developments with a decline in the real GDP ranging from -7.1 percent in 1983 to -0.6 percent in 1987, while the rest of the period relatively showed positive growth, especially between 2006 and 2010 except for 2008 when the prime and maximum interest rates averaged 16.9 per cent and 20.2 per cent, respectively, and were assumed to impede investment by both large and small scale investors (Essien *et al.*, 2016). A cursory observation of Figure 3 further shows that within the period of relative positive growth, M2_GDP was trending upward until 2009 while unemployment rate steadily increased from 12.3 per cent in 2006 to 23.9 per cent in 2011 when it declined abruptly. A further increase in the second quarter of 2014 was attributed to the effect of economic recession experienced by the country.

Figure 3: M2/GDP and unemployment rate succession from 1985 - 2015



Theoretical Literature Review

Broadly speaking, there are two prominent theories in the literature linking money supply and unemployment. The Monetarists that argue that the control of money supply should be the main concern of the monetary authorities, and the Keynesians that maintain that monetary policy should be directed towards interest rates rather than money supply (Sullivan and Steven, 2003).

The Keynesian economists also argue that unemployment is a natural consequence that can be reduced through some combination of two approaches: “a reduction in interest rates; and Government investment in infrastructure”. However, another schools of thought (Hayek economists) are of the view that this Keynesian policy of reducing unemployment would result in inflation because money supply would have to be increased by the central bank to keep levels of unemployment low (Blinder, 2008; Sanz-Bas, 2011; and Arevuo, 2012). But from the modern theory of money neutrality, changes in money supply is seen to affect unemployment levels only in the short run, while in the long run the neutrality is still assumed after money has circulated throughout the economy.

It is also evident in the literature, that money supply has a prevailing effect on economic activity. Although, there seems to be no consensus among economists on the direct link between money supply and unemployment, the Keynesian structural model provides what can best be described as the causal effect of monetary expansion on the level of employment. Following this Keynesian structural model, an increase in money supply arising from adjustments in the money market, assuming a constant level of prices, will lead to a fall in nominal interest rates which in-turn encourages both consumption and investment spending and consequently increase in output. Increase in investment spending requires more hands to carry out the production activities, hence fall in unemployment. In other words, the Keynesian structural model is seen to validate the channels through which interest rate effect operates to affect the level of employment and output (Keen, 2013).

Specifically, proponents of this model, identify two critical channels through which the model works, namely: the credit view and asset channel. Under the credit view, an increase in money supply brings about fall in interest rate which improves firms' balance sheet. A robust firm balance sheet raises capacity utilization, employment and output. This channel can be schematically presented as:

$$M \uparrow \geq i \downarrow \geq \text{cash inflow} \uparrow \geq \text{adverse selection} \downarrow \geq \text{moral hazard} \downarrow \geq \text{lending} \uparrow \geq I \uparrow \geq Y \uparrow$$

For the asset prices channel, on the other hand, an increase in money supply leads to appreciation in stock prices thereby boost consumption on durable goods and services leading to robust output and declining level of unemployment. Schematically we have:

$$M \uparrow \geq P_s \uparrow \geq \text{wealth} \uparrow \geq \text{consumption} \uparrow \geq Y \uparrow$$

EMPIRICAL LITERATURE

Historically, Friedman (1968) opined that "high and rising nominal interest rates have been associated with rapid growth in the quantity of money. As an empirical matter, low interest rates are a sign that monetary policy has been tight-in the sense that the quantity of money has grown slowly; high interest rates are a sign that monetary policy has been easy-in the sense that the quantity of money has grown rapidly. The broadest facts of experience run in precisely the opposite direction from that which the financial community and academic economists have all generally taken for grant. For that reason, it is far better to look at the rate of change of the quantity of money".

Despite the uncertainty on the nature of the relationship between unemployment and monetary policy, Bhattacharyya (2012) posited that there is still a general acceptability that monetary policy has a significant impact on domestic economic activities and employment, but varies significantly from country to country. Other commentators include Bernanke and Blinder (1992) in a study on the relationship between bank credits and unemployment ratio in US using monthly data. The study concludes that narrowing in credit volume increases unemployment ratio at the same time. Lundborg (2004) also showed that monetary policy had been instrumental in adding between 50,000 and 70,000 to the number of unemployed persons in Sweden, Friorentini and Tamborini (1999) examined the effects of long-run bank lending channel for the Italian economy using an inter-temporal macroeconomic equilibrium model. The result showed a permanent effect of credit variables on employment and output through the supply side of the economy by altering credit supply conditions to firms. On the other hand, Ordine and Rose (2008) evaluated the relationship between bank loans efficiency and employment for Italy through credit channel and found that a 10 percent increase in banking sector supply of credit increases employment rate by 5 percent.

Berument *et al.* (2008) examined the effect of monetary policy shocks on sectoral unemployment in Turkey using quarterly data for the period 1988:01 to 2004:04 in a VAR model with a recursive order.

The results showed that among other macroeconomic variables, a positive money shock decreases unemployment in sectors of Mining, Manufacturing, Construction, Wholesale-Retail Trade, Transportation and, Finance-Insurance. In another study to investigate the response of unemployment to selective macroeconomic shocks from 2000q1-2010:q1, Doğan (2012) finds that shocks to exchange rate, interbank interest rate and money supply, increase unemployment in Turkey.

Cambazoğlu and Karaalp (2012) analyzed the effectiveness of narrow credit view on employment and output for Turkey using money supply, total loans, employment rates and industrial production index monthly variables in a vector autoregressive (VAR) framework. The result showed that changes in money stock (m2) impacts on employment and output.

Göçer (2013) examined the relationship between changes in money supply in terms of total lending of the banking sector and unemployment in fourteen selected European Union countries for the period 1980-2012, using panel data analysis method. The result showed a reduction in unemployment rate in these countries being attributed to increase in lending.

There have been few studies conducted in Nigeria that explored the relationship between monetary policy and employment. Related studies include Babatunde and Shuaibu (2011) that found significant positive relationship between money supply and capital stock in Nigeria, while inflation and growth have a negative relationship.

Umaru and Zubairu (2012) also examined the relationship between unemployment and inflation for the period 1977–2009. The result showed that inflation impacted negatively on unemployment, but the causality test shows no causal relationship between unemployment and inflation within the period of study, rather, there is a long-run relationship between them.

Udoka and Ayingang (2012) investigated the effect of interest rate fluctuation on the economic growth of Nigeria before and after the interest rate deregulation regime. Data collected from 1970-2010 were analysed and tested using the ordinary least square multiple regression method. The result showed that increase in interest rate decreases economic growth in Nigeria.

Akeju and Olanipekun (2014) examined the relationship between unemployment rate and economic growth in Nigeria under the theoretical proposition of the Okun's law using error correction model and Johansen cointegration test. The result shows that there exists both short and long run relationship between unemployment rate and output growth in Nigeria. The study also recommended that foreign direct investment (FDI) should be increased to reduce the high rate of unemployment.

In examining the inflation and unemployment relationship in Nigeria using time series data from 1970-2011 and based on Phillips curve proposition, Orji and Okafor (2015) opined that unemployment is a significant determinant of inflation and that there is a positive relationship between inflation and unemployment rate in Nigeria.

It is evident in the literature, both theoretical and empirical, that economic growth is positively related to an increased ratio of money supply to GDP (IMF, 2015). Georgiou (2013) posited that “the massive expansion of monetary policy together with the deregulation and the increase of credit to the private sector was a stimulus for the GDP and reduced unemployment rate. However, after the year 2000, the ratio of domestic credit over GDP became very high in most western countries. Consequently, GDP became sluggish and unemployment rate started rising”. Though there are many studies on financial deepening and economic growth in Nigeria (Okarfor *et al.*, 2016; Nwanna and Chinwudu, C. F., 2016), focus on financial deepening and unemployment, to the best of our knowledge, still remains a gap in the literature, This paper is set to fill this gap.

METHODOLOGY

The standard time series techniques of cointegration, error-correction modelling and Granger causality techniques presume symmetric relations between macroeconomic variables. In this paper, we adapt the Shin *et al.* (2013) asymmetric ARDL approach in analysing the potential asymmetries in the growth of money supply as a percentage of GDP and its impact on unemployment rate in Nigeria. The variables used in the study include M2/GDPg (hereafter denoted by M2g) and unemployment rate (denoted by UR).

Model Specification

The asymmetric ARDL model (also known as the nonlinear ARDL (NARDL) model following Shin *et al.* (2013) is given as:

$$UR_t = \beta^+ x_t^+ + \beta^- x_t^- + u_t; \quad \Delta x_t = \epsilon_t \quad (1)$$

This is asymmetric long-run regression, where UR_t and x_t are I(1) scalar variables and $x_t = x_0 + x_t^+ + x_t^-$ are the decompositions of x_t with x_t^+ and x_t^- being the partial sum processes of positive and negative changes in x_t such that:

$$x_t^+ = \sum_{j=1}^t \Delta x_j^+ = \sum_{j=1}^t \max(\Delta x_j, 0), \quad x_t^- = \sum_{j=1}^t \Delta x_j^- = \sum_{j=1}^t \min(\Delta x_j, 0), \quad (2)$$

Embedding the long run regression model into a standard $ARDL(p, q)$ gives a dynamic parametric framework of $NARDL(p, q)$ model exhibiting combine asymmetries of long-run and short-run relationships:

$$UR_t = \sum_{j=1}^p \alpha_j UR_{t-j} + \sum_{j=0}^q (\theta_j^+ x_{t-j}^+ + \theta_j^- x_{t-j}^-) + \epsilon_t \quad (3)$$

where α_j is the autoregressive parameters, θ_j^+ and θ_j^- are the asymmetric distributed lag parameters and ϵ_t is the error term which is identically and independently distributed with mean zero and variance σ_ϵ^2 . An unconstrained error correction (ECM) form of Eq. 3 is given as:

$$\begin{aligned} \Delta UR_t &= \rho UR_{t-1} + \theta_j^+ x_{t-1}^+ + \theta_j^- x_{t-1}^- + \sum_{j=1}^{p-1} \delta_j \Delta UR_{t-j} + \sum_{j=0}^{q-1} (\varphi_j^+ x_{t-j}^+ + \varphi_j^- x_{t-j}^-) + \epsilon_t \\ &= \rho \gamma_{t-1} + \sum_{j=1}^{p-1} \delta_j \Delta UR_{t-j} + \sum_{j=0}^{q-1} (\varphi_j^+ x_{t-j}^+ + \varphi_j^- x_{t-j}^-) + \epsilon_t \end{aligned} \quad (4)$$

where $\rho = \sum_{j=1}^p \alpha_{j-1}$, $\delta_j = -\sum_{i=j+1}^p \alpha_i \forall j=1, \dots, p-1$, $\theta^+ = \sum_{j=0}^q \theta_j^+$, $\theta^- = \sum_{j=0}^q \theta_j^-$, $\varphi_0^+ = \theta_0^+$, $\varphi_j^+ = -\sum_{i=j+1}^q \theta_i^+$, $\forall j = 1, \dots, q-1$, $\varphi_0^- = \theta_0^-$, $\varphi_j^- = -\sum_{i=j+1}^q \theta_i^-$, $\forall j = 1, \dots, q-1$, and $\gamma_t = UR_t - \beta^+ x_t^+ - \beta^- x_t^-$ is the nonlinear error correction term with $\beta^+ = -\theta^+/\rho$ and $\beta^- = -\theta^-/\rho$ being the asymmetric long-run associated parameters. Applying the NARDL framework to analyse the relationship between unemployment and money supply in Nigeria, we take into cognisance the possibility of endogeneity bias. We modify Eq. (4) by specifying a marginal data generating process for Δx_t such that $\Delta x_t = \sum_{j=1}^{q-1} \omega_j \Delta x_{t-j} + e_t$ and $\epsilon_t = \varphi'(\Delta x_t - \sum_{j=1}^{q-1} \omega_j \Delta x_{t-j}) + u_t = \varphi' e_t + u_t$. Thus, Eq. (4) becomes:

$$\Delta UR_t = \rho \gamma_{t-1} + \sum_{j=1}^{p-1} \delta_j \Delta UR_{t-j} + \sum_{j=0}^{q-1} (\pi_j^+ M2g_{t-j}^+ + \pi_j^- M2g_{t-j}^-) + u_t \quad (5)$$

where $\pi_0^+ = \theta_0^+ + \varphi$, $\pi_0^- = \theta_0^- + \varphi$, $\pi_j^+ = \varphi_j^+ - \varphi' \omega_j$, $\pi_j^- = \varphi_j^- - \varphi' \omega_j$; $\forall j = 1, \dots, q-1$ and u_t is a random disturbance term. With appropriate lag structure Eq. (5) is free from residual serial correlation problem (see also Shin *et al.*, 2013).

Following Pesaran and Shin (1999) and Pesaran *et al.* (2001), we employ a pragmatic bounds-testing procedure for the existence of a stable long-run relationship which is valid irrespective of whether the underlying regressors are I(0), I(1) or mutually cointegrated. More so, the asymmetry hypotheses are tested for possible equality between the positive and the negative coefficients of each variable in both the long-run and the short-run set-ups, respectively. If the null hypotheses of long-run symmetry, $\beta^+ = \beta^-$ short-run symmetry, $\pi_j^+ = \pi_j^-$, $\forall j = 0, \dots, q-1$ are rejected, it means that both the positive and the negative components of $M2g$ have different impact on UR and impose different long and short-run equilibrium relationships between the positive and negative shocks (see also Choudhry *et al.*, 2014). If the hypotheses are accepted for both the short and long-run, we will be analysing estimates of long-run and short-run symmetry model:

$$\Delta UR_t = \rho UR_{t-1} + \theta x_{t-1} + \sum_{j=1}^{p-1} \varphi_j \Delta UR_{t-j} + \sum_{j=0}^{q-1} \pi_j x_{t-j} + \mu_t \quad (6)$$

If only the symmetry hypothesis for long-run is accepted, we will have long-run symmetry and short-run asymmetry:

$$\Delta UR_t = \rho UR_{t-1} + \theta x_{t-1} + \sum_{j=1}^{p-1} \varphi_j \Delta UR_{t-j} + \sum_{j=0}^{q-1} (\pi_j^+ x_{t-j}^+ + \pi_j^- x_{t-j}^-) + \mu_t \quad (7)$$

If only the symmetry hypothesis for the long-run is rejected, we will have long-run asymmetry and short-run symmetry:

$$\Delta UR_t = \rho UR_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{j=1}^{p-1} \varphi_j \Delta UR_{t-j} + \sum_{j=0}^{q-1} \pi_j x_{t-j} + \mu_t \quad (8)$$

where x represents $M2g$ in each case. In all cases of the asymmetries, the asymmetric responses to positive and negative shocks are respectively captured by the positive and negative dynamic cumulative multipliers associated with unit changes in $M2g_t^+$ and $M2g_t^-$ as follows:

$$m_h^+ = \sum_{j=0}^h \frac{\partial UR_{t+j}}{\partial M2g_t^+} \text{ and } m_h^- = \sum_{j=0}^h \frac{\partial UR_{t+j}}{\partial M2g_t^-}; h = 0, 1, 2, \dots \quad (9)$$

where $h \rightarrow \infty$, $m_h^+ \rightarrow \theta^+$ and $m_h^- \rightarrow \theta^-$ are the dynamic adjustment patterns.

Data Selection

Annual data of broad money supply growth as a share of gross domestic products ($M2g$) and unemployment rates (UR) from Nigeria are obtained from the Statistical bulletin of the Central Bank of Nigeria and Labour Statistics by the National Bureau of Statistics (NBS), respectively. The data period spans from 1985 to 2015.

ESTIMATION RESULTS

Preliminary examination of the statistical properties of the variables used was carried out.

Table 1: Descriptive Statistics Unemployment Rate and growth of Money Supply

| | UR | M2g |
|--------------|----------|----------|
| Mean | 9.410 | 17.431 |
| Median | 8.100 | 17.686 |
| Maximun | 23.900 | 37.957 |
| Minimum | 1.900 | 8.577 |
| Std. Dev. | 6.065 | 6.203 |
| Skewness | 0.649 | 1.487 |
| Kurtosis | 2.468 | 5.960 |
| Jarque-bera | 2.542 | 22.747 |
| Probabilty | 0.281 | 0.000 |
| Sum | 291.700 | 540.356 |
| Sum Sq. Dev. | 1103.547 | 1154.358 |
| Observations | 31 | 31 |

The result in Table 1 shows that the descriptive statistics of M2g and UR over the sample periods. The Mean of the unemployment rate in Nigeria from 1985 to 2015 is approximately 9.4 percent, while financial deepening (M2g) averages 17.4 percent. The result also shows that unemployment rate is normally distributed while financial deepening is not.

We estimate the NARDL model for both long- and short-run nonlinearities in the relationship between UR and M2g. Although ARDL approach to cointegration evades the pre-testing for unit root problem, to avoid including a variable with I(2), we first subject each time series to the ADF unit root test. The results of the test shows that UR is I(1) while M2g is I(0). We include only constant term and employ the SIC for the optimal lag order in the ADF test. We follow the general-to-specific approach to select the ARDL specification and the preferred specification of ARDL (1,2,2) was selected using AIC model selection method. We performed cointegration test for linear and nonlinear specifications over a 5 percent critical value bound as presented in Table 2.

Table 2: Bounds test for Linear/Nonlinear Specifications

| Null Hypothesis: No long-run relationships exist | | | |
|--|-------------|-----------------|-----------------|
| Model Specification | F-statistic | 95% Lower Bound | 95% Upper Bound |
| Linear | 2.032 | 3.620 | 4.160 |
| Nonlinear | 7.170** | 3.100 | 3.870 |

** Significane at 5% critical value bounds

The results reveal that there is no cointegration when a linear model is specified. This indicates that there is a possibility of wrong inference when a wrong specification is used with regards to the movement of unemployment rate and money supply growth in the long-run. The NARDL cointegration results are shown in Table 3. Compared with the standard (symmetric) long-run equilibrium models, this approach of decomposing *M2g* into positive and negative expresses much more information, exhibits more flexibility and captures the fluctuations under both regimes simultaneously. The estimated coefficient of the error correction term is found to be negative and significant. This result implies that money supply growth variables (positive and negative) affect unemployment in the long run.

Table 3: NARDL Estimation Results: Relationship between UR and M2g

| ARDL Cointegrating And Long Run Form | | | | |
|--|-------------|------------|-------------|-------|
| Dependent Variable: UR | | | | |
| Selected Model: ARDL(1,2,2) | | | | |
| Cointegrating Form | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| $\Delta M2g^+$ | 0.110 | 0.055 | 2.015 | 0.058 |
| $\Delta M2g+(-1)$ | -0.123 | 0.043 | -2.832 | 0.010 |
| $\Delta M2g^-$ | -0.005 | 0.040 | -0.112 | 0.912 |
| $\Delta M2g-(-1)$ | -0.116 | 0.055 | -2.116 | 0.047 |
| CointEq(-1) | -0.473 | 0.100 | -4.745 | 0.000 |
| Cointeq = UR - (0.4404*M2g_POS + 0.3982*M2g_NEG-2.2856) | | | | |
| Long Run Coefficients | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| M2g+ | 0.440 | 0.179 | 2.457 | 0.023 |
| M2g- | 0.398 | 0.182 | 2.186 | 0.041 |
| C | -2.286 | 4.569 | -0.500 | 0.622 |

The speed of adjustment as determined by the size of the coefficient on the error correction term is about 0.473 in absolute value. This indicates that gradual improvements in money supply can steer the rate of unemployment to equilibrium at the long run. The long-run coefficients showed that both the positive and negative shocks to money supply growth are important to the rate of unemployment during the transition to the new equilibrium. The positive shock is more likely to lead to increased economic activities and thus reduce unemployment rate. On the other hand, the negative shock can lead to lower economic activity and higher unemployment rate.

The estimated coefficients in Table 4 indicate that the Wald tests reject the null in long-run symmetry ($\beta^+ = \beta^-$). However, the null hypothesis of $\pi_j^+ = \pi_j^-, \forall j = 0, \dots, q-1$ or $\sum_{j=0}^{q-1} \pi_j^+ = \sum_{j=0}^{q-1} \pi_j^-$ over the short-run could not be rejected (Equation 8).

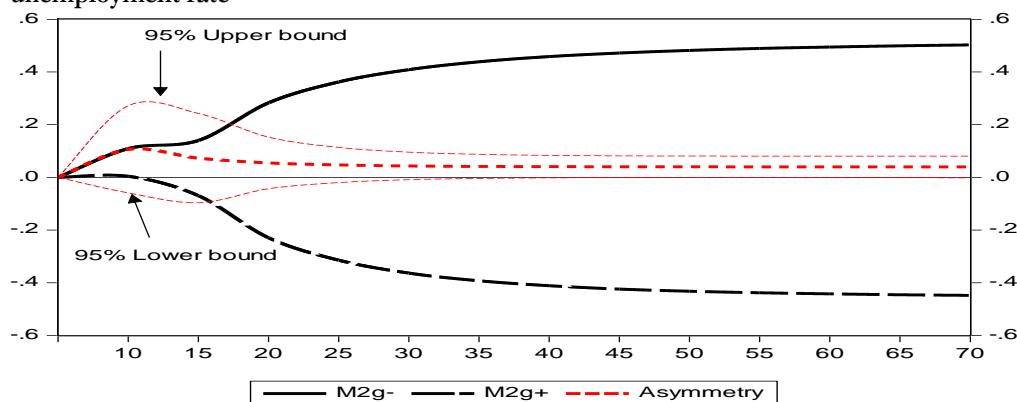
Table 4: NARDL Analytical Summary

| Estimated Coefficients | | |
|---|----------|---------|
| Parameter | Estimate | Prob |
| ρ | -0.473 | 0.005** |
| β^+ | 0.440 | 0.023** |
| β^- | 0.398 | 0.041** |
| π_0^+ | -0.024 | 0.795 |
| π_0^- | 0.077 | 0.328 |
| $\sum_{j=1}^{q-1} \pi_j^+$ | 0.110 | 0.127 |
| $\sum_{j=1}^{q-1} \pi_j^-$ | -0.005 | 0.934 |
| Symmetry Tests | | |
| Long-asymm | 6.078 | 0.014** |
| Short-asymm | 1.354 | 0.245 |
| $\sum_{j=1}^{q-1} \pi_j^+ = \sum_{j=1}^{q-1} \pi_j^-$ | 0.437 | 0.508 |
| ** implies significant at 5% | | |
| Diagnostics | | |

This implies that the positive and the negative components of money supply growth have different impact on unemployment rate and impose different long-run equilibrium relationships between the positive and the negative shocks as shown in Figure 3. The test of long run equilibrium amongst these variables could also be seen through the hypothesis that $\rho = 0$ (meaning that there is no long-run relationship between the levels of UR_t , $M2g_t^+$ and $M2g_t^-$) being rejected.

The asymmetric cumulative dynamic multiplier in Figure 4 allows us to easily depict in an intuitive manner the pass-through to a new equilibrium (trace the asymmetric adjustment patterns following the positive and the negative shocks to money supply growth). The positive and negative change curves provide the information about the asymmetric adjustment of unemployment rate to positive and negative shocks to money supply at a given forecasting horizon, respectively.

Figure 4: Asymmetric cumulative dynamic multiplier: Impact of money supply growth on unemployment rate



The lower and the upper bands for the asymmetry indicate a 95 percent confidence interval. The graph shows that in the short run unemployment rate reacts positively and is linked to the impact of the negative changes in money supply to GDP growth. However, after the first ten months, it started declining towards positive shock to money supply but the in the long-run, the cumulative unemployment reaction becomes stable at equilibrium position. This result is in tandem with the modern theory of money neutrality. Specifically, it clearly underscores the importance of taking into consideration the positive and the negative growth when investigating the relationship between unemployment rate and money supply, making it possible to judge the quantitative effects of monetary policy on unemployment.

CONCLUSION AND POLICY IMPLICATIONS

The paper presents evidence of a cointegrated relationship between unemployment rate and money growth for Nigeria using the asymmetric ARDL approach over the period 1985-2015. Unlike the dynamic adjustment in most ECMs, which were discussed in terms of the percentage of the disequilibrium error that is corrected in each period, the paper employs asymmetric dynamic multiplier (ADM) that provides an intuitive and computationally straightforward means of assessing the traverse between the short- and long-run relationships. In addition, the ADM sheds light on the nature of the dynamic adjustment, and maps the gradual movement of the process under examination from initial equilibrium through the shock and toward the new equilibrium. The paper also specifies a linear relationship between unemployment and money growth and finds that there is no cointegration in the

estimation of the linear model. These results suggest that the imposition of long-run symmetry where the underlying relationship is nonlinear will confound efforts to test for the existence of a stable long-run relationship and will result in spurious dynamic responses. Similarly, it underscores the importance of correctly capturing short-run symmetries (asymmetries) in order to shed light on potentially important differences in the response of policy makers to positive and negative shocks.

In summary, there is an implied path for money supply growth pass-through effect on unemployment rate in Nigeria. More so, if economic activity is stimulated with an increase in money supply, which involves putting more money in the hands of consumers, this will stimulate spending and unemployment rate will decline. However, in the long run, it will adjust towards equilibrium level, as money supply is decreased to stabilise inflation. These results are consistent with the quantity theory of money, which assumes that the quantity of money is the main influence of economic activity in a society. Increase in money supply may reduce unemployment through a positive multiplier effect on output and incomes, but will primarily cause a change in spending (make consumption typically more attractive relative to savings), thus, supporting inflation. This is also in tandem with previous study by Orji and Okafor (2015) on the relationship between money supply and inflation. Hence, policy makers need to monitor the rate of change of the quantity of money when taking monetary policy decisions as proposed by Friedman (1968) because shocks to spending could have their derivation in the shocks to money supply.

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