An examination of the structural inflation dynamics in Nigeria

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Abstract

The attainment and sustenance of price stability defined as single digit inflation is expected to create an enabling environment for the growth of the real sector. This has been one of the cardinal goals of the Central Bank of Nigeria's monetary policy, since its establishment in 1958. However, in most of the years the attainment of this objective had been elusive as episodes of very high inflation rates were prevalent, especially in the 1980s and 1990s in Nigeria. Among other issues, the Central Bank of Nigeria has regarded inflation as monetary phenomenon, requiring management of monetary aggregates as a means of price stability. Persistent high rates of inflation despite sluggish growth in monetary aggregates suggest that there could be other drivers of inflation outside of monetary factors.   Against this backdrop, this study examines the dynamics of inflation in Nigeria, including the structural evolution as well as the direction of its movement with a view to designing appropriate policy measures to rein in the inflationary pressures. Following Argy (1970) and Masha (1996), four (4) hypotheses of structural variables namely; agricultural bottleneck, demand shift, export variability, and foreign exchange scarcity were tested. The study utilised quarterly data from 1970(1) to 2013 (4) except for Bureau de Change (BDC) premium where the duration was 1991(1) to 2013 (4) based on Auto Regressive Distributed Lag (ARDL) model.   The results show that structural factors like budget deficit, rainfall, variation in export, exchange rate premium have profound influence on movement in CPI in Nigeria during the period. Exchange rate premium appears to significantly influence inflation in both the short- and long-run equations while most of the other structural variables are significant only in the long-run. The study therefore concludes that the monetary authority should incorporate structural variables in its inflation model in order to holistically rein in inflationary pressures in Nigeria.

Keywords: Price Stability, Monetary Policy, Central Banks

JEL Classification Numbers: E31, E52, E58

I.   Introduction

The Central Bank of Nigeria, since its establishment in 1958, has continued to strive to achieve and sustain price stability measured in terms of single digit inflation target, with a view to strengthening real output and employment. In pursuance of this goal, the Bank has relied heavily on monetarist's axiom which believes that inflation

is always a monetary phenomenon and therefore monetary authority should keep a firm grip on growth in monetary aggregates in order to achieve low and stable price level in the economy. This position derives strength from the classical school of thought which postulates that growth in price level is positively related to growth in money supply. In line with this thesis therefore, the monetary policy of the Central Bank of Nigeria, for a considerable time, focused on direct control of monetary aggregates in order to achieve the ultimate objective of low and stable inflation. Experiences over the years have however shown evidence of persistent rising inflationary trend despite sluggish growth in money supply, suggesting that other factors outside monetary factors are at play in inflationary development in Nigeria.

To reinforce this view, anecdotal evidences have shown that inflationary developments in most developing economies are significantly influenced by non-monetary factors including climatic conditions, the structure of production, level and availability of foreign exchange as well as political and security conditions (Lim 1987, Yeldan 1999, Sowa and Kwakye 1993). Reflecting this position, policy makers and academics have argued that central banks should not focus on the entire gamut of inflation as measured by the headline but should concentrate on the core component given that significant drivers of headline inflation are non-monetary and therefore outside the control of central bank. The counter argument however is that focusing only on a measure of inflation is not sufficient to deliver on economic growth and development which is the ultimate objective of economic policy. Thus, there is a compelling need to have a holistic view of movement in price level, which implies that both monetary and non-monetary factors should be taken into consideration in formulating policies aimed at taming inflation. This, invariably, requires empirical based studies that would identify non-monetary factors which drive inflation in Nigeria in view of the fact that significant deal of effort have been invested on the impact of monetary factors.

Apart from few authors like Masha (1996), Akinnifesi (1984), and Fashoyin (1986) most of the research works on inflation in Nigeria have viewed it from the prism of monetary phenomenon, leaving significant knowledge gap about other factors that could influence price development and by extension constrain policy. Given the apparent disconnect between monetary aggregates and inflation outcomes in recent times, policy makers and academics are now beginning to have a rethink on inflation and monetary growth nexus in Nigeria.

In light of the foregoing, the pertinent questions include: does structural inflation exist in Nigeria? Which element(s) of structural inflation is dominant in Nigeria? What is the dynamic nature of the various elements of structural inflation in Nigeria? Lack of

precise answers to these questions, constitute a significant gap in knowledge and by extension effective formulation of monetary policy. This study intends to fill this gap by examining the possibility of structural inflation in Nigeria as well as the relative influence of such structural factors on the movement in price level. Unlike most of the works on Nigeria which employed ordinary least square regression techniques, this study employs bound test cointegration and Auto Regressive Distributed lag (ARDL) methods. This approach provides sufficient insight to the existence of long-run relationship among the variables, hence obviates the likelihood of spurious regression, among others advantages. The output is expected to improve the contents of information provided to the policy makers, especially the Monetary Policy Committee of the Central Bank of Nigeria and other relevant stakeholders.

The remainder of this paper is organised as follows: section two examines both theoretical and empirical literature while section three dwells on the methodology. Section four contains descriptive and empirical analyses while section five concludes the study.

II. Literature Review
II.1 Theoretical Literature

Conceptually, inflation is defined as a sustained increase in the general level of prices for goods and services. It is a phenomenon that affects all economies irrespective of their stages of development, producing undesirable results, and making monetary authorities to direct considerable effort to curbing it. Fundamental economics identify some causes of inflation to include cost push and demand pull. Cost-push inflation arises from increasing factor cost in the production process e.g. rising wages, rising capital cost, etc., while Demand-pull inflation stems from excess demand or expenditure above the currently existing productive capacity of the economy.

Several schools of thought including monetarists, Keynesians, neo-classical and structuralists have attempted to explain the causes of inflation in an economy. The conflict theory asserts the origin of inflation as an outcome of the process of competition amongst economic agents over total factor income in the economy. Price stability would only occur if total factor income claims by the competing agents is less than or equal to actual real economic output. Thus, if wages rises beyond average labour productivity, firms would respond by increasing prices in order to restore their share of total real output.

Both the Keynesian and monetarist schools attribute the cause of inflation to demand factors. In the Keynesian case, inflation arises because of the gap that exists when current aggregate demand exceeds the current full employment output. The

Keynesians assume endogenous money supply. Keynes (1936) provided a soothing exposé about inflation. He noted that there would always be underemployment in the economy and therefore, an increase in money supply would lead to increase in employment and output. However, Keynes' alluded to the possibility of bottleneck in production and the concept of diminishing returns and concluded that at the level of full employment, inflation could occur. Thus, both the Neo-classical and Keynesian postulations are based on demand side analysis.

Monetarists on the other hand, attribute the root cause of inflation to excess supply of money in the economy, too much money chasing too few goods beyond the existing absorptive capacity of the economy. The monetarists' argument relies on the quantity theory of money, which assumes that money supply is exogenously determined and changes in same would result in an equal directional change in price (Friedman, 1956).

The Structuralists trace the origin of inflation to structural bottlenecks, which constrain productive and allocative efficiency in the economy. Inflation is seen to originate from the supply side, which are propagated through the financial sector. Money supply is assumed to be endogenous, while inflation is delinked from money supply and is assumed to be caused by imbalances in the economy that are non-monetary in nature. These imbalances include supply bottlenecks (inelastic food supply), competition by groups over share of factor income that manifests in rent seeking activities and high import dependence for intermediate goods amongst others.

Phillip (1958) maintained that there is a stable inverse relationship between inflation and the rate of unemployment.

Figure 1: Phillips Curve showing relationship between Inflation and rate of Unemployment
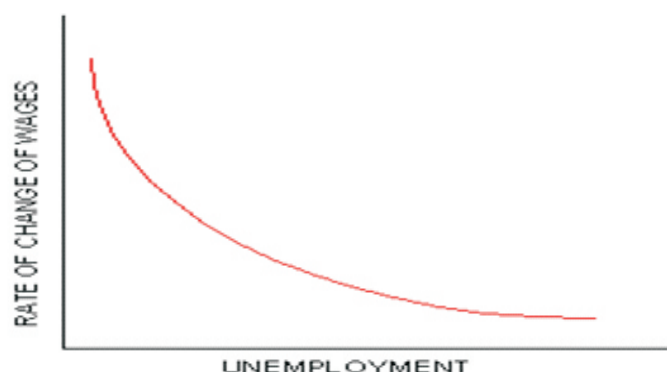
That proposition gained wide acceptability among macroeconomists in the 1960s. However, some economists contended that Phillips curve analysis was too simplistic and could not in explain real world problems and trade-offs. That thinking gave impetus to the theory of Non-Accelerating Inflation Rate of Unemployment (NAIRU) that explained the likelihood for the occurrence of stagflation. The argument against Phillips Curve relates to market 'imperfections.' The South American structuralists School emphasised structural rigidities as the principal cause of inflation.

The structuralists agreed with the Neo-classical school that inflation is necessary to engender growth but argued that as the economy develops, some rigidity arises in the system thereby leading to structural inflation. Beginning with non-agricultural income, aggregate demand increases in consonance with high growth rate. The resultant pressure from a growing population and high demand for goods and services induce a rise in the general price level as well as wages. Another cause of structural inflation in developing economies is the adoption of protective measures, which leads to increased prices of the local industrial products (Olivera, 1964). Buttressing this view, Hall and Hitch (1939) argued that the existence of relative price rigidity in markets other than pure competition showed that prices were 'administered'. Furthermore, firms operating in non-perfectly competitive markets fix their own prices arbitrarily.

Olowo (2003) asserted that structural bottlenecks emerge as economies develop and transits from agrarian to manufacturing. Invariably, population growth and upward trending urban wages exert pressures on the system, which kick starts a vicious mechanism that leads to increasing prices of agricultural produce and feeds into increased price levels and further wage increases. This is further aggravated by low capital, financial base and foreign exchange restraints and government intervention to accelerate the industrialisation process by taking a prominent role in industrial, manufacturing and infrastructure development either through deficit financing or monetisation.

Categorically, structuralists posit that inflation results from supply inelasticity; rise in agricultural product prices, worsening terms of trade, devaluation, import substitution, among others. Compared with Phillips curve and the monetarist theory of inflation, structuralists have a broader approach to understanding the inflation phenomenon.

II.2   Empirical Review

The causes of inflation within the traditional monetarists school, underscores the relationship between money supply and inflation. Monetarists see inflation as "always and everywhere a monetary phenomenon" (Friedman, 1956). However, several studies including Akinboade, Niedermeier and Siebrits (2004), have identified non-monetary factors among the key determinants of inflation in both industrialized and emerging economies. In particular, exchange rate depreciation has been identified as a significant cause of inflation, directly through the price of tradable goods, and indirectly through imported inputs and exchange rate indexed nominal wages. Ho

and McCauley (2003) in a study on inflation in emerging countries found that exchange rate depreciation affect inflation significantly.

Beside the commonly identified structural elements, the impact of movement in wages on price levels has also been investigated by some authors. For instance Harberger (1963) showed that in Chile, wage changes appear not to cause significant increase on price level. The authors however, emphasized that the finding was probably a reflection of the level of development of the economy given that price level may not react to wage level in developing economies due to myriad of factors including cost of capital that could mask the effect of wage increase. Nonetheless, Greene (1989) found that the general price level could be impacted even in developing economies when the rate of change in wage is higher than the general price level.

Moore and Smith, (1986) and Akinboade, Niedermeier and Siebrits (2004) found that increases in wage level impacted on general price level in South Africa. They found a positive correlation between inflation and wage level, and concluded that wage changes were among the key drivers of structural and cyclically upward trend in inflation.

Argy (1970), appraised the contribution of structural elements to inflation in developing countries by testing four hypothesis namely demand-shift, export variability, agricultural bottleneck, and foreign exchange scarcity.   Most of the structural elements performed poorly in the model, thus the author concluded that monetary variables were the main determinants of inflation in developing economies.

Contrary to the finding of Argy, a number of studies have shown that non-monetary factors pose significant threat to price level in many developing economies. Lim (1987), Yeldan (1999), Sowa and Kwakye (1993), and Kwargbo (2011) showed that developments in price level were positively correlated with underlying structural factors in the economy rather than changes in monetary aggregates alone. Kwargbo (2011) found that monetary and credit contraction increases the cost of working capital required for the expansion of the real sector thereby causing short-run stagflation and supply shocks. Reinforcing this position, Adu and Marbuah (2011) identified real output, interest rate, nominal exchange rate, fiscal deficit, terms of trade, expansionary fiscal stance, shock to agricultural output, and government consumption as the major structural elements in most of the developing economies. Furthermore, Durevall and Ndung'u (1999), in a study on inflation dynamics in Kenya between 1974 and 1996, reported that the long run inflation was determined by developments in exchange rate, foreign prices and terms of trade, while developments in money supply and interest rates only impacted on inflation in the short run.

Another strand of the literature investigates the joint impact of both monetary and structural factors on price level. Adusei (2013) estimated an error correction model for South Africa to isolate the short and long run impact of selected monetary and structural factors in inflation. Dummy variables used to capture structural break included stock market crash and collapse of the apartheid regime. The result indicated that degree of openness of the economy as well as monetary variables were the key drivers of inflation in South Africa.

Findings of several studies on inflation in Nigeria broadly corroborate the results in other developing and emerging economies. Adebuga et al (2012) estimated a Quantity Theory of Money type model and reported that Nigeria's inflation was not purely monetary in nature as the results indicated that the elasticity of price with respect to money supply was less than one.

Evidence of structural inflation as well as joint impact of both monetary and structural factors was reported in (Ajayi and Awosika, 1980; Fashoyin, 1986; and Akinnifesi, 1984) on Nigeria. Structural factors commonly identified included development in the oil sector, wage level, imports, exports, and indirect taxes. Asogu (1991) studied the determinants of inflation in Nigeria using 10 different specifications. He found that money and exchange rates were significant determinants of inflation in all equations. Furthermore, the results suggested that inflation was significantly determined by real GDP, price of domestic agricultural produce, output of industrial sector, net exports, exchange rate and money supply. This finding was corroborated by Chete, Egwaikhide, and Fatokun (1994) who found that monetary and structural variables as well as the openness of the Nigerian economy were important determinants of the inflation in Nigeria.

Moser (1995), using an error correction model, established that monetary variable, exchange rate, and real income significantly impact on inflation. He noted that the monetary impact was driven by expansionary fiscal policies and agro-climatic condition. The impact of official and parallel exchange rates was underscored in Masha (1996), and Chete, Egwaikhide, and Fatokun (1994). Masha (1996)based on the results obtained from two stage least squares, pointed out that developments in the parallel foreign exchange market was a significant determinant of inflation in Nigeria. The developments in parallel exchange rate resulted in inflation through increases in production costs, which was passed on to consumers.

In a related study, Itua (2000) argued that structural, demand-pull and cost-push factors were the major causes of inflation in Nigeria between 1981 and 1998. Other authors including Olowo (2003), and Folarin and Sanni (2010) confirmed Itua's findings. Similarly, Olubusoye and Oyaromade (2008) found that past inflation expectation, developments in the oil market and real exchange rate were factors that significantly drive inflation in Nigeria.

Adebayo (2008) put the impact of structural factors in perspective by arguing that strategies to promote industrial and agricultural production must be introduced in addressing inflation in Nigeria.

III.   Methodology
III.1   Data

The quarterly data used in this study covers the period 1970(1) to 2013(4), except for the data on Bureau de change (BDC) premium which ranged from 1991:1 to 2013:4. The data were obtained from the Central Bank of Nigeria (CBN) statistical database and National Bureau of Statistics (NBS). The variables include Real GDP (Y), Consumer Price Index (P), Broad Money (M_2), Budget Deficit (BD), Demand Shift (DS), Quarterly Rainfall (QR), Exchange Rate Premium (EP), naira value of external reserves (NR), Variance of Export (VEX); and Excess Demand (ED).

III.2   Model Specification

In line with the literature, we assume that price developments are a function of non-structural/nominal variables (i.e. Money supply [M_2] and output level [Y]), fiscal variables (i.e. budget deficit [BD]) and structural variables (i.e. quarterly rainfall [qr] to estimate the impact of agricultural bottleneck, excess demand [ed], exchange rate premium [EP] and naira value of foreign reserves [nr] to capture the impact of foreign exchange scarcity, demand shift [ds] and export variability [vex]). This is represented in equation (1) and (2).

$$p_t \quad f(M_{2t}, bd_t, qr_t, ed_t, ep_t, ds_t, nr_t, vex_t, y_t) \tag{1}$$

$$p_t \quad c_t m_{2t} \ bd_t \ qr_t \ ed_t \ ep_t \ ds_t \ nr_t \ vex_t \ y_t \tag{2}$$

An estimable function is derived from taking logs of equation (2) and is expressed as equation (3), which is the long-run equilibrium relationship. The variables are defined above, while the coefficients represent the elasticity of the variables with respect to price, c is the constant term, and εt is the error term.

$$\ln p_t = c + \alpha \ln m2_t + \beta \ln bd_t + \phi \ln qr_t + \eta \ln ed_t + \delta \ln ep_t + \gamma \ln ds_t + \lambda \ln nr_t + \tau \ln vex_t + \psi \ln y_t + \varepsilon_t \tag{3}$$

The *apriori* expectations based on theoretical underpinning of the four hypotheses are presented in Table 3. The additional variables included in the model (annual rainfall and the naira values of foreign exchange reserves) are expected to have a negative coefficient. Agriculture in less developed economies, including, Nigeria is essentially rain-fed, rudimentary and subsistence, involving very low level mechanisation. Thus, the higher the average rainfall and the more evenly distributed, the greater the expected agricultural output.

For developing countries, food consumption accounts for a significant proportion of household consumption thereby constituting a significant weight in the CPI basket. Consequently, factors that affect agriculture production invariably impact on inflation. As a country builds up foreign external reserves arising from improved international trade and/or capital receipts, the domestic currency appreciates vis-à-vis the currency of its trading partners. The appreciation of the currency is expected to moderate the impact of imported inflation, thus improvement in external reserves should be negatively signed, all things being equal.

Table 1: A priori expectations of the signs of coefficient

S/N	Variable	A priori coefficient
1	QR	Negative
2	BD	Positive
3	DS	Positive
4	ED	Positive
5	M2	Positive
6	NR	Negative
7	Y	Negative
8	VEX	Positive
9	EP	Positive

Source: Authors' computation

III.2.1   ARDL Methodology

The paper adopted the Auto Regressive Distributed Lag (ARDL) bound test approach developed by Pesaran et al., (1999) to test the existence of cointegration of the variables and Vector Error Correction Model (VECM) to model the long-run and dynamic relationship between the dependent variable, CPI and the independent variables (i.e. fiscal, structural and Monetary). The approach allows the estimation of the cointegration relationship using Ordinary Least Square (OLS) method, subsequent to the identification of the lag order of the model. Significantly, the approach facilitates estimation of variables that are I (0), I (1) or mutually cointegrated and is relatively efficient with small sample sizes.

The bounds test procedure was applied to equation (3) using Vector Auto Regressive (VAR) model of order p in

$$z_t \quad c_0 \quad t \quad \sum_{i=1}^{p} {}_t z_{t-i} \quad {}_t, t \quad 1,2,3,......, T$$

Where C_0 and ω are a *(k+1)* vector of intercepts and trend coefficients, respectively. In line with Pesaran et al (1999), the derived Vector Equilibrium Correction Model (VECM) for equation (4) is represented by equation (5).

$$z_t \quad c_0 \quad t \quad z_{t-i} \quad \sum_{i=1}^{p} {}_i z_{t-i} \quad {}_t, t \quad 1,2,3,...., T$$

The long-run multiplier and short-run dynamic coefficients of the VECM are contained in the *(k+1)*(k+1)* matrices $I_{k-1} \sum_{i=1}^{p} {}_i$ and $\sum_{j-i-1}^{p} {}_i$ respectively.

Z_t is a vector of the dependent I(1) variable Y_t represented in our model as $\ln P_t$ and independent variable, $M2_t, bd_t, qr_t, ed_t, ep_t, ds_t, nr_t, vex_t, y_t$
 which forces the I(0) and I(1) variables to be defined with a multivariate identically and independently distributed (i.i.d) zero mean error vector ${}_t \quad ({}_{1t}, {}_{2t}')'$ generated by a homoscedastic process. The existence of a unique long-run relationship between the variables implies that we can represent the conditional VECM (5) as equation (6).

$$y_t \quad c_{y0} \quad t \quad {}_{yy} y_{t-1} \quad {}_{xx} x_{t-1} \quad \sum_{i=1}^{p-1} {}_i y_{t-1} \quad \sum_{i=1}^{p-1} {}_i x_{t-1} \quad {}_{yt}, t \quad 1, 2,....., T \qquad (6)$$

Based on equation (6), the conditional VECM pertaining to our model can be represented as equation (7):

$$\ln p_t = c_0 + \beta_1 \ln p_{t-1} + \beta_2 \ln m2_{t-1} + \beta_3 \ln bd_{t-1} + \beta_4 \ln qr_{t-1} + \beta_5 \ln ed_{t-1}$$
$$+ \beta_6 \ln ep_{t-1} + \beta_7 \ln ds_{t-1} + \beta_8 \ln nr_{t-1} + \beta_9 \ln vex_{t-1} + \beta_{10} \ln y_{t-1}$$
$$+ \sum_{i=1}^{p} \ln p_{t-1} + \sum_{i=1}^{p} \ln m2_{t-1} + \sum_{i=1}^{p} \ln bd_{t-1} + \sum_{i=1}^{p} \ln qr_{t-1} + \sum_{i=1}^{p} \ln ed_{t-1}$$
$$+ \sum_{i=1}^{p} \ln ep_{t-1} + \sum_{i=1}^{p} \ln ds_{t-1} + \sum_{i=1}^{p} \ln nr_{t-1} + \sum_{i=1}^{p} \ln vex_{t-1} + \sum_{i=1}^{p} \ln y_{t-1} + \varepsilon_t$$

Where c_0, β_i and ε_t represent the constant term, long run multipliers and the error term.

III.2.2 Bounds Testing Procedure

In order to carry out the bounds test, we estimate equation (7) using OLS method and perform an F-test of joint significance of the coefficients of the lagged variables to determine the existence of a long-run relationship. The test that is normalized on P is represented by $F_p(P \mid m2, bd, qr, ed, ep, ds, nr, vex, y)$

This entails testing the null hypothesis:
$H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = 0$ against the alternative hypothesis $H_1: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} \neq 0$. The critical values provide a test for cointegration for independent variables of order I(d) given that ($0 \leq d \leq 1$). The lower bound indicates that the variables are I(0), while the upper bound indicates that the variables are I(1), the null hypothesis is rejected and the variables are statistically cointegrated in the long-run if the F-statistic is greater than the upper critical value. The null hypothesis is accepted if the F-statistic is below the lower critical value, and the result is deemed inconclusive if the F-statistics lies between the upper and lower bounds.

Having established long-run cointegration, the methodology requires that we estimate the long-run unrestricted ARDL $p_1, q_1, q_2, q_3, q_4, q_5, q_6, q_7, q_8, q_9$ model represented by equation (8) to determine the optimal lag length and the order of the ARDL model.

$$\ln p_t = c_0 + \sum_{i=1}^{p} \beta_1 \ln p_{t-i} + \sum_{i=1}^{q1} \beta_2 \ln m2_{t-i} + \sum_{i=1}^{q2} \beta_3 \ln bd_{t-i} + \sum_{i=1}^{q3} \beta_4 \ln qr_{t-i} + \sum_{i=1}^{q4} \beta_5 \ln ed_{t-i}$$
$$+ \sum_{i=1}^{q5} \beta_6 \ln ep_{t-i} + \sum_{i=1}^{q6} \beta_7 \ln ds_{t-i} + \sum_{i=1}^{q7} \beta_8 \ln nr_{t-i} + \sum_{i=1}^{q8} \beta_9 \ln vex_{t-i} + \sum_{i=1}^{q9} \beta_{10} \ln y_{t-i} + \varepsilon_t$$

Finally, an error correction model represented by equation (9) is estimated to obtain the dynamic coefficients associated with the long-run model.

$$\ln p_t = c_0 + \sum_{i=1}^{p} \alpha_i \ln p_{t-i} + \sum_{j=1}^{q} \beta_j \ln m2_{t-j} + \sum_{k=1}^{q} \gamma_k \ln bd_{t-k} + \sum_{l=1}^{q} \delta_l \ln qr_{t-l}$$

$$+ \sum_{m=1}^{q} \phi_m \ln ed_{t-m} + \sum_{n=1}^{q} \eta_n \ln ep_{t-n} + \sum_{o=1}^{q} \lambda_o \ln ds_{t-o} + \sum_{p=1}^{q} \mu_p \ln nr_{t-p} + \sum_{r=1}^{q} \nu_r \ln vex_{t-r} + \sum_{s=1}^{q} \omega_s \ln y_{t-s} + \theta ecm_{t-1} + \varepsilon_t$$

The short-run dynamic coefficients are , , , , , , , , *and* while the rate of adjustment to equilibrium is .

IV.   Analysis of Results
IV.1   Descriptive Analysis

For a considerable time dating back to the commencement of operation by the CBN in 1959, monetary policy was based on direct control of monetary aggregates in order to achieve the ultimate objective of low and stable inflation. Apart from the fact that the monetary authority could not effectively control monetary aggregates during the period, preliminary observation revealed that movements in money supply and inflation were not completely synchronized. On a general note, the outcome of monetary policy has been mixed, albeit dominated by high inflation. The outturns could be classified into three phases; low, moderate and high inflation. We classify as low when inflation was in single digit, while inflation rate within the range of 10 and 14 per cent is classified as moderate. The outturn of above 15 per cent is considered high.

Figure 1.0 below shows the trend of inflation in relation to money supply from 1970 to 2012. Periods of low inflation were generally short, found mostly in the early 1970s and a few years in the 1980s. Moderate inflation characterized the late 1970s to mid-1980s as well as from 2002 to 2012, while the rest of the period exemplified high inflation. The highest inflation rate (75.0 per cent) was recorded in 1994, followed by 60 per cent in 1988, and 40 per cent in 1976 and 1984. This period constituted the high inflation phase.

The overall performance, represented by the growth of broad money, reveals an erratic and seemingly volatile pattern except in the early to mid-1980s.

Figure 2: Growth in Broad money and Inflation
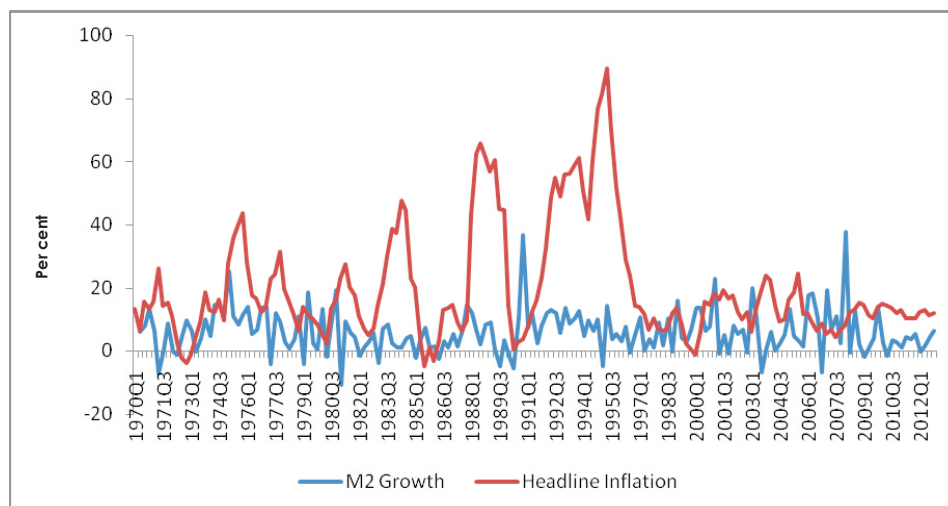
Monetary growth was generally high throughout the 1970s, reaching its peak of 80.0 per cent in 1976, while other periods of growth in excess of 40.0 per cent included the early 1980s, 1990s, and the later part of the 2000s decade.

In terms of co-movement, there seems to be some alignment in trend between the two variables in some periods while wide deviation was visible in other periods. The highest growth of money supply (80 per cent) in 1976 was associated by a significant rise in inflation rate (40.0 per cent) in the same year. Similar trends in movement were also noticed in other periods such as 1988 and 1994. In the early 1980s, late 1990s and 2000s, however, a sharp contrast was observed in the direction of inflation and money supply with the phenomenon being more pronounced in the later part of the 2000s.The divergent in movement of the variables gives credence to the likelihood of structural inflation in the economy.

Apart from diverging movement in the two variables which supports presence of structural inflation, detailed analysis revealed that other factors besides the growth in money supply contributed to high inflation in periods of co-movements. For example the high level of inflation in 1976 was not just due to high growth of money supply but the influence of drought which ravaged the Northern part of the country during the period. Thus, the high level of inflation recorded during the period could also be ascribed to supply shocks.

Similarly, the high inflation in the mid-1970s was attributed to significant distortion in the foreign exchange market. This was a period of fixed exchange rate in which there was a huge premium between the official and the parallel market rates, traced to bottlenecks in the production process. Furthermore, the very high level of inflation (40.0 per cent) in 1985, against a paltry growth of 12 per cent in money supply further reinforced the likelihood of the ascendancy of structural inflation in the country. During the period, significant pressure by external creditors compelled the government to reach an agreement with the International Monetary Fund (IMF) in which the devaluation of the domestic currency was part of the options for consideration. Economic units expected the devaluation of the naira, and consequently factored in the anticipated exchange rate in the pricing regime. The highest level of inflation of 60 - 70 per cent was between 1994 and 1995 when the country was confronted with serious socio-political challenges arising from the political impasse caused by the annulment of the1993 general election, which persisted till 1994. This created an environment that constrained economic activities with the attendant supply shock. The trend analysis therefore tends to lend credence to the existence of structural inflation in Nigeria during the period.

IV.2   Empirical Results
IV.2.1   Unit Roots Tests

In estimating the ARDL Bound testing procedure, it is pertinent to ensure that none of the variables under consideration are I(2). The time series properties of the data were evaluated by adopting Augmented Dickey Fuller (ADF) and Phillips-Peron (PP) procedures for unit root tests. The results as reported in Table 2 show that all the variables are either stationary at levels or at first difference. Specifically, four out of the ten variables are stationary at level I (0), while six are stationary after first difference I(1).

Table 2:		UNIT ROOT TESTS			
VARIABLE			**TESTS**		**CONCLUSION**
	Order of Integration	**ADF**		**PP**	
Buddef (BD)	Level	-1.8711		-0.8791	I(1)
	1St Diff	-3.6688		-5.5316	
Rainfaff (QR)	Level	-3.5404		-14.4036	I(0)
CPI (P)	Level	14.2391		14.166	I(1)
	1st Diff	-10.9922		-9.1462	
Demand Shift (DS)	Level	-3.2315		-5.9559	I(0)
Broad Money (M2)	Level	6.1292		6.0423	I(1)
	1st Diff	-5.356		-10.7838	
NERV (ER)	Level	-0.501		0.648	I(1)
	1st Diff	-4.6293		-13.4465	
VARANEXP (VEX)	Level	-4.678		Money	I(0)
RGDP (Y)	Level	1.2577		0.9316	I(1)
	1st Diff	-5.1479		-19.1724	
EXPREM (EP)	Level	-2.2729		-2.3053	I(1)
	1st Diff	-9.5201		-9.5199	
EXDD2 (ED)	Level	-12.9571		-12.9803	I(0)

Source: Authors' computation.

IV.2.2   Bounds Tests for Cointegration

In line with ARDL analysis procedure, we investigate the presence of long-run relationships in equation (6), using equation (7). Based on the AIC, we chose maximum lag order of 7 for the conditional ARDL-VECM. The results of the bound test are presented in table 4.2 below.

Table 3: Results of Bounds Tests

S/N	Equation	Lag Length (AIC)	F-Obs	F-Lower	F-Upper	Remarks
I	F_P (P|M2,BD,QR,ED,EP,DS,NR,VEX,Y)	7	5.37630	2.54	3.86	Cointegration
II	F_{M2} (M2|P,BD,QR,ED,EP,DS,NR,VEX,Y)	1	2.90930	2.54	3.86	Inconclusive
III	F_{BD} (BD|P,M2,QR,ED,EP,DS,NR,VEX,Y)	8	2.70810	2.54	3.86	Inconclusive
IV	F_{QR} (QR|P,M2,BD,ED,EP,DS,NR,VEX,Y)	7	3.81730	2.54	3.86	Inconclusive
V	F_{EP} (ED|P,M2,BD,QR,EP,DS,NR,VEX,Y)	3	3.60790	2.54	3.86	Inconclusive
VI	F_{EP} (EP|P,M2,BD,QR,ED,DS,NR,VEX,Y)	3	3.06490	2.54	3.86	Inconclusive
VII	F_{DS} (DS|P,M2,BD,QR,ED,EP,NR,VEX,Y)	4	2.84940	2.54	3.86	Inconclusive
VIII	F_{NR} (NR|P,M2,BD,QR,ED,EP,DS,VEX,Y)	5	1.31820	2.54	3.86	No Cointegration
IX	F_{VEX}(VEX|P,M2,BD,QR,ED,EP,DS,NR,Y)	0	5.58420	2.54	3.86	Cointegration
X	F_Y (Y|P,M2,BD,QR,ED,EP,DS,NR,VEX)	5	3.92620	2.54	3.86	Cointegration

Source: Authors' computation

The bound test results in table 3 above indicate that we cannot reject the null hypothesis of no cointegration in the exchange rate scarcity equation while the results are inconclusive on the equations of money supply, budget deficit, quarterly rainfall, excess demand, exchange rate premium, and demand shift. The results, however, suggests that a long run relationship exist between price and other variables including the structural variables.

Having established a long run co integrating relationship in equation (8), we estimate an ARDL equation of the form 7,1,1,1,1,1,1,1,1, 1 as in equation (8). The results are presented in Table 4.

Table 4: Estimated Long Run Coefficient using the ARDL Approach				
Equation (7): ARDL (7,1,1,1,1,1,1,1,1,1) Selected Based on AIC. Dependent Variable is P_t				
Regressor	Coefficient	S.E	T-Ratio	Probability
C	8.1660	2.3479	3.4780	0.0008
$LnM2_t$	1.0952	0.0834	13.1348	0.0000
$LnBD_t$	-0.0108	0.0046	-2.3437	0.0216
$LnQR_t$	0.0199	0.0137	1.4528	0.1503
$LnEP_t$	0.0381	0.0122	3.1268	0.0025
$LnED_t$	0.0159	0.0177	0.8966	0.3727
$LnDS_t$	0.3971	0.0850	4.6715	0.0000
$LnNR_t$	-0.0147	0.0454	-0.3234	0.7473
$LnVEX_t$	0.0146	0.0108	1.3447	0.1826
LnY_t	-1.6144	0.2644	-6.1048	0.0000

Source: Authors' computation.

The results in table 4 based on equation 7 revealed that broad money supply (M2), Exchange rate premium (EP), Demand Shift (DS) and Real Gross Domestic Product (Y) are significant in explaining development in the level of inflation even at 1 per cent. Budget deficit is significant at 5 per cent but the coefficient is negative contrary to apriori expectations, suggesting that an increase in budget deficit leads to moderation in price level. A rationale justification for this observation could be the investment of such expenditure on productivity enhancing projects while simultaneously placing high restrain on monetization of such deficits. The estimated coefficients of the long-run relationship show that a 1 per cent increase in broad money leads to approximately 1.10 per cent increase in inflation, all things being equal. The results further indicate that a 1 per cent increase in exchange rate premium

and demand Shift would lead to about 0.04 and 0.41 per cent increase in the level of inflation. Lastly, the sign of the real output growth (RGDP) conforms to the apriori expectation. The results indicate that a one per cent increase in output would lead to about 1.62 per cent decline in inflation.

Figure 3: Plot of Cumulative Sum (Cusum) for Coefficients Stability for ECM Model
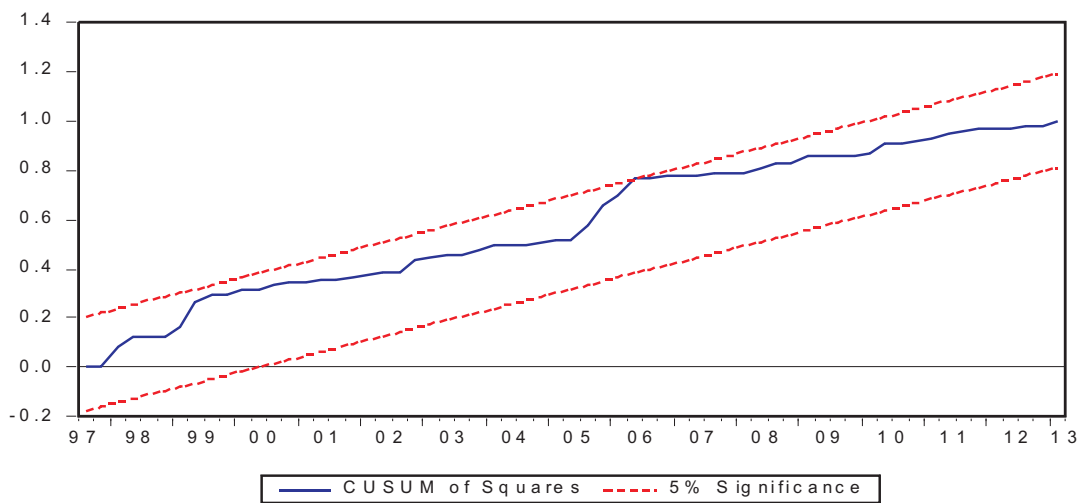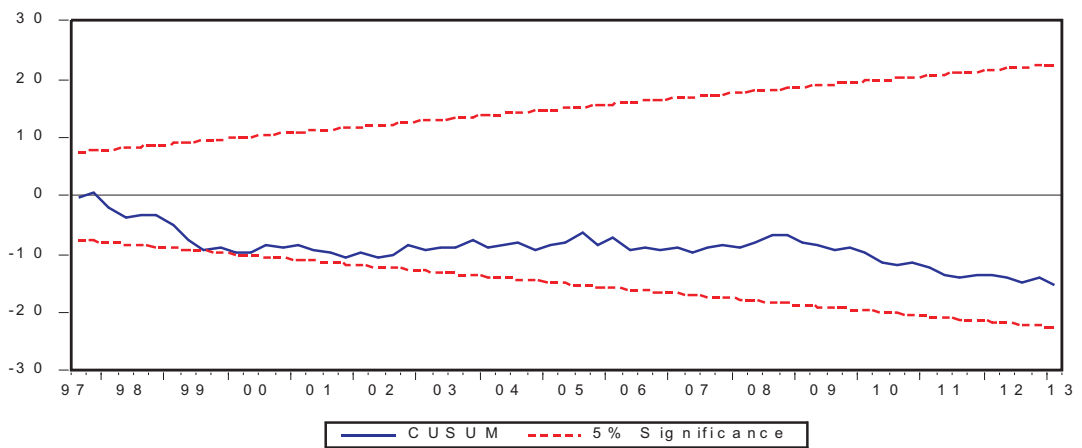

Figure 4: Plot of Cumulative Sum of Squares for Coefficients Stability for ECM Model

The coefficients of the model are stable as indicated by the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMQ) charts which are within the 5 per cent confidence interval. Similarly, the underlying regression of the ARDL equation shows that the model has roots lying inside the unit circle (see Figure 4)

Figure 5: Inverse Roots of AR Characteristic Polynomial
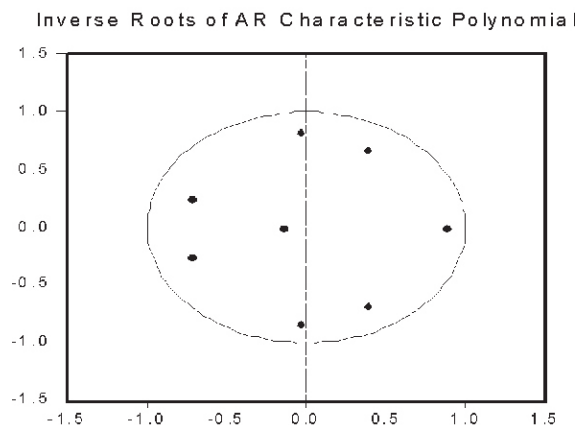

Table 5 presents the results of the short-run dynamic coefficients of the long-run relationships obtained from the ECM equation (9).

Table 5: Error Correction Representation for the Selected ARDL Model

Regressor	Coefficient	S.E	T-Ratio	Probability
C	-0.01693	0.01398	-1.21053	0.23060
DM2(-1)	0.06861	0.07980	0.85977	0.39320
DBD(-1)	0.00166	0.00143	1.16154	0.24980
DQR(-1)	-0.00354	0.00223	-1.58592	0.11780
DED(-1)	0.00066	0.00250	0.26296	0.79340
DEP(-1)	0.00602	0.00291	2.06638	0.04290
DDS(-1)	-0.01825	0.02293	-0.79573	0.42920
DNR(-1)	0.01362	0.00813	1.67514	0.09890
DVEX(-1)	0.00068	0.00179	0.38185	0.70390
DY(-1)	0.18722	0.11047	1.69467	0.09510
ECM(-1)	-0.05767	0.02494	-2.31242	0.02400

Equation (7): ARDL (7,1,1,1,1,1,1,1,1,1) Selected Based on AIC. Dependent Variable is

$ecm = \ln P + 1.189\ln M2 + 0.029\ln BD - 0.061\ln QR + 0.011\ln ED + 0.104\ln EP - 0.316\ln DS + 0.236\ln NR + 0.012\ln VEX - 3.246\ln Y - 0.294C$

R-Squared = 0.6289	R-Bar Squared = 0.4934	F-stat = 4.6422
SER = 0.0377	DW-Stat = 2.0131	
Akaike Info. Criterion = -3.4907	Schwarz Bayesian Criterion = -2.8105	

Source: Authors' computation.

Only the exchange rate premium is significant at 5 per cent while output and scarcity of foreign exchange are weakly significant at 10 per cent level. The error correction coefficient, estimated at -0.057 is significant at 5 per cent and is correctly signed. The coefficient of the error correction model suggests that about 6.0 per cent of disequilibria in a quarter is corrected in the following quarter which connotes a relatively low speed of adjustment to equilibrium after a shock.

V.   Conclusion and Recommendation

The study examines the dynamics of structural inflation in Nigeria, leveraging on the works of Argy, (1970) and Masha, (1996). The motivation was largely due to the fact that exclusive focus on monetary aggregates by the monetary authorities in developing economies has not delivered low inflation on consistent basis, suggesting that non-monetary factors could also be significant drivers of inflation. Trend analysis shows that movements in monetary aggregates and inflation were not perfectly synchronized in a significant part of the study period, lending credence to the presence of structural factors in inflationary process. The Bound test cointegration technique shows that there is a long-run relationship between the structural variables and price level while the error correction model indicates that both exchange rate depreciation and level of rainfall have significant influence on inflation in the short run. The Auto Regressive Distributed Lag (ARDL) model shows that a number of structural variables such as exchange rate premium, demand shift, and real output have significant effect on inflation. In terms of weight, shock to output appears to have the highest impact on inflation as 1 per cent contraction in output would lead to an increase in inflation by 1.6 per cent in the long run. Following output are demand shift and exchange rate premium in terms of influence on inflation.

The findings of the study have profound policy implications. Given the impact of structural factors on inflation, efforts at reining in inflation should go beyond exclusive focus on monetary aggregates to some other non-monetary factors. Specifically, the monetary authority should collaborate with relevant authorities to ensure that disruption to output is minimised. Furthermore, the premium on the exchange rate should be considerably minimized in addition to the need to moderate factors that could cause shift in pattern of demand.

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