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## Research

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# Are Fiscal Deficits Inflationary in Nigeria? Evidence from Cointegration with Structural Breaks

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## Abstract

In this paper, we model the relationship between fiscal deficit and inflation for Nigeria using annual data from 1980 to 2019. We employ the Linear ARDL approach and also account for structural breaks using the Bai and Perron (2003) test that allows for multiple structural changes in regression models. The paper finds that fiscal deficit is a major determinant of inflation along with other macroeconomic factors considered in the study. However, we observe that it may be necessary to pre-test for structural breaks when modelling the relationship between fiscal deficit and price level as it performs better than when structural events are not considered. The results imply that a fiscal management process that does not encourage increased revenue and reduce fiscal deficits in Nigeria will further worsen the level of inflation in the country.

**Keywords:** Fiscal deficit; Price level; ARDL cointegration; Structural breaks

**JEL Classification Codes:** C32; E31; E62

## 1. Introduction

The long-standing controversies between the monetarists and fiscalists on the theory of price level have received a tremendous amount of renewed interest in academic discussions as well as policy debates for the last decades. The monetarist school of thought regards the theory of price as a monetary phenomenon (see, inter alia, McCallum, 2003; Komulainen and Pirttila, 2002; Niepelt, 2004; Grauwe and Polan, 2005) and this has also been echoed by Friedman (1951) statement that “inflation is always and everywhere a monetary phenomenon”, hence, provides an exclusive role for monetary policy regarding inflation dynamics. However, an influential strand of literature, inspired by the seminal contribution of Sargent and Wallace (1981), argue that the monetary authority’s control over inflation is limited, for this reason, fiscal policy can equally be a source of inflation. Indeed, in a context of “fiscal dominance”, a loose fiscal policy can drive inflation because the central bank must ultimately monetize the public debt, consistently with the unpleasant monetarist arithmetic (Sargent and Wallace, 1981). An

alternative rationale, which is the heart of the Fiscal Theory of the Price Level (see, *inter alia*, Leeper, 1991; Woodford, 1995; Cochrane, 1999, 2001; Gordon and Leeper, 2005; Sims, 2011) or more broadly of the literature on the price level determinacy (see, e.g., Aiyagari and Gertler, 1985; Woodford, 1994), is that under fiscal dominance, newly issued nominal government bonds will cause the price level to rise to meet the government's intertemporal budget constraint.

The structural characteristics of most developing countries has made the study of fiscal inflation quite intriguing and well pronounced in the literature as these characteristics have created some bottlenecks which include dynamic inconsistencies of the monetary policies as result of non-independence of the central banks (see, Alesina and Tabellini, 1987; Van Aarle et al., 1995; and Minea et al., 2012), political instability (see, Fischer et al., 2002; Vu, 2004; Catao and Terrones, 2005; and Wimanda et al., 2011), poor tax system (see, Alesina and Drazen, 1991; Cukierman et al., 1992; Calvo and Veigh, 1999; Catao and Terrones, 2005), accessibility of external funds (see, Dornbusch *et al.*, 1990) tend to reduce seigniorage revenue and compel the government to increase dependence on inflation tax. Intuitively, the government can reduce budget deficits through the aggregate demand component either by increasing tax revenue or cutting down expenditure. As an alternative way of financing fiscal deficits, the government can easily borrow from the banks. If government finances budget deficits by selling government bonds to public then budget deficits will not create any inflation as no new money is created in the process. However, if borrowing is made from banks then monetary deposits will expand and causes inflation (Easterly and Hebbel, 1993).

While numerous studies have been conducted, no consistent evidence exists for a significance relationship between fiscal deficit and inflation, in a positive or a negative direction. Results and evidence differ by countries/region, analytical method employed, and categorisation of budget deficit. For example, empirical studies of the United States (Dwyer, 1982; Darrat, 1985; King and Plosser, 1985), and those of other industrial or developed countries (King and Plosser, 1985; Giannaros and Kolluri, 1986; Protopapadakis and Siegel, 1987; Barnhart and Darrat, 1988) have not yielded conclusive results on the deficit-inflation relationship. Meanwhile, empirical studies of developing countries, such as those of Samimi (2000), Samimi and Jamshidbaygi (2011), Metin (1998), Özatay (2000), Seljuk (2001), Tekin-Koru and Özmen (2003), Kia (2010), Loungani and Swagel (2003), and Domaç and Yücel (2005), Suliman and Ahmed (2011), Jalil et al. (2014) generally indicate that the inflationary effect of deficit financing is significant and also observe a strong causality of fiscal deficits on inflation in high-inflation countries.

The focus of this study is therefore to examine the relationship that exists between fiscal deficit and inflation rather than just monetary factors. The choice of Nigeria is a reliable candidate for evaluating the deficit-inflation nexus based on the fact that monetary authority in Nigeria in recent times has been pointing finger at the budgetary borrowing to be the main source of

inflation in the country. But, this area is not well researched in the case of Nigeria. Although few studies have shown the monetary policy behind the inflation in Nigeria (Olomola and Olagunju, 2004; Umeora, 2010) but these papers did not incorporate the fiscal side. There are few studies like Oyejide (1972), Onwioduokit (1999), Chimobi and Igwe (2010), Oladipo and Akinbobola (2011), Dockery, *et al.* (2012) which have shown conflicting results on the fiscal deficits inflation relationship. Assessing the role of inflation in Nigeria is also crucial as being a developing country it has suffered inflation that may negatively affect the living standards and purchasing power of the vulnerable segments of society. Inflation also has political cost as political governments cannot afford to allow undue increase in prices as it would have a negative impact on the vote attitude of the public during elections. This has induced the need to find the under lying causes of inflation in Nigerian economy.

Foreshadowing our main results, we find a positive relationship between inflation and fiscal deficit. In addition, the results seem to perform better when likely structural events are modelled with the nexus between budget deficits and inflation in Nigeria. Therefore, this paper calls for fiscal consolidation to bring down the prices and to depend on less inflationary policies of financing deficit.

The remainder of the paper is organized as follows. Section two deals with the literature review. In Section three, the methodological framework of the study is pursued while the empirical results are discussed in section four. Section five concludes the paper.

## **2. Literature Review**

In recent years, several studies have carried out both the time and cross-sectional dimensions of data (panel data) to examine the relationship between fiscal deficits and inflation on different countries, using different estimation procedures and theories with varying findings and conclusions. However, the inferences drawn from these studies have also varied considerably depending on whether the countries involved are developed or developing. Thus, the link between fiscal deficits and inflation has been inconclusive.

In a cross-country study, Guess and Koford (1986) used granger casualty test, to see if deficits really cause of inflation or recession in 17 OECD countries for data-set 1949 to 1981. Results indicate deficits are not responsible for changes in recession, inflation or crowding out phenomena of private investment. King and Plosser's (1985) used VAR and single equation OLS model to identify determinants of inflation for United States and 12 other countries and did not found any empirical evidence on causal relationship between deficit, money growth and inflation. On empirical basis, Protopapadakis and Siegal (1986) extended literature by empirically investigating relationship between government deficit and money growth, for ten

industrialized economies for period 1974-1983. Rank correlation test used for simple estimation process and excess-money growth and excess debt growth were concerned variables. Results showed no positive association between government debt and money growth. Argument was given that financial structure of economy is responsible for such conclusion. Based on empirical evidence of panel data (1980-2008) of seventeen European countries, it was indicated that generally no long run relation exists between inflation and budget deficits. Relationship changes depending on developmental level and structural features of economy (Sahan and Bektasoglu 2010). This gave a rationale that in order to examine inflationary impact of deficit it is necessary to analyze the financial structure of economy. Karras (1994) investigates the effects of budget deficits on money growth, inflation, investment and real output growth using annual data from a sample of 32 countries in the period of 1950-1989 and finds that fiscal deficits are not inflationary. However, Cottarelli et al. (1998) find a significant impact of fiscal deficits on inflation in industrial and transition economies by using the dynamic panel data model in 47 countries from 1993 to 1996. Fischer et al. (2002), using fixed effects for a panel of 94 developing and developed economies, showed fiscal deficits are main driver of high inflation, and estimated that an improvement (deterioration) in the fiscal balance leads to a decline (rise) in inflation, if all else remain constant. However, it was also concluded that changes in budget balance have no significant inflationary effects in low-inflation countries. Catão and Terrones (2005) apply the pooled mean group estimation method to a data set spanning 107 countries over the 1960-2001 period. It is shown that, empirically, deficits have an impact on inflation and such an impact is stronger in high-inflation or developing countries. Using the Dynamic Panel Quantile Regression (DPQR) model under the autoregressive distributional lag (ARDL) specification, Lin and Chu (2013) examines the deficit-inflation relationship in 91 countries from 1960 to 2006. The study discovered that deficit inflation relationship is strong in high-inflation episodes due to the increase in money creation and that persistent fiscal deficit are inflationary in high and middle-inflation economies and is less inflationary in low-inflation economies. However, they empirically tested the suggestion of Romer (1993) that more trade openness leads to lower inflation as against the observation of Jalil et al. (2014) who observed that fiscal deficit is a major determinant of the price level along with other variables like interest rates, government sector borrowing and private borrowing.

While on other side empirical studies conducted in different regions supports hypothesis that deficits are inflationary. Studies provide support from panel as well as from country specific data. Samimi (2000) and Samimi and Jamshidbaygi (2011) focusing on relationship for Iranian economy strongly confirmed positive relationship between budget deficits and inflation. Metin (1998), Özatay (2000), Seljuk (2001), Tekin-Koru and Özmen (2003) and Kia (2010) provided the empirical evidence from Turkish economy that deficits and government debt remained important factors behind inflation during different time spans. Lozano (2008) empirically tested relationship between deficit, money growth and inflation for Columbian economy for period

1981-2007. Empirical results pinpoint that long run relationship exists between deficit, money growth and inflation. Dejtbamrong (1993) examined the impact of Budget deficits on money-supply and output for the selected sample of South East Asian Central Banks (SEACEN) countries for the period 1974-II to 1989-IV. Empirical results based on reduced form equations of fiscal and monetary policy showed mixed results. No impact of fiscal policy on money supply in case of Korea and Philippines but there exists strong relationship in case of Sri Lanka and Singapore. Due to lack of strong capital market structure in Sri Lanka and Singapore, fiscal variables can affect foreign inflow of capital which may lead to increase in money supply. Habibullah *et al.* (2011), investigated relationship between budget deficits, money growth and inflation for thirteen Asian countries. Granger causality test and Error correction model confirmed long run relationship exists between deficits, money growth and inflation for time period 1950-1999. Evidence from African countries includes Kilindo (1997) observed strong relationship between fiscal deficits, money growth and inflation in Tanzania. Suliman and Ahmed (2011) explored long run relationship between money-supply, real GDP and price level for economy of Sudan, using annual data for period 1960-2005.

The studies regarding Nigeria show inconclusive relationships between fiscal deficit and inflation. For instance, Oladipo and Akinbobola (2011) observed a causality running from fiscal deficit to inflation. Olusoji and Oderinde (2011) investigation of the fiscal deficit and inflationary trends in Nigeria over the period 1970 – 2006 showed no evidence of causality between fiscal deficit and inflation in Nigeria. Using vector error correction model (VECM) and causality techniques, Chimobi and Igwe (2010) showed the presence of a positive long-term relationship between inflation and money supply. In another study, Ezeabasili *et al.* (2012) conducted an empirical analysis of fiscal deficit and inflation over the period 1970 – 2006 in Nigeria. The study applied cointegration test technique and find a positive but insignificant long run relationship between fiscal deficits and inflation. Also, the impulse response and variance decomposition result does not support fiscal deficit as a significant contributor of inflationary trend in Nigeria. The finding does not corroborate Chimobi and Igwe (2010) empirical work. Wosowei (2013) examined the relationship between fiscal deficit and some macroeconomic aggregates in Nigeria for the period 1980-2010. Using OLS and Engel Granger co-integration approach, the result revealed a negative but insignificant relationship between fiscal deficit and gross domestic product. While on the direction of causality, a bi-directional relationship was reported between fiscal deficit and GDP also between government tax and unemployment in Nigeria.

### **3. Data and Methodology**

#### **3.1 Data**

This study uses yearly data from 1980 to 2019 for Consumer Price Index (CPI) used to measure inflation rate, Fiscal Deficit (FD) measured as a ratio of gross domestic product, Real Exchange

Rate (EXR), Lending Interest Rate (LR) and Money Supply (MS). The data are sourced from Central Bank of Nigeria (CBN) and the World Development Indicator (WDI) data base.

Inflation as measured by the consumer price index reflects the annual percentage change in the cost to the average consumer of acquiring a basket of goods and services that may be fixed or changed at specified intervals, such as yearly. The Laspeyres formula is generally used. Thus, Fiscal Deficit refers to the financial situation wherein the government's total budget exceeds the total receipts excluding borrowings made during the fiscal year. It is measured as a ratio of GDP.

This study further includes exchange rate and lending interest rate for better specification of the model. As regards the definition of exchange rate, it is measured in Naira (₦) per US dollar, meaning that an increasing in exchange rate refers to depreciation in the Naira while a decrease means appreciation of the Naira. On the other hand, lending interest rate is usually measured in percentage (%) and an increase (decrease) in this percentage denotes increase (decrease) in interest rate. Growth rate of M2 is taken as measure of growth of money supply defined as "money and quasi money comprise the sum of currency outside banks, demand deposits other than those of the central government, and the time, savings, and foreign currency deposits of resident sectors other than the central government".

### 3.2 Methodology

Following the literature, we present an econometric model which essentially is informed by standard economic theory as evince in Keynesian approach. The inflation-fiscal deficit function adopted in this model is:

$$\log CPI_t = \alpha_0 + \alpha_1 \left( \frac{FD}{GDP} \right)_t + \alpha_2 \log LR_t + \alpha_3 \log EXR_t + \alpha_4 \log MS_t + U_t, \dots, 1$$

$$\alpha_1 > 0, \alpha_2 < 0, \alpha_3 > 0, \alpha_4 > 0$$

To empirically analyze the relationship between fiscal deficit and inflation, the ARDL model specification popularly known as bound test is used to show both the short and long-run relationships. This method is adopted for this study for three reasons. First, compare to other multivariate cointegration methods, the bounds test is a simple technique because it allows the cointegration relationship to be estimated by OLS once the lag order of the model is identified. Second, adopting the bound testing approach means that pretest such as unit root is not required. That is the regressors can either I(0), purely I(1) or mutually cointegrated. However, while the bounds test for cointegration does not depend on the pre-testing of the order of integration, to satisfy the curiosity and quell the anxiety of spurious result from regression which is obtainable from regressing non-stationary series, and also to scrutinize the integrating

level of the variables which is to ensure that the variables are not of order I(2). Following the study by Ouattara (2004), the computed F-statistics provided by Pesaran et al (2001) are not valid in the presence of I(2) variables because the bounds test is based on the assumption that the variables are I(0) or I(1). Therefore, the implementation of unit root tests in the ARDL procedure might still be necessary in order to ensure that none of the variables is integrated of order 2 or beyond but fall within the computed F-statistics range provided by Pesaran et al (2001). Third, the long-run and short run parameters of the models can be simultaneously estimated. The ARDL framework of Eq. (1) is as follows:

$$\begin{aligned} \Delta lcp_i = & \beta_0 + \sum_{i=1}^p \psi_i \Delta lcp_{i-i} + \sum_{i=0}^p \phi_i \Delta fd_{i-i} + \sum_{i=0}^p v_i \Delta lr_{i-i} + \sum_{i=0}^p \gamma_i \Delta lexr_{i-i} \\ & + \sum_{i=1}^p \delta_i \Delta lms_{i-i} + \theta_1 lcp_{i-1} + \theta_2 fd_{i-1} + \theta_3 lr_{i-1} + \theta_4 lexr_{i-1} + \theta_5 lms_{i-1} + u_i \end{aligned} \quad (2)$$

where  $\beta_0$  is the drift component and  $U_t$  white noise. Furthermore, the terms with summation signs represented the error correction dynamics. While the second part of the equation with  $\theta_i$  corresponds to long run relationship. This is an error correction representation. So, the following error correction model is estimated in the third step.

$$\begin{aligned} \Delta lcp_i = & \beta_0 + \sum_{i=1}^p \psi_i \Delta lcp_{i-i} + \sum_{i=0}^p \phi_i \Delta fd_{i-i} + \sum_{i=0}^p v_i \Delta lr_{i-i} + \sum_{i=0}^p \gamma_i \Delta lexr_{i-i} \\ & + \sum_{i=0}^p \delta_i \Delta lms_{i-i} + \alpha_{ecm_{i-1}} + u_i \end{aligned} \quad (3)$$

The error correction model result designates the speed of adjustment back to long run equilibrium after a short run shock. We extend the model in equations (2) and (3) to include endogenous structural breaks. Neglect of structural breaks when they actually exist can bias the study findings. In the case of modelling inflation, structural breaks have observed to be crucial in improving the inflationary behaviour of Nigeria (Fasanya and Adekoya, 2017). Hence, the model is then specified below:

$$\begin{aligned} \Delta lcp_i = & \beta_0 + \sum_{i=1}^p \psi_i \Delta lcp_{i-i} + \sum_{i=0}^p \phi_i \Delta fd_{i-i} + \sum_{i=0}^p v_i \Delta lr_{i-i} + \sum_{i=0}^p \gamma_i \Delta lexr_{i-i} \\ & + \sum_{i=0}^p \delta_i \Delta lms_{i-i} + \theta_1 lcp_{i-1} + \theta_2 fd_{i-1} + \theta_3 lr_{i-1} + \theta_4 lexr_{i-1} + \theta_5 lms_{i-1} + \sum_{r=1}^s D_r B_{rt} + u_i \dots \quad 4 \end{aligned}$$

As shown in equation (4), the breaks are captured with the inclusion of  $\sum_{r=1}^s D_r B_{rt}$  where  $B_{rt}$  is a

dummy variable for each of the breaks defined as  $B_{rt}=1$  for  $t>T_B$  otherwise  $B_{rt}=0$ . The time period is represented by  $t$ ;  $T_B$  are the structural break dates where  $r=1, 2, 3, \dots, k$  and  $D_r$  is the coefficient of the break dummy. All the other parameters have been previously defined. As earlier noted, the Bai-Perron (2003) test which determines breaks endogenously is used. This test is relevant when dealing with models with probable multiple structural changes over time. Apart from computational simplicity, the test allows for up to five (5) breaks in the regression model and is therefore considered a more general framework for detecting multiple structural changes in linear models. We also test for the existence of long run relationship in the presence of structural breaks using the ARDL test. In essence, we are also able to determine long run and short estimates for the fiscal deficit – inflation nexus in the presence of structural breaks. In addition, the results obtained are compared with those from equation (5) to see if accounting for breaks in the regression is necessary. Subsequently, the Wald test is used to test for the joint significance of structural breaks in equation (4). That is, we test  $\sum_{r=1}^k D_r = 0$  against  $\sum_{r=1}^k D_r \neq 0$ . The rejection of the null hypothesis implies that the breaks are important and should be included in the model, hence, suggesting the adoption of equation 4 while the non-rejection implies that structural breaks do not matter in this case.

#### 4. Results and Discussions

This section presents the summary of statistics of the variables, unit root tests to test the level of integration of the variables under consideration, the estimation result of the ARDL with and without structural breaks.

Table 1 highlights some of the statistical properties of the selected variables for this study over the period of 1980-2016. The description from the table above reveals that the average percentage of inflation, fiscal deficit, lending interest rate, real exchange rate and money supply between the years 1980-2016 is approximately 2.57%, -2.87%, 17.53%, 154.8%, and 48.59% in that order. Over the period, the values of INF, FD, LR, EXR, MS range between -0.895% to 5.21%, -6.73% to 0.79%, 8.43% to 31.65%, 33.06% to 546.04%, and 13.23% to 43.27% respectively.

**Table 1: Descriptive Statistics of Variables**

	INF	FD	LR	EXR	MS
<b>Mean</b>	2.574	-2.871	17.526	154.803	24.224
<b>Maximum</b>	5.214	0.794	31.650	546.038	43.266
<b>Minimum</b>	-0.894	-6.730	8.431	33.061	13.230
<b>Skewness</b>	-0.406	-0.306	0.149	1.607	0.812
<b>Kurtosis</b>	1.664	2.110	3.327	4.733	3.473
<b>Jarque-Bera (probability)</b>	3.764 (0.152)	1.799 (0.406)	0.304 (0.858)	20.568 (0.000)	4.412 (0.110)
<b>Observations</b>	40	40	40	40	40

Also, considering the skewness statistics whose threshold value for symmetry (or normal distribution) is zero, none of the variable is exactly zero, although some are close to zero). While the skewness statistics of -0.41 and -0.31 for inflation rate and fiscal deficit show that both variables are negatively skewed (since they are less than zero), which denotes that more of the values of inflation rates and fiscal deficit fall on the left-hand side of the mean, lending rate, exchange rate and money supply are positively skewed since their skewness statistics are greater than zero.

Furthermore, the kurtosis value whose threshold is three indicates that all variables are leptokurtic (highly peaked), with the exception of inflation rate and fiscal deficit which are platykurtic (lowly peaked). However, neither skewness nor kurtosis can singularly confirm the normality of a series. Hence, since the Jarque-Bera statistics combines skewness and kurtosis properties, it provides more comprehensive information. Following the above highlight on Jarque-Bera, since its probability value for the variables (with the exception of EXR) are less than 5%, it therefore suggests that the hypothesis of normal distribution cannot be rejected and the series can be regarded as having a normal distribution. However, since the Jarque-Bera probability value for EXR is less than 5%, it therefore suggests that the hypothesis of normal distribution is rejected for EXR. Thus, EXR is not normally distributed.

**Table 2: Unit Root Result**

	Unit root without structural breaks						Unit root with structural breaks			
Variables	ADF			PP			Vogelsang-Perron SB test			
	Level	First Diff.	I(d)	Level	First Diff.	I(d)	Break Date	Coeff.	t-stat.	I(d)
INF	-1.81 <sup>b</sup>	-3.36 <sup>a**</sup>	I(1)	-1.12 <sup>b</sup>	-3.20 <sup>a**</sup>	I(1)	1994	13.25 <sup>b***</sup>	-7.139	I(0)
FD	-5.26 <sup>b***</sup>	-----	I(0)	-5.42 <sup>b***</sup>	-----	I(0)	1994	-5.84 <sup>b***</sup>	-9.002	I(0)
LR	-1.12 <sup>b</sup>	-6.43 <sup>a***</sup>	I(1)	-1.27 <sup>b</sup>	-6.45 <sup>a**</sup>	I(1)	1994	-6.51 <sup>a***</sup>	-11.056	I(0)
EXR	-1.70 <sup>b</sup>	-5.42 <sup>a***</sup>	I(1)	-1.95 <sup>b</sup>	-5.42 <sup>a**</sup>	I(1)	2016	-4.42 <sup>b**</sup>	-4.169	I(1)
MS	-3.35 <sup>b*</sup>	-----	I(0)	-2.20 <sup>b</sup>	-5.45 <sup>a***</sup>	I(1)	2006	-4.93 <sup>b***</sup>	-6.290	I(0)

Note: <sup>a</sup> Indicates constant without deterministic trend; <sup>b</sup> is the model with constant and deterministic trend as exogenous lags are selected based on Schwarz info criteria. \*, \*\*, \*\*\* imply that the series is stationary at 10%, 5% and 1% respectively. ADF and PP denote Augmented Dickey-Fuller and Phillip-Perron Unit Root tests. Also, the ADF test with structural break is determined using the Vogelsang (1993) asymptotic one-sided p-values. Critical values from Vogelsang (1993), which are -4.04 and -4.44 for 5% and 1% level of significance respectively.

All three specifications-with intercept and trend, with intercept only and none- outlined in ADF and PP are assessed to ensure a robust conclusion in Table 2. From the ADF test result, fiscal deficit and money supply are stationary at their level form. However, inflation rate, lending rate and exchange rate are rendered stationary at their first difference. This result is consistent

with the PP test result, with the exception of money supply as it is rendered stationary at its first difference rather than in its level form as reported in the ADF test result. Graphical illustration shows the movements, trends, fluctuation, structural breaks and discontinuities in the series. It also provides a qualitative assessment of possible relationship among the series.

On the structural break test, Bai and Perron (2003) advocate the determination of multiple breaks among series. Rather than the conventional way of determining break individually among variables which post a challenge while estimating the variables or why trying to neutralize the effect of the breaks during estimation. Several breaks were identified by the tests in linear combination of the variables used in this study. Table 4 shows selected dates from breakpoint least square result for five models. However, model five was not presented in the table as no break dates are identified. The result shows the several breaks identified by the tests. Hence, with existence of significant break in the models, the study compares each model with and without structural break so as to investigate the consequence of the inclusion or exclusion of break in the signs, magnitude and significance of the explanatory variables in the model.

**Table 4: Bai-Perron Multiple Structural Breaks**

Models	Breaks	Range	Signs
Inflation rate and fiscal deficit (1) $lcpi = f(fd)$	1988	1980 - 1987	+
	1994	1988 - 1993	-
	2004	1994 - 2003	-
		2004 - 2016	-
Inflation rate, fiscal deficit and real exchange rate (2) $lcpi = f(fd, exr)$	1987	1980 - 1986	-
	1993	1987 - 1992	-
	1999	1993 - 1998	+
	2009	1999 - 2008	+
		2009 - 2016	+
Inflation rate, fiscal deficit and lending interest rate (3) $lcpi = f(fd, lr)$	1993	1980 - 1992	+
	2000	1993 - 1999	-
		2000 - 2016	-
Inflation rate, fiscal deficit and money supply (4) $lcpi = f(fd, ms)$	1990	1980 - 1989	+
	1998	1990 - 1997	+
	2008	1998 - 2007	+
		2008 - 2016	-

Note: \*\*\*, \*\* and \* imply significance at 1%, 5% and 10% respectively

The unit root test conducted above indicates that some of the variables are stationary I(0) while some variables are not stationary I(1). Owing to these facts, there is need to check whether there

is existence of similar trend properties between or among the series as a regression model on cointegrated series is said to be consistent. Thus, the Autoregressive Distributed Lag (ARDL) bound test is employed, which allows for the combination of stationary and non-stationary series.

**Table 5: ARDL Bounds co-integration test result (Without Breaks)**

Models	F-statistics	Significance level	Critical Values I(0)	Bounds I(1)
$lcpi = f(fd)$	4.708	10%	5.59	6.26
		5%	6.56	7.3
		1%	8.74	9.63
$lcpi = f(fd, exr)$	4.891	10%	4.19	5.06
$lcpi = f(fd, lr)$	4.388	5%	4.87	5.85
$lcpi = f(fd, ms)$	3.701	1%	6.34	7.52
$lcpi = f(fd, exr, lr, ms)$	4.717**	10%	3.03	4.06
		5%	3.47	4.57
		1%	4.4	5.72

Note: \*\*\*, \*\* and \* imply significance at 1%, 5% and 10% respectively

**Table 6: ARDL Bounds co-integration test result (With Breaks)**

Models	F-statistics	Significance level	Critical Values I(0)	Bounds I(1)
$lcpi = f(fd)$	19.078***	10%	3.03	4.06
		5%	3.47	4.57
		1%	4.4	5.72
$lcpi = f(fd, exr)$	26.284***	10%	2.53	3.59
		5%	2.87	4
		1%	3.6	4.9
$lcpi = f(fd, lr)$	4.918**	10%	3.03	4.06
		5%	3.47	4.57
		1%	4.4	5.72
$lcpi = f(fd, ms)$	5.604***	10%	2.75	3.79
		5%	3.12	4.25
		1%	3.93	5.23
$lcpi = f(fd, exr, lr, ms)$	-----	-----	-----	-----
	-----	-----	-----	-----
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Note: \*\*\*, \*\* and \* imply significance at 1%, 5% and 10% respectively

**Table 7: Long-Run Model Estimation Result (Without Breaks)**

Explanatory Variables	Model 1	Model 2	Model 3	Model 4	Model 5
FD	-1.508(-0.529)	0.098(0.78)	0.124(1.89)*	-0.751(-0.86)	0.016(0.299)
EXR	-----	-1.288(-1.82)*	-----	-----	0.54(1.83)*
LR	-----	-----	2.284(3.954)***	-----	2.55(4.599)***
MS	-----	-----	-----	-1.81(0.65)	0.469(1.467)
Constant	-3.29(-0.58)	7.58(1.59)*	4.76(-4.23)***	3.92(0.648)	-11.19(-3.28)***
@Trend	-----	0.119(2.735)***	0.117(5.816)***	0.211(3.54)***	0.158(13.9)***

Note: \*\*\*, \*\* and \* imply significance at 1%, 5% and 10% respectively. t- statistics are presented in parentheses and probability values are presented in brackets.

**Table 8: Short Run Model Estimation Result (Without Breaks)**

Explanatory Variables	Model 1	Model 2	Model 3	Model 4	Model 5
D(INF)(-1))	0.475(3.31)***	0.698(4.27)***	0.488(2.96)***	0.469(3.01)***	0.548(2.91)***
D(INF)(-2))	-----	-0.488(-2.68)***	-0.426(-2.53)***	-----	-----
D(INF)(-3))	-----	0.385(2.477)**	-----	-----	-----
D(FD)	0.004(0.434)	0.0083(0.784)	0.021(1.737)*	0.002(0.207)	0.004(0.293)
D(FD)(-1))	0.026(2.397)**	-----	-----	0.038(3.299)***	-----
D(EXR)	-----	0.012(0.254)	-----	-----	0.045(0.963)
D(EXR)(-1))	-----	-----	-----	-----	0.036(0.505)
D(EXR)(-2))	-----	-----	-----	-----	-0.196(-3.283)***
D(LR)	-----	-----	0.01(0.077)	-----	0.049(0.292)
D(LR)(-1))	-----	-----	-0.246(2.022)**	-----	-0.329(-2.158)***
D(LR)(-2))	-----	-----	-----	-----	-0.161(-0.979)
D(LR)(-3))	-----	-----	-----	-----	-0.028(-1.806)*
D(MS)	-----	-----	-----	-0.140(-1.227)	-0.028(-0.308)
D(MS)(-1))	-----	-----	-----	0.246(2.306)**	-----
@trend	-----	-----	-----	-----	-----
ECT(-1)	-0.025(-0.58)	-0.085(-2.017)*	-0.165(-3.35)***	-0.05(-1.01)	-0.265(-3.737)***
F-stat.	2295.12***	1753.98***	1963.8***	1698.1***	1227.48***
Adj. R <sup>2</sup>	0.928	0.928	0.928	0.928	0.898
DW	1.759	1.907	1.752	1.716	2.169
Diagnostics tests					
J-B test	1.667[0.435]	5.039[0.080]	4.14[0.126]	1.666[0.435]	6.057[0.053]
ARCH-LM test:	0.007[0.934]	0.473[0.497]	0.394[0.535]	0.221[0.641]	0.299[0.589]
B-G LM test:	2.66[0.089]	0.077[0.926]	0.646[0.533]	1.204[0.318]	5.023[0.021]
RESET test	6.70[0.015]	7.57[0.011]	0.294[0.593]	5.299[0.030]	1.545[0.232]

CUSUM	stable	stable	stable	stable	stable
CUSUMSQ	stable	stable	stable	stable	stable

*Note: \*\*\*, \*\* and \* imply significance at 1%, 5% and 10% respectively. t- statistics are presented in parentheses and probability values are presented in brackets.*

Table 5 and 6 shows the co-integration test result on all five models with and without breaks. For the models without breaks, Model 1, 3 and 4 statistical values are seen to be lower than the I(0) critical value at 5% chosen level of significance signifying no long-run relationship. While Model 2 result was found to be inconclusive, evidence of long run relationship was found in Model 5. However, with the inclusion of structural breaks as specified in Bai-Perron break test result in Table 4, the conclusion was completely reversed, as there was presence of long run relationship among the variables considered in the models. Following this result, the study examines both the short-run dynamics and the long run relationship for all five Models.

Table 7 and 8 presents the long run and short run estimation result between inflation rate and other explanatory variables. In the long run, the result shows that the coefficient of fiscal deficits exerts positive relationship in all regressions except for model 1 and 4. However, in model 3 fiscal deficits is seen to be significantly positive. Specifically, the coefficient 0.124 implies that the inflation may be increased by 0.12% by 1% increase in fiscal deficit. The positive relationship between fiscal deficit and inflation follows the preposition of fiscal theory of price level which attributes inflation as fiscal phenomenon (Leeper,1991; Woodford,1995; Cochrane,1999, 2001; Gordon and Leeper, 2005; Sims, 2011). Our result that the fiscal deficit affecting inflation positively in Nigeria is also corroborated earlier results by Onwioduokit (1999) and Oladipo and Akinbobola (2011) who finds positive and significant results. The result also shows that real exchange rate is significantly positive in influencing the rate of inflation. It reveals that a unit change in the percentage of exchange rate resulted in only 1.29% in model 2 and 0.54% in model 5 total variation in the rate of inflation. With the increase in exchange rate, inflation increased moderately.

In the short run, the result shows that inflation is significantly positive in its relation with past fluctuations. The significance of lagged inflation indicated that the Nigeria inflationary process has been influenced by its past behavior. Lagged inflation explains stickiness in prices, with periods of high inflation tending to persist and conversely periods of low inflation will also persist. The error correction coefficient also shows that there is 26.5% speed of adjustment from short run into the long run equilibrium.

The adjusted R-squared indicates that 92.8% variations in inflation rate are explained by fiscal deficit, real exchange rate, lending interest rate and money supply. The F-stat also indicates that each of the models estimated are statistically significant implying that at least one of the

explanatory variables in each case is statistically significant. The Durbin- Watson statistic reported in each case also reveal that the models do not suffer from autocorrelation.

**Table 9: Long-Run Model Estimation Result (With Breaks)**

Explanatory Variables	Model 1	Model 2	Model 3	Model 4	Model 5
FD	0.001(2.01)***	0.058(0.01)	0.11(2.05)***	0.46(1.952)**	-----
EXR	-----	-0.53(0.107)	-----	-----	-----
LR	-----	-----	1.376(0.359)	-----	-----
MS	-----	-----	-----	-1.344(1.906)**	-----
D <sub>1987</sub>	-----	0.078(1.881)*	-----	-----	-----
D <sub>1988</sub>	1.103(0.169)	-----	-----	-----	-----
D <sub>1990</sub>	-----	-----	-----	2.256(0.528)	-----
D <sub>1993</sub>	-----	1.85(0.101)	0.968(1.824)*	-----	-----
D <sub>1994</sub>	1.01(0.165)	-----	-----	-----	-----
D <sub>1998</sub>	-----	-----	-----	2.63(0.52)	-----
D <sub>1999</sub>	-----	-0.699(0.149)	-----	-----	-----
D <sub>2000</sub>	-----	-----	-0.425(0.196)	-----	-----
D <sub>2004</sub>	0.06(4.051)***	-----	-----	-----	-----
D <sub>2008</sub>	-----	-----	-----	1.646(0.439)	-----
D <sub>2009</sub>	-----	0.159(0.06)	-----	-----	-----
Constant	-0.81(0.066)	2.99(0.696)	-3.18(0.526)	6.03(1.694)**	-----

Note: \*\*\*, \*\* and \* imply significance at 1%, 5% and 10% respectively. t- statistics are presented in parentheses and probability values are presented in brackets.

**Table 10 Short Run Model Estimation Result (With Breaks)**

Explanatory Variables	Model 1	Model 2	Model 3	Model 4	Model 5
D(INF(-1))	0.688(3.98)***	0.004(0.07)	0.13(0.96)	-1.08(-2.32)*	-----
D(INF(-2))	-----	-0.423(-9.57)***	-0.57(-3.81)***	-1.07(-1.59)	-----
D(INF(-3))	-----	-----	-----	-0.40(-0.98)	-----
D(FD)	0.000(0.09)	0.026(6.31)***	0.03(3.18)***	0.009(0.54)	-----
D(FD(-1))	-----	-----	-----	0.13(4.67)**	-----
D(FD(-2))	-----	-----	-----	0.08(1.99)**	-----
D(FD(-3))	-----	-----	-----	0.08(2.30)**	-----
D(EXR)	-----	-0.064(-4.07)***	-----	-----	-----
D(LR)	-----	-----	0.104(0.87)	-----	-----
D(MS)	-----	-----	-----	0.13(0.617)	-----
D(MS(-1))	-----	-----	-----	0.17(1.30)	-----
D(MS(-2))	-----	-----	-----	-0.42(-2.31)*	-----
D(D <sub>1987</sub> )	-----	-0.25(-7.958)***	-----	-----	-----

D(D <sub>1987</sub> (-1))	-----	-0.114(-3.06)***	-----	-----	-----
D(D <sub>1988</sub> )	0.33(9.129)***	-----	-----	-----	-----
D(D <sub>1988</sub> (-1))	0.144(1.92)*	-----	-----	-----	-----
D(D <sub>1988</sub> (-2))	-0.26(-3.81)***	-----	-----	-----	-----
D(D <sub>1988</sub> (-3))	-0.25(-5.61)***	-----	-----	-----	-----
D(D <sub>1990</sub> )	-----	-----	-----	-0.29(-1.31)	-----
D(D <sub>1990</sub> (-1))	-----	-----	-----	0.60(1.88)	-----
D(D <sub>1990</sub> (-2))	-----	-----	-----	0.16(1.13)	-----
D(D <sub>1990</sub> (-3))	-----	-----	-----	0.199(1.59)	-----
D(D <sub>1993</sub> )	-----	0.248(6.554)***	0.12(1.50)	-----	-----
D(D <sub>1993</sub> (-1))	-----	-0.284(-6.67)***	-0.29(-2.35)**	-----	-----
D(D <sub>1993</sub> (-2))	-----	-----	0.237(2.28)**	-----	-----
D(D <sub>1994</sub> )	0.17(2.17)**	-----	-----	-----	-----
D(D <sub>1994</sub> (-1))	0.103(1.205)	-----	-----	-----	-----
D(D <sub>1994</sub> (-2))	-0.11(-1.32)	-----	-----	-----	-----
D(D <sub>1994</sub> (-3))	-0.104(-2.44)**	-----	-----	-----	-----
D(D <sub>1998</sub> )	-----	-----	-----	0.17(1.72)	-----
D(D <sub>1998</sub> (-1))	-----	-----	-----	0.84(3.32)**	-----
D(D <sub>1998</sub> (-2))	-----	-----	-----	0.70(2.51)*	-----
D(D <sub>1998</sub> (-3))	-----	-----	-----	0.25(1.65)	-----
D(D <sub>1999</sub> )	-----	-0.098(-3.06)***	-----	-----	-----
D(D <sub>1999</sub> (-1))	-----	-0.143(-6.06)***	-----	-----	-----
D(D <sub>2000</sub> )	-----	-----	-0.16(-3.00)***	-----	-----
D(D <sub>2004</sub> )	0.04(1.095)	-----	-----	-----	-----
D(D <sub>2008</sub> )	-----	-----	-----	-0.24(-1.47)	-----
D(D <sub>2008</sub> (-1))	-----	-----	-----	0.19(2.19)	-----
D(D <sub>2008</sub> (-2))	-----	-----	-----	0.14(0.7)	-----
D(D <sub>2008</sub> (-3))	-----	-----	-----	0.408(3.03)*	-----
D(D <sub>2009</sub> )	-----	0.07(3.12)***	-----	-----	-----
@trend	0.061(3.05)***	0.04(7.896)***	0.047(2.97)***	0.07(2.25)*	-----
ECT(-1)	-0.57(-3.03)***	-0.44(-10.04)***	-0.38(-2.94)***	0.70(2.44)*	-----
F-Stat	7133.9***	21417.7***	2767.6***	2755.8***	-----
Adj. R <sup>2</sup>	0.912	0.913	0.929	0.899	-----
DW	1.799	2.108	1.915	2.65	-----
Diagnostics tests					
J-B test	1.054[0.591]	11.491[0.003]	0.935[0.627]	25.83[0.000]	-----
ARCH-LM test:	1.758[0.195]	0.143[0.708]	0.943[0.339]	3.756[0.062]	-----
B-G LM test:	1.471[0.416]	0.463[0.639]	0.532[0.597]	3.134[0.371]	-----
RESET test	2.951(0.264)	2.31[0.149]	0.000[0.987]	1.026[0.418]	-----
CUSUM	stable	stable	stable	stable	-----
CUSUMSQ	stable	stable	stable	stable	-----

*Note: \*\*\*, \*\* and \* imply significance at 1%, 5% and 10% respectively. t- statistics are presented in parentheses and probability values are presented in brackets.*

Table 9 reveals that the coefficient of fiscal deficit enters positive in all regressions but the level of significance and magnitude of the coefficient differs in the models. Real exchange rate and lending interest rate are significantly positive in model 2 and model 4 respectively. Extensively, the long run result shows that exchange rate and lending interest rate are positively and negatively related to inflation rate. The results also provide evidence of a positive long run-relationship between money supply and inflation in the Nigerian economy over the study period.

In the short run, the significance of lagged inflation indicated that the Nigeria inflationary process has been influenced by its past behavior. The result also shows that the coefficient of fiscal deficits exerts positive influence in all the models estimated. Specifically, fiscal deficit is statistically significant in model 2 and model 3 and in model 4 lagged by one year when money supply was incorporated into the model. The adjusted R-squared indicates around 93% variations in inflation rate are explained by fiscal deficit, real exchange rate, lending interest rate and money supply. The F-stat also indicates that each of the models estimated are statistically significant implying that at least one of the explanatory variables in each case is statistically significant. The Durbin- Watson statistics reported in each case also reveal that the models except model 3 do not suffer from autocorrelation.

## **5. Conclusion and policy implications**

This study assesses fiscal deficits and inflation in Nigeria, using yearly data spanning over the periods of 1980 – 2016. The unit root test reveals that the series are integrated of order one and zero and as a result a dynamic model which incorporates fractionally integrated series is employed. Specifically, five models are estimated using the Autoregressive Distributed Lag Model. Furthermore, given the importance of structural breaks in behavior of these series overtime in Nigeria, a multiple structural break tests such as that suggested by Bai-Perron (2003) is adopted. Thus, both the ARDL with structural breaks and without structural breaks are estimated. From the results, it can be seen that fiscal deficit, exchange rate, lending rate and money supply affect inflation rate both in the short run and long run both with and without structural breaks. Specifically, in the short run, expected inflation positively affects the current inflation. The significance of inflation expectation indicated that the Nigeria inflationary process has been influenced by its past behavior. Expected inflation explains stickiness in prices, with periods of high inflation tending to persist and conversely periods of low inflation will also persist. The long run estimates show that fiscal deficits have a positive impact on inflation along with other variables taking into account only model three. However, when structural breaks were considered, the coefficient of fiscal deficit enters positive in all

regressions where only model two, three and four are significantly positive. All other variables also have significant influence on inflation rate taking into account the various models.

Given the above findings and conclusions, it becomes imperative for Nigeria to provide an enabling environment for industries and firms to thrive, as this will help check the multitude of homemade inflation; a contractionary monetary policy should also be pursued by the regulatory authorities to check money-induced inflation and also the price regulatory bodies should be fully equipped to function effectively, in order to address the impact of expected inflation. The Nigerian government could display a high sense of transparency in the fiscal operations to bring about realistic fiscal surplus. Fiscal surplus, when recorded should be channeled to productive investments like road construction, electricity provision and so on, that would serve as incentives to productivity through the attraction of foreign direct investment, in order to reduce the incidence of inflation in Nigeria. In addition, what should be of utmost concern to policy makers as regards the fiscal deficit-inflation nexus should not necessarily be the level of fiscal deficits but the channels through which the deficits are financed and the ability of the productive base of the economy to absorb the impact of such financing. However, a fiscal management process that does not encourage increased revenue and reduce fiscal deficits in Nigeria will further worsen the level of inflation in the country.

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## Declarations

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This is available on request.

### **Competing interests:**

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