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Original Article

The Prevailing Inflationary Pressures in Nigeria - What are the Possible Causes? FM-OLS and DOLS Approach

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Abstract *- This current research was basically an empirical inquiry to determine the contributions of various macroeconomic variables to the observed unstable movements of inflation in Nigeria in recent years. Globally, it is generally accepted that unstable movements of inflation lead to general instability in the macroeconomy. With such understanding, it becomes pertinent to have an objective understanding of the factors that contribute to this unwanted movement as such knowledge will provide a practical policy framework to guide against the continuous occurrence. Time series data spanning 1981 to 2017, which was obtained from the Central Bank of Nigeria (CBN) statistical bulletin of 2018, was used for the analysis. To provide reliable and super-consistent results, we applied both the FM-OLS and the Dynamic OLS regression techniques after moderating the time-varying properties of the data through Elliot-Rothenberg-Stock and KPSS stationarity tests. The results from the Trace and Max-Eigen tests statistic of the Johansen method of cointegration provided evidence that the variables have a long-run relationship among them. The elasticities of the coefficients of the variables show that exchange rate movements were the major causes of inflation instability, followed by money supply. It was equally ascertained that Nigeria is currently battling with stagflation (inflationary recession) as there was a negative relationship between RGDP and inflation. The contributions of the other variables like MPR, GEXP, and DOP were not the major causes of inflation instability in Nigeria. Based on the outcome of the research, it was recommended, among other things, that; the Nigerian government should make a concerted effort to upscale the local productive capacity of the economy to reduce the level of dependence on foreign-made products as this will help in conserving foreign exchange and ensure a favorable exchange rate for the local currency; the monetary authorities should objectively regulate the volume of money supply and ensure that such monies were channeled to sectors that have the capacity of revamping the productive capacity of the economy.*

Keywords *- Inflation, FMOLS, DOLS, Macroeconomy, Cointegration.*

I. INTRODUCTION

The extent of damage and pervasive nature of the rising and almost uncontrollable rate of inflation currently being witnessed in Nigeria had led the government and many researchers to ponder possible control measures. Not too long ago, the Nigerian economy witnessed a great surge in the rate of inflation which brought about a total breakdown and instability in the economy, and such instability brought untold hardship and misery in the land. In the words of [3], the domineering feature on the headlines of the national dallies had been issued bordering on the high rate of inflation, volatility of exchange rate of Naira vis-à-vis other currencies, slow growth, and other non-economic factors like corruption. It is evident that the nature of the current rate of inflation in the last decade became alarming as its rate rose from single-digit to double digits. As reported in FSDH, the rate of inflation in Nigeria became even more pervasive as in the last few years; the value had jumped from 9% in the last quarter of 2015 to an alarming rate of 18.3% in the first quarter of 2017. Such an upsurge leads to 100% increase in the prices of commodities and other facilities [3]. It is generally accepted by economists and other researchers that the major objective of every nation's monetary authorities is the maintenance of price stability. [4] citing Metwally states that countries see economic stability vis-à-vis price stability as the baseline for the realization of macroeconomic stability. From economic theories, a stable rate of inflation is acceptable as it will ensure growth, but when the rate becomes uncontrollable, it is seen as a menace in the system.

Be that as it may, several economists and researchers alike have ascribed the cause of such an

upsurge to many factors. As aptly put by [14], the problem of inflation can easily be ascribed to the failure of the government to address the existing structural and institutional weaknesses in the economy. Taking into account the failure to diversify the economy and made it less dependent on proceeds from oil exports, some other researchers attributed such rise to many other factors such as corruption and misappropriation of funds. [12] citing Batini maintains that the quest for price stability in Nigeria had become elusive as the monetary authorities seem not to have any control over it again. They further state that based on available evidence, Nigeria has the highest inflation rate and exchange rate volatility amongst other emerging economies.

Going further, they attributed such a situation to factors such as the high degree of openness, high exchange rate pass-through, fiscal dominance, and the unstable macroeconomic environment. Such factors had made it difficult for the monetary authorities to win the war against price instability in the country, and such had visibly undermined their credibility. Despite adopting several strategies and policy measures, price instability still remains a major source of challenge to the monetary authorities. This does not actually translate that the monetary authorities are handicapped or do not have the potentials to effectively ensure price stability in the economy; rather, the essential thing is to know the root cause or causes of inflation. Such knowledge will make them adequately equipped to combat rising inflation rates despite how difficult it is. An adequate understanding of the real cause of inflation and its dynamics will put the monetary authorities in a vintage position to respond speedily and adequately to inflationary surges.

The major reason for this current study is basically to contribute to the existing knowledge on the interplay between inflation and its determinants and to suggest possible ways out of the woods. The research will x-ray the long-run equilibrium, the causal relationship between inflation and some identified determinants, and subsequently ascertain policy milieu that will ensure the stability of prices in the economy.

Consequently, the understanding of the root cause/causes of the rising rate of inflation remains the first and best option for ensuring its stability; thus, this study has its objectives as to empirically identify:

a. The key determinants of inflation in Nigeria
b. To explore the trends and magnitudes of inflation in the country, and
c. To make recommendations about the possible way out of the shambles.

The rest of the paper is structured thus; the first section is the introduction, the next section is section two, which contains the review of related literature, followed by section three, which details the methodology adopted; section four presents the data analysis and discussions of findings; section five is the last section, and it is concerned with the conclusion of the study and policy recommendations.

II. THEORETICAL LITERATURE

The term 'inflation is popularly defined as a continuous and sustained upsurge in general prices of goods and services, which invariably lead to a fall in the value of money as such money loses its feature as a store of value [10]. Several theories have been put in place as the cause of inflation by several authors; such theories are Demand-Pull inflation, cost-push inflation, and wage-push inflation [4].

A. Demand-Pull Inflation

In the words of [7], the demand-pull theory is the traditional and more-or-less the most common theory of inflation. It arises when aggregate demand exceeds aggregate supply in an economy. [7] further state that such gap between demand and supply could be a result of underutilization of the scarce resources, limited supply of spare parts, high-interest rate or exchange rate, or the inability to speedily increase the rate of production to fill the increasing rate of demand. There are two competing views of this theory: the monetarist school and the Keynesian school [10].

B. The Cost-Push Inflation

The cost-push theory of inflation is of the view that prices rise due to increases in the cost of production. It equally attributes such rise in wages, which could be as a result of trade union activities, or it can also be a function of the pricing power and policies of monopolistic and oligopolistic organizations that have the necessary market-power. The cost-push had recently been attributed to non-monetary factors such as crop production failures, shortages of commodities, and increases in the prices of oil [4], [5], [15].

C. The Structuralist Theory

The structuralists are of the opinion that the nature of the less developed countries made them prone to the high inflation rates as such economies are characterized by structural rigidities, non-productive interventions from the government, and the incessant political interferences as it is witnessed in such countries [1].

III. EMPIRICAL LITERATURE

Several types of research have been conducted on the possible determinants of inflation, and such studies have been conducted both in Nigeria and some other countries. In this present study, we considered some of these studies dedicated to Nigeria; equally, we

considered few other studies made with data from some other countries. [3] in their work titled: looking inwards: is money supply the cause of rising inflation in Nigeria? They used Nigeria's time series data between 1970 to 2016 and adopted co-integration and the Autoregressive Dynamic Error Correlation Model (ADLECM). From their findings, they attest that money supply does not have a considerable influence on inflation both in the long and short run. They are of the opinion that there are many other economic conditions that are key determinants of inflation in Nigeria. They recommend that the Nigerian government should make an effort to diversify the economy, thereby reducing importation and encouraging local production.

[1] while studying the inflation determinants – Milton Friedman's theory and the evidence from Ghana. He used Ghana data of 1965 – 2012 in an Autoregressive Distributed Lag Model (ARDL). His findings gave credence to the theory of monetarism. It revealed that both in the short run and long run, a strong positive relationship exists between rising inflation and growth of money supply. He suggested that a deliberate monetary policy framework should be designed that will critically target the growth rate of the money supply.

[8] carried out a study on the analysis of the determinants of inflation in Nepal between 1975 – 2016. They included variables such as broad money supply, real GDP, and Indian prices (import prices) in their model. They discovered that all the variables were significant functions of inflation and such; they are all determinants of inflation in Nepal. They made use of the Ordinary Least Square (OLS) model of regression.

In their own study, [6] carried out an analysis of inflation dynamics in Nigeria between 1981 to 2015 with the use of the bounds testing approach to cointegration. Based on the result from the econometrics test, they showed that past inflation, average rainfall, and money supply were the main determinants of the inflationary process in Nigeria in the period they studied. They opined the dominance of the monetarist position in the dynamics of inflation in Nigeria. They conclusively recommend that the monetary authority should continue with the moderation of growth of money supply, and they should include consumers' expectations as an input in the monetary policy framework.

[12] carried out a study titled: Inflation dynamics in Nigeria: implications for a monetary policy response. The univariate autoregressive model was employed in their study to determine the persistence of headline, food (noncore), and non-food (core) inflation. An impulse Response Function was used to ascertain the transmission effects existing between food and non-food inflation in Nigeria. The evidence emanating from their analysis suggests that headline, food, and non-food inflation has a lower rate of persistence while headline inflation has the highest level of persistence. They reveal that food inflation that has the highest level of persistence and transmits more shock to non-food inflation in Nigeria. They conclude that using the headline inflation as the underlying inflation by the monetary authorities is most acceptable and much appropriate.

[4] working on the analysis of the main determinants of inflation in Nigeria, made use of time series data between 1986 – 2011 sourced from the statistical bulletin of the CBN. The result from the VAR model, which they adopted, revealed that fiscal deficits, exchange rate, import of goods, money supply, and output from agriculture have a long-run impact on the inflation process in Nigeria over the study period. Their study equally reveals that both fiscal and monetary policies influenced inflation in Nigeria. They conclusively recommended that the government should avoid wastage of public funds through unhealthy fiscal deficits, while the monetary authority should promote a lending rate that will streamline investment and internal rates that will help in reducing the growth rate of inflation. In their own work, [14] studied the money supply and inflation in Nigeria: implication for national development. They adopted a Vector Auto-Regressive (VAR) model in analyzing data from 1970 to 2008. From their findings, a unidirectional causality runs from money supply to inflation, from interest rate to inflation to money supply. Their recommendation is that government should make use of the level of inflation as an operational tool in the measurement of the effectiveness of its monetary policy.

In another study by [7] captioned - determinants of inflation in Nigeria between 1981 to 2013. The result from the Ordinary Least Square (OLS) reveals that fiscal deficits, money supply, interest rates, and exchange rates have positive and significant impacts on inflation in Nigeria within the study period. He concluded that the cause of inflation in Nigeria is multi-dimensional in nature; thereby, there is the need for a full knowledge of the dynamics and a frequent review of such so as to proffer possible solutions to the challenges of inflation in the country.

[9] carried out research on exchange rate depreciation and inflation in Nigeria between 1986 – 2008. They adopted the Auto Regressive Distributed Lag (ARDL) cointegration procedure. Their findings reveal that exchange rate depreciation, money supply, real Gross Domestic Product (RGDP) are the major determinants of inflation upsurge in Nigeria. They equally maintain that depreciation of the Naira has a positive and significant effect on Nigeria's inflation rate. They contended that while taking into cognizance that Naira depreciation is necessary for ensuring an improvement in the production of goods for exports, it

should not be completely relied upon as a potent measure of inflation control in Nigeria as such will lead to adverse effects. They recommended that policymakers should adopt exchange rate depreciation as a complementary tool to other stabilization measures to curtail the volatile nature of the inflation rate in Nigeria.

Summary of Literature and Identified Gap

The various studies had, in one way or the other, considered various factors that affect inflation. The researchers used different methodologies and incorporated different factors that they considered appropriate in their study. Having conducted the detailed review, the present work took a lift from the work of [3]; we deviated further by extending the data range to 2017, which will reveal the current realities. We incorporated total government expenditure in our model to have a better representation of fiscal policy impact on inflation in Nigeria. Equally, we made use of models Fully Modified Ordinary Least Square (FM-OLS) and the Dynamic Ordinary Least Square (DOLS) as our estimation techniques.

IV. METHODOLOGY

A. Data Source

The study made use of time-series data obtained from the Central Bank of Nigeria (CBN) statistical bulletin and data abstractions from the National Bureau of Statistics (NBS). The data considered in this study covers the periods between 1981 – 2017; the idea behind this choice is to reveal the current state of things as regards inflation in Nigeria.

B. Model Specification

Taking a lift from the works reviewed on the core determinants of inflation both in Nigeria and some other countries, our choice of variables is inflation proxied by the consumer price index (CPI) as the dependent variable. The independent variables are broad money supply (BMS), output (RGDP), monetary policy rate (MRR), Real Exchange Rate (REXR), government expenditure (GEXP), Domestic Oil Price (DOP).

Specifically, the model becomes:

$$CPI = f(BMS, RGDP, REXR, DOP, MPR, GEXP) \quad \ldots\ldots (1)$$

Re-writing equation (i) into econometrics form, we have:

$$CPI_t = a_0 + a_r(BMS)_t + q_2(RGDP)_t + q_3(REXR)_t + q_4(DOP)_t + q_s(MPR)_t + q_6(GEXP)_t + u_t \quad \ldots\ldots (2)$$

C. Estimation Procedure

The empirical analysis adopted in this current research was specified into four phases: firstly, we subjected the variables to a stationarity test to ensure that our variables are suitable for policy decision and they are devoid of the unit root problem. We made use of the Elliot-Rotenberg-Stock test and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root test procedures to arrive at the conclusion that the variables were not stationary at their level form but became stationary after differencing once, that is, they are integrated by order-one I(1). The next dimension in this study was to determine whether our variables share a long-run relationship or if they are cointegrated along with the same parts.

Having arrived at the conclusion that our variables are differenced stationary and were all stationary after differencing once, we proceeded by subjecting them to a cointegration test with the Johansen cointegration test as developed by [11]. Having determined the existence of cointegration in our model, we proceeded with the Fully Modified OLS (FM-OLS) and the Dynamic Least Square (DOLS) to check for the long-run elasticities of the variables. The FMOLS and DOLS are among the modern econometrics tools that were introduced for investigating the existence of long-run elasticities in variables that were integrated. The FMOLS and DOLS are cointegrating regression models and were first introduced by [16], [17], respectively. These methods are preferred to OLS because they take care of endogeneity problems and serial correlation that might arise in the OLS technique. [2] citing Rukhsana and M. Shahbaz, maintained that FMOL and DOL techniques are able to modify the least-squares; they account for serial correlation effects and equally take account of the endogeneity of the regressors which may arise from the existing cointegrating relationships among the variables. Lastly, we estimated and subjected our model to residual and stability diagnostics tests. We adopted the Breusch-Godfrey serial correlation LM test, the ARCH heteroskedasticity test, and the Ramsey RESET specification test.

D. Empirical Results

1) Unit Root Test

Tables 1 and 2 present the results of the Elliot-Rotenberg-Stock and KPSS unit root/stationarity test of the variables used in the study. The tests show that the variables became stationary after differencing once. That means they were not stationary in their natural form. They only became stationary after the first difference at the 5% and 10% chosen level of significance. Conclusively, they are integrated of order one I(1).

Table 1. Kwiatkowski-Philips-Schmidt-Shin (KPSS) stationarity test

Variable	*KPSS Test Statistic*	*5% critical*	*10% critical*	*Order of Integration*
CPI	0.220113	0.463000	0.347000	*I(1)*
BMS	0.258454	0.463000	0.347000	*I(1)*
EXR	0.323046	0.46000	0.347000	*I(1)*
DOP	0.245327	0.463000	0.347000	*I(1)*
GEXP	0.218719	0.463000	0.347000	*I(1)*
MORE	0.152809	0.463000	0.347000	*I(1)*
RGDP	0.288433	0.463000	0.347000	*I(1)*

Source: Authors' computation.

Table 2. Result of Elliot-Rothenberg-Stock DF-GLS stationarity test

Variable	*ERS Test Statistic*	*5% critical*	*10% critical*	*Order of Integration*
CPI	1.622301	2.970000	3.910000	*I(1)*
BMS	1.711989	2.970000	3.910000	*I(1)*
EX	2.816152	2.970000	3.910000	*I(1)*
DOP	1.844173	2.970000	3.910000	*I(1)*
NEXT	2.040846	2.970000	3.910000	*I(1)*
MORE	1.291627	2.970000	3.910000	*I(1)*
RGDP	2.687836	2.970000	3.910000	*I(1)*

Source: Authors' computation.

2) Cointegration Test

Having determined that our variables share a common trend as they were integrated of the same order I(1), we estimated the cointegration test to confirm the number of cointegrating equations in the model. We made use of the Johansen method of cointegration which is applicable and acceptable when all the variables are integrated of the same order, and in this case, integrated of order one I(1). The Johansen method, as reported in Table 3 below, demonstrates the unrestricted cointegration Rank Tests using the Trace Test and the Max-Eigen statistics, respectively. Both the Trace Test and Max-Eigen Test show the presence of a long-run relationship in the model. The Trace Test Statistic provides evidence of six cointegrating equations, while the Max-Eigen test shows the existence of five cointegrating equations in the test – both at a 5% level of significance. Conclusively, the two tests provide ample evidence that the chosen variables have a long-run relationship amongst them.

Table 3. Johansen cointegration test

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Stat	0.05 Crit Value	Prob. **
None *	0.886611	232.4765	125.6154	0.0000
At most, 1 *	0.813420	156.2838	95.75366	0.0000
At most, 2 *	0.654750	97.52243	69.81889	0.0001
At most, 3 *	0.515482	60.30039	47.85613	0.0022
At most, 4 *	0.437930	34.93938	29.79707	0.0117
At most 5	0.227517	14.77488	15.49471	0.0640
At most, 6 *	0.151253	5.739815	3.841466	0.0166
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigen value	Max-Eigen Stat	0.05 Crit Value	Prob. **
None *	0.886611	76.19271	46.23142	0.0000
At most 1 *	0.813420	58.76136	40.07757	0.0002
At most 2 *	0.654750	37.22204	33.87687	0.0192
At most 3 *	0.515482	25.36101	24.58434	0.0338
At most 4	0.437930	20.16450	21.13162	0.0678
At most 5	0.227517	9.035066	14.26460	0.2832
At most 6 *	0.151253	5.739815	3.841466	0.0166

***** *Significant at 5% level of significance.*
Source: Authors' computation.

3. FMOLS and DOLS Test

The results that were established from the ERS and KPSS unit root/stationarity tests and the Johansen cointegration tests suggest that a long-run relationship exists among the variables of interest. Having established that, our next step is to examine the long-run elasticities of the coefficients of individual variables vis-à-vis their relative impact on inflation in Nigeria within the study period. To have a robust and more reliable result, we applied both the FMOLS and DOLS techniques in our analysis. Tables 4 and 5 below empirically demonstrate the result of the FM-OLS and DOLS, respectively.

Table 4. FM-OLS Result - Dependent Variable: CPI

Variable	Coefficient	t-value	P-value
BMS	0.006267	5.235935	0.0000*
RGDP	-0.001640	-3.886551	0.0005*
MORE	0.816056	1.574647	0.1262
NEXT	0.006644	1.596510	0.1212
EX	0.371151	5.676034	0.0000*
DOP	0.096938	0.549864	0.5866
Constant	17.44620	1.481936	0.1491

***** *Significant at 1%, 5%, and 10% levels of significance.*
Source: Authors' computation.

Table 5. DOLS Result - Dependent Variable: CPI

Variable	Coefficient	t-value	P-value
BMS	0.006014	4.262980	0.0002*
RGDP	-0.001612	-3.279606	0.0026*
MORE	0.739595	1.249678	0.2211
NEXT	0.007190	1.467087	0.1528
EX	0.362587	4.703696	0.0001*
DOP	0.138025	0.670407	0.5077
Constant	15.59073	1.163108	0.2540

***** *Significant at 1%, 5%, and 10% levels of significance.*
Source: Authors' computation.

V. DISCUSSION OF FINDINGS

The result from both the FM-OLS and the DOLS are unique and agrees with each other. The results demonstrate that exchange rate, money supply, and real GDP are the factors that affect the inflation rate significantly in Nigeria. The coefficient of the money supply is 0.006 with a probability value of 0.0000. That of the RGDP is -0.0016 (0.0005), and the exchange rate is 0.371151 (0.0000), probability values in the bracket. The result is pointing to the fact that the many factors leading to the rising and upsurge in inflation in Nigeria are the exchange rate, followed by broad money supply, and the RGDP. It demonstrates that a one-percent change or depreciation of the Naira leads to an overwhelming thirty-seven percent increase in the inflation rate in Nigeria.

From the point of money supply, a one-percent increase in money supply leads to a 0.06% increase in the inflation rate, while the RGDP has a negative relationship with the inflation rate, and this is a clear case of inflationary recession. The results state that with a one-percent reduction in RGDP, the inflation rate increases 0.002%. This is clear evidence of inflationary recession as it has been observed in the country today. Conversely, if Nigeria's RGDP is increased, it will be accompanied by a reduction in inflation. The result suggests that Nigeria needs to raise its productive base to increase its growth, as this will ensure a reduction of the inflation rate in the country. The other factors considered in the study are MPR, GEXP, and DOP. They all have a positive effect on inflation, but such effects were not significant in explaining the unstable nature of inflation in Nigeria. The R-squared and the Adjusted R-squared from the two results provided ample evidence that ninety-eight percent (98%) variations of inflation rates in Nigeria were as a result of variations in the variables considered.

Our empirical findings are in tandem with the findings of other researchers like [8] for Nepal, [3], [6], [6], [9] for Nigeria, whose analysis indicates that exchange rate and money supply are the major determinants of inflation. It contradicts the findings of [13], whose findings suggest that the exchange rate has a negative contribution to inflation rates in Nigeria. The residual and stability diagnostic tests results confirm that our model is not serially correlated; it is homoscedastic and rightly specified based on Breusch-Godfrey serial correlation test, ARCH heteroskedasticity test, and Ramsey RESET test, respectively.

VI. CONCLUSION

The study sets out to explore and explain the macroeconomic factors that affect inflation in Nigeria between 1981 – 2017. It is obvious that Nigeria had been battling with an unstable and increasing rate of inflation for a long time. Recently, the economy plunged into a recession that brought about untold hardship in the country. Still on that, the inflation rate continues with an upward movement which is a clear indication of a case of inflationary recession. The current research clearly demonstrates that the exchange

rate was the major factor responsible for the unstable inflation in Nigeria, followed by money supply and falling real GDP. The result provides evidence of the dominance of the Monetarist postulations in Nigeria based on the evidence provided from the elasticities of the money supply. Based on the aforementioned, we strongly recommend that the monetary authorities and the Nigerian government should map out practical strategies that will ensure that Nigeria's overdependence on foreign goods is curtailed to the beeriest minimum. There is a need to ensure that the money pushed into circulation is properly channeled to productive sectors so that such money will not find expression in the inflation rate in the country. The obvious case of inflationary recession demands that Nigeria, as the country, needs to upscale her productive capacity and revamp her agricultural arrangements in order to get out of the trap.

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