“Impact of inflation on economic growth: evidence from Nigeria”

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IMPACT OF INFLATION ON ECONOMIC GROWTH: EVIDENCE FROM NIGERIA

Abstract

In an attempt to examine the influence of inflation on the growth prospects of the Nigerian economy, the study employs the autoregressive distributed lag on the selected variables, i.e. real gross domestic product (GDP), inflation rate, interest rate, exchange rate, degree of economy`s openness, money supply, and government consumption expenditures for the period 1980–2018. The study findings indicate that inflation and real exchange rate exert a significant negative impact on economic growth, while interest rate and money supply indicate a positive and significant impact on economic growth. Other variables in the model depict no influence on the economic growth of Nigeria. The causality result shows the unidirectional relationships between interest rate, exchange rate, government consumption expenditures and gross domestic product. However, inflation and the degree of openness show no causal relationship with gross domestic product. As a result, the study recommends that a more pragmatic effort is needed by the monetary authorities to target the inflation vigorously to prevent its adverse effect by ensuring a tolerable rate that would stimulate the economic growth of Nigeria.

Keywords inflation, economic growth, autoregressive distributed lag (ARDL)

JEL Classification E31, E39

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INTRODUCTION

Amidst the debilitating macroeconomic problems that had received serious attention from financial analysts, policymakers, and the monetary officials in both developed and developing countries of the world is the relationship between the inflation and economic growth (Ndoricimpa, 2017; Seleteng, Bittencourt, & Van-Eyden, 2013). One of the main responsibilities assigned to monetary agencies is to maintain relative stability in the domestic price of goods and services. This emphasis is premised on the belief that monetary policy promotes sustainable growth and development by strengthening the value of money and prevents inflation and its associated uncertainties, thereby increasing the future growth prospects of the country. Thus, maintaining relative stability remains one of the vital goals of monetary authorities in a country (Anidiobu, Okolie, & Oleka, 2018).

Studies such as Aydin (2017), Mamo (2012), Manoel (2010) and Ndoricimpa (2017) on the inflation and economic growth nexus are mainly cross-country. The findings obtained cannot be directly applied to Nigeria because of the differences in their exposure to political, financial, economic structures, and their reactions to external shocks. This study applies a country-specific approach to investigate whether inflation is detrimental to the economic growth of a country with specific inclination to Nigeria. Also, previous studies use different estimation techniques and receive contradictory results. Some studies show that inflation induces the growth prospects of the economy as

observed by the structuralists (Anidiobu, Okolie, & Oleka, 2018; D. Chude & N. Chude, 2015; Enejoh & Tsauni, 2017; Umaru & Zubairu, 2012), while others showed that inflation is harmful to economic growth (Al-Taeshi, 2016; Denbel, Ayen, & Regasa, 2016; Idris & Suleiman, 2019; Kasidi & Mwakanemela, 2015; Manoel, 2010; Mkhatshwa, Tijani, & Masuku, 2015). Apart from this, Anochiwa and Maduka (2015) found no clear convincing evidence, either positive or negative, for the inflation and growth rate of an economy. This implies that the relationship between these two economic variables is far from being empirically settled. Thus, studies in these areas appear inconclusive. The different results obtained by the empirical studies do not permit the researchers to draw an unequivocal conclusion on the subject matter.

More so, few that address the area cannot provide a valid conclusion on the direction of relationship between the inflation and economic growth (Anochiwa & Maduka, 2015; Denbel et al., 2016; Gatawa, Abdulgafar, & Olarinde, 2017; Inyiama, 2013; Oladipo & Akinbobola, 2011; Shuaib, Augustine, & Frank, 2015). This study attempts to fill this gap by documenting the nature of the causal relationships among the variables. Also, the periods used by most of the highlighted studies are not as inclusive to capture the prevailing trend in these two economic variables. Besides, this study employs an autoregressive distributed lag (ARDL) model against studies that mostly used ordinary least squares, which at best explains the short-run relationship (Anidiobu et al., 2018; D. Chude & N. Chude, 2015; Phiri, 2010; Umaru & Zubairu, 2012). ARDL being a dynamic specification model, uses the lags of both the dependent and independent variables. With this, the short- and long-run impacts can be directly estimated.

The empirical studies provided show that the inflation rate and economic growth relationship is still open to further discussion, as their mixed results indicate. These among others are the reasons behind this study as it adds to the existing body of knowledge by bringing out the changes inflation has on economic growth. It, therefore, provides suitable policy implications meant to curb the adverse effect of inflation in the country. Apart from this introduction, the study is divided into four sections as follows: the review of literature where empirical studies both locally and internationally were adequately reviewed in order to provide concrete evidence on the research gap. This is followed by materials and methods where model specification was carried out, and the next section presents a discussion of findings, while the last section shows conclusion and recommendations.

1. LITERATURE REVIEW

Inflation occurs when there is an increase in the price of goods and services. This increase in price is seen as inflation when it is persistent and above the specified benchmark. For instance, an increase in the money supply can gravitate to a higher price level in a matter of time. There are various types of inflation known in the literature, some of these types are: demand-pull, which arises as a result of an increase in aggregate demand without a corresponding increase in supply, supply push or cost-push inflation happens when a reduction in supply caused by an increase in the cost/price of the commodity produced (Anochiwa & Maduka, 2015). It can also be structural inflation, which arises as a result of changes in monetary policy. This type of inflation is generally referred to as built-in inflation. Within these categories, inflation can be hyper, extremely high, chronic, high, moderate, and low inflation (Umaru & Zubairu, 2012).

Anochiwa and Maduka (2015) are of the view that the ability of monetary authorities to maintain single-digit inflation would increase the capacity to accelerate economic growth. However, the reverse is the case for Nigeria. Available data from the Central Bank of Nigeria Statistical Bulletin (2018) on the trend of inflation indicate that the inflationary situation in the country has become alarming since 1980 until 2018. The inflationary trend shows that Nigeria had only maintained single-digit inflation for fourteen years in the past thirty-eight years. However, the persistent increase in the inflation rate in Nigeria is evidence of the failure of both monetary and fiscal policies. The inflationary situation in Nigeria has become a threat to the economy and closely relat-

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ed to the persistent increase in the price of oil over the years, which began in the early 1980s when the petrol price increased from 9.5k per liter to 15.4k per liter. This increase directly or indirectly affects the economic activities of the country, the transportation cost, the cost of locally produced goods, rents, foodstuffs, among others. Also, 2012 witnessed another increase in the price of petrol to ₦97.00 per liter and on assuming to the office by the present administration, also moves the price to ₦145 per liter in 2016. This eventually made the price of goods and services skyrocket (Idris & Suleiman, 2019).

The study of the nexus between inflation and economic growth remain perennial and has given rise to different schools of thought. One of the prominent supporters of the positive relationship between inflation and economic growth is the structuralist view. This school of thought advocates that a moderate degree of inflation is reasonable for efficient economic mobilization. This is based on the assumption that an increase in prices as a result of inflation reduces the real wages and tends to increase the profits when wages lag behind. With this situation, income is transferred from economic units that have a lower propensity to save to those units with high propensity. The government thus can raise resources for development because people are forced to save (Doguwa, 2013; Enejoh & Tsauni, 2017; Mankiw, 2010). The positive contributions of inflation to economic growth are also propelled when there is an increase in the price, which stimulates workers to structurally change from the traditional subsistence sector to a more expanding industrialized sector, thus giving room for more optimal and full utilization of economic resources (Dewett & Navalur, 2010).

Despite this assertion that certain degrees of inflation foster the economic growth, most findings still reveal that inflation is detrimental to economic activities (Kasidi & Mwakanemela, 2015; Manoel, 2010; Mkhatshwa, Tijani, & Masuku, 2015). They posit that inflation needs to be reduced and kept to the barest and should not rise above a single digit. This is the view of the Monetarists and the Keynesians who assert that inflation has serious contagious effects as it discourages domestic production and creates a favorable atmosphere for foreign goods to compete with the domestic market, encourages deficit balance in the international payment transaction, uncertainty in the profitability of future investment projects, redistributes income in a haphazard way, reduction in purchasing power of money, which results in frequent agitations by a trade union to increase workers' salaries, interacts with the tax system to distort the decision between lenders and borrowers and above all places a huge toll on individuals with fixed income or fixed interest rate on assets (Al-Taeshi, 2016; D. Chude & N. Chude, 2015; Eggoh & Muhammad, 2014; Olu & Idih, 2015).

In addition to the main variable of interest (inflation rate), interest rate was added. This is because high interest rate reduces the volume of output of the real sector of the economy and hinders the borrowing capacity of the investors. With an increase in interest rate, the purchasing power of liquid cash declines, and investors are scared away from making investment decisions. Also, the exchange rate was included because it is directly affected by the prevailing inflation rate in the country. For instance, depreciation or devaluation can encourage domestic production and boost private sector investment, which in turn can encourage export, thus improving the balance of payment of the country (Idris & Suleiman, 2019). Money supply was also added; this is premised on the understanding that inflation is caused as a result of monetary expansion, information regarding the current movements in the money supply is important in conditioning expectations (Rousseau & Wachtel, 2002; Shuaib, Augustine, & Frank, 2015). Other added variables are trade openness and government consumption expenditures.

Here it is reviewed empirical works related to inflation and economic growth locally and internationally. This review is justified to provide a comparative analysis with earlier studies and to establish valid gaps that could serve as a basis for this study.

In Latin America, Manoel (2010) examines how the inflation rate affects the growth of the country employing panel estimation techniques on data sets from 1970 to 2007 among four Latin American countries. The study uses the growth rate of real GDPs made as a function of inflation, the contributions of government's share in GDP,

trade openness, investment ratio, structural development index, the proportion of liquid liabilities to GDP, and political regime. From the result, inflation and the growth of the economy depict significant negative relationship.

In South Africa, using ordinary least squares (OLS) estimation techniques on quarterly data from February 2000 to July 2010, Phiri (2010) conducts a study on the inflation level that could be considered harmful to growth-financing activities. The variables for the analysis are real gross domestic product, inflation rate, capital accumulation, lending capacity of banks, equity trade volume, and exchange rate. The result indicates that inflation depicts an adverse effect on growth-financing activities in South Africa at all levels.

Mkhatshwa et al. (2015) analyze how the inflation rate affects both economic and agricultural growth in Swaziland for the period 1980–2013. The autoregressive distributed lag (ARDL) result indicates that inflation depicts a negative relationship, while agricultural growth indicates a positive relationship on the growth of Swaziland. The causality test shows unidirectional relationship between the growth of the economy and the inflation, rate while no causal relationship was found among other variables.

Mamo (2012) conducts a study among 13 Sub-Saharan Africa (SSA) countries from 1969 to 2009 on how inflation affected the economic growth. The study employs panel regression on variables, which include inflation, investment, population, and gross domestic product. The study shows that the inflation rate and economic growth are inversely related, while Granger causality reveals that the inflation rate in the country can be used to predict the growth rate among countries. Kasidi and Mwakanemela (2015) analyzed the influence of inflation on the economic growth for the period 1990–2011 in Tanzania using correlation and co-integration techniques, and state that no strong relationship exists between inflation rate and the growth of their economy.

Employing Johansen co-integration and Granger causality test, Denbel et al. (2016) investigate if there is any relationship among money supply, inflation, and economic growth in Ethiopia. The results from Johansen co-integration support the work of Mkhatshwa et al. (2015), while the direction of causality indicates that its runs from economic growth to inflation rate and from money supply to economic growth.

Al-Taeshi (2016) examines how inflation impacts Malaysian economy from 1970 to 2014 using co-integration and Granger causality test. Evidence from the study suggests that inelastic response was found between economic growth and inflation rate. Using the panel analysis, Ndoricimpa (2017) studies inflation threshold on economic growth in some selected African countries. The result indicates the nonlinear relationship between the two variables, and that low inflation enhances the growth of the economy in the middle-income countries, while it has no effect on the sample put together. The result also shows that inflation beyond the threshold negatively influences the economy in all the countries.

In Nigeria, investigating budget deficit and economic growth is causally examined by Oladipo and Akinbobola (2011) using the growth of the economy, inflation rate, budget deficit, and exchange rate. The study shows unidirectional causal relationship between deficit budget and inflation rate and that it runs from the former to the latter. The result also reveals that budget deficit affects inflation rate as a result of frequent fluctuations in the exchange rate.

Umaru and Zubairu (2012), using regression analysis and causality estimation test on data ranging from 1970 to 2010, examine how inflation impacts on the Nigerian economy. The result shows unidirectional relationship between gross domestic product and rate of inflation, while there exist the causal relationships between the former and the latter. The result also indicates that inflation reveals positive influence on the growth of the economy.

Inyiama (2013) employs Johansen co-integration and Granger causality test to determine if inflation weakens the growth of Nigerian economy for the period 1979–2010. The result shows that the rate of inflation is inversely related on economic growth, while the exchange rate and interest rate indicate a direct impact on the economy. The causality test indicates no causal relationships between inflation rate and economic growth.

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Ogbonna (2014) employs vector error correction model (VECM) estimation to examine the government size and the dynamics of inflation in Nigeria for the period 1981–2013. The results indicate long-run relationship between government size and consumer price index, while there is no causal relationship between the two variables, and that consumer price index in Nigeria is affected by its lagged value and current period of exchange rate of the domestic currency.

Anochiwa and Maduka (2015) determine if any relationship can be found between the growth of the economy and inflation rate in Nigeria during 42 years (1970–2012). The results of Johansen co-integration test reveal the nonlinear negative influence between the two economic variables, while Granger causality indicates no causal relationship between them.

Chude and Chude (2015) employ time-series data from 2000 to 2009 using ordinary least squares regression estimation technique to examine the influence of inflation on economic growth of Nigeria. The result indicates the positive and significant relationship between inflation, exchange rate and growth of the economy. Olu and Idih (2015), using least squares method, analyze the influence of inflation on economic growth of Nigeria from 1980 to 2013. The result shows an insignificant positive relationship between two variables.

Shuaib et al. (2015) employ co-integration and Granger causality tests to examine how inflation rate affects the economy of Nigeria for the period 1960–2012. The result reveals no long-run relationship in the model, while causality test also indicates no causal relationship among the variables. Enejoh and Tsauni (2017) examined how inflation rate affects the country's economy using ARDL techniques and Granger causality during 47 years (1970–2016). The result indicates that inflation rate and exchange rate have a positive impact on economic growth, while the lagged value of exchange rate indicates a negative relationship with the growth of the economy. The causality test shows no causal relationship between inflation rate, exchange rate and the growth of Nigeria economy.

Anidiobu et al. (2018) determine the influence of inflation on the economic growth of Nigeria using descriptive and ordinary least squares on the data for the period 1986–2015. The result indicates that inflation rate depicts an insignificant positive relationship, exchange rate shows a significant positive relationship, while there is a negative insignificant relationship between interest rate and growth of Nigeria economy.

In a similar study, Idris and Suleiman (2019) investigate the influence of inflation on economic growth of Nigeria from 1980 to 2017. The study employs vector error correction mechanism on variables selected, which are gross domestic product, inflation rate, interest rate, and exchange rate in the country. Findings reveal long-run relationship among the variables and that inflation rate and interest rate affect the economic growth of Nigeria significantly and negatively in the long run.

Following all these empirical studies, it is evident that consensus has not been reached on the subject matter. This has actually paved the way for this study to justify the types of relationship and the direction of causality among variables selected for this study.

2. METHOD

This study investigates whether inflation is detrimental to economic growth of Nigeria for the period 1980–2018. The choice of the base period is informed as it marks the era when inflation becomes more pronounced in the country following the oil price increase at the international market, while the current period reflects the year at which annual data can be found. This study includes other variables that are directly affected by inflation rate. The study employs autoregressive distributed lag (ARDL) and starts by conducting unit root test of the variables.

2.1. Model specification

In an attempt to examine if inflation is detrimental to economic growth of Nigeria, the study modifies the model in the works of Idris and Suleiman (2019) and Inyiama (2013). In line with their models, the model for this study is formulated as follows:

$$RGDP = f\left(INFR, INTR, EXGR, DOP, MS, GCE\right). \quad (1)$$

From equation (1), it can further be stated in more explicit form as follows:

$$RGDP = f\left(\beta_0 + \beta_1 INFR + \beta_2 INTR + \beta_3 EXGR + \beta_4 DOP + \beta_5 MS + \beta_6 GCE\right). \quad (2)$$

Table 1. Variables used and expected signs based on the theories

Dependent variable	Independent variables	Expected relationship based on the theories
Real gross domestic product (RGDP)	Inflation rate (INFR)	–
	Real interest rate (INTR)	–
	Real exchange rate (EXGR)	+/–
	Degree of openness (DOP)	+
	Money supply (MS)	+
	Government consumption expenditures (GCE)	–

2.2. Estimation techniques

2.2.1. *Unit root test*

Macroeconomic variables are generally known with their random walk nature, which can be mitigated when converting it into first differencing. Datta and Kumar (2011) note that regressing a non-stationary series on another would generate spurious results. In an attempt to guide against this, Augmented Dickey-Fuller (ADF) technique developed by Dickey and Fuller (1979) was employed. This test is necessary as it guides the study on the selection of appropriate estimation techniques required for the analysis. The trend and intercept of the unit root are represented in equations (3) and (4), respectively.

$$\Delta Y_t = \beta_0 + \lambda Y_{t-1} + \beta i \Delta Y_{t-1} + \mu_{ti} \quad (3)$$

for intercept

$$\Delta Y_t = \beta_0 + \lambda Y_{t-1} + \beta_{it} + \beta i \Delta Y_{t-1} + \mu_{ti} \quad (4)$$

for trend

where Y_t is the tested variable for unit root, Δ is the first difference, μ_{ti} denotes error term at period i, Y_{t-1} represents the one period lag of the tested variable for unit root.

2.3. Autoregressive distributed lag (ARDL)

Following the unit root test, the study proceeds to examine short- and long run relationship among the variables. This is done using autoregressive distributed lag (ARDL) known as the bound test approach to co-integration. ARDL model developed by Pesaran, Shin and Smith (1996) and later popularized by Pesaran, Shin and Smith (2001) is more advantageous to other co-integration procedures as it can be used when the variables under consideration are integrated of order zero I(0) and order one I(1) but will crash when integrated stochastic trend of I(2) is found. With this, bound test eliminates the variability in the order of integration against co-integration approach. Also, it produces better result because the error correction mechanism can be obtained via simple linear transformation, which integrates short-run adjustments with long-run equilibrium without losing any information in the long run. Also, for a small sample size of 39 observations (1980–2018), the approach is more suitable.

Two sets of adjusted critical values put forward by Pesaran, Shin, and Smith (2001) are the lower and the upper bounds. The former assumes that all variables are I(0), while the later indicates that they are all I(1). The decision is that the null hypothesis of no co-integration is rejected if the *F*-statistics falls above the critical upper bound test, while the null hypothesis cannot be rejected if it falls below the lower bound. Lastly, the result would be regarded as inconclusive if it falls between the lower and upper bound. In line with Pesaran et al. (2001), the unrestricted error correction mechanism for testing co-integration among the variables used in this study is stated as follows:

$$\begin{aligned}\Delta RGDP_t = {} & +\beta_0 + \sum_{i=1}^{n} \beta_1 \Delta RGDP_{t-i} + \\ & + \sum_{i=1}^{n} \beta_2 \Delta INFR_{t-i} + \sum_{i=1}^{n} \beta_3 \Delta INTR_{t-i} + \sum_{i=1}^{n} \beta_4 \Delta EXGR_{t-i} + \\ & + \sum_{i=1}^{n} \beta_5 \Delta DOP_{t-i} + \sum_{i=1}^{n} \beta_6 \Delta M2_{t-i} + \sum_{i=1}^{n} \beta_7 \Delta GCE_{t-i} + \\ & + \alpha_1 RGDP_{t-1} + \alpha_2 INFR_{t-1} + \alpha_3 INTR_{t-1} + \alpha_4 EXGR_{t-1} + \\ & + \alpha_5 DOP_{t-1} + \alpha_6 M2_{t-1} + \alpha_7 GCE_{t-1} + \mu_t.\end{aligned} \quad (5)$$

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The ARDL long-run model is estimated if co-integration is found while the short-run model is estimated if otherwise.

$$\begin{aligned}\Delta RGDP_t = &+\beta_0 + \beta_1 RGDP_{t-1} + \\ &+\beta_2 INFR_{t-1} + \beta_3 INTR_{t-1} + \beta_4 EXGR_{t-1} + \\ &+\beta_5 DOP_{t-1} + \beta_6 M2_{t-1} + \beta_7 GCE_{t-1} + \mu_t.\end{aligned} \quad (6)$$

$$\begin{aligned}\Delta RGDP_t = &+\alpha_0 + \sum_{i=1}^{n} \alpha_1 \Delta RGDP_{t-i} + \\ &+\sum_{i=1}^{n} \alpha_2 \Delta INFR_{t-i} + \sum_{i=1}^{n} \alpha_3 \Delta INTR_{t-i} + \\ &+\sum_{i=1}^{n} \alpha_4 \Delta EXGR_{t-i} + \sum_{i=1}^{n} \alpha_5 \Delta DOP_{t-i} + \\ &+\sum_{i=1}^{n} \alpha_6 \Delta M2_{t-i} + \sum_{i=1}^{n} \alpha_7 \Delta GCE_{t-i} + \\ &+\sum_{i=1}^{n} ECM_{t-1} + \mu_t.\end{aligned} \quad (7)$$

where $\beta_0 - \beta_7$ are short-run elasticities, $\alpha_0 - \alpha_7$ are long-run elasticities, ECM_{t-1} is one lag of error correction term, Δ is first difference, μ_t is white noise, β_0 is constant term.

2.4. Granger causality

After ARDL model, pairwise Granger causality test developed by Granger (1988) was employed. Since ARDL cannot determine the direction of relationship among the variables, Granger causality test assists the study to know the variables that Granger cause each other or whether no relationship exists. The decisions whether to accept or reject the hypothesis are made on the value of the *F*-statistics and the probability. There exist three types of causality: bidirectional causality, which arises when the two variables relate with each other, that is, they influence one another; unidirectional causality occurs when only one variable influence the other variable and when no causality occurs from the variables implies that none of the variable relates. However, the Granger equations for the model are presented as follows:

$$RGDP_t = \sum_{i=1}^{n} \beta_i RGDP_{t-1} + \sum_{j=1}^{n} \alpha_j INFR_{t-j} + u_t. \quad (8)$$

$$INFR_t = \sum_{i=1}^{n} \delta_i INFR_{t-1} + \sum_{j=1}^{n} \varphi_j RGDP_{t-j} + u_t. \quad (9)$$

$$INTR_t = \sum_{i=1}^{n} \beta_i INTR_{t-1} + \sum_{j=1}^{n} \alpha_j RGDP_{t-j} + u_t. \quad (10)$$

$$RGDP_t = \sum_{i=1}^{n} \delta_i RGDP_{t-1} + \sum_{j=1}^{n} \varphi_j INTR_{t-j} + u_t. \quad (11)$$

$$EXGR_t = \sum_{i=1}^{n} \beta_i EXGR_{t-1} + \sum_{j=1}^{n} \alpha_j RGDP_{t-j} + u_t. \quad (12)$$

$$RGDP_t = \sum_{i=1}^{n} \delta_i RGDP_{t-1} + \sum_{j=1}^{n} \varphi_j EXGR_{t-j} + u_t. \quad (13)$$

$$DOP_t = \sum_{i=1}^{n} \beta_i DOP_{t-1} + \sum_{j=1}^{n} \alpha_j RGDP_{t-j} + u_t. \quad (14)$$

$$RGDP_t = \sum_{i=1}^{n} \delta_i RGDP_{t-1} + \sum_{j=1}^{n} \varphi_j DOP_{t-j} + u_t. \quad (15)$$

$$MS_t = \sum_{i=1}^{n} \beta_i MS_{t-1} + \sum_{j=1}^{n} \alpha_j RGDP_{t-j} + u_t. \quad (16)$$

$$RGDP_t = \sum_{i=1}^{n} \delta_i RGDP_{t-1} + \sum_{j=1}^{n} \varphi_j MS_{t-j} + u_t. \quad (17)$$

$$GCE_t = \sum_{i=1}^{n} \beta_i GCE_{t-1} + \sum_{j=1}^{n} \alpha_j RGDP_{t-j} + u_t. \quad (18)$$

$$RGDP_t = \sum_{i=1}^{n} \delta_i RGDP_{t-1} + \sum_{j=1}^{n} \varphi_j GCE_{t-j} + u_t. \quad (19)$$

According to equation (8), *INFR* Granger causes *RGDP* when the past (lagged) values of *RGDP* and *INFR* really cause the behavior of the current value of *RGDP*. Equation (9) also shows that RGDP is said to Granger cause *INFR* if the past (lagged) values of *INFR* and *RGDP* cause the behavior of the current value of *INFR*. This is also applicable to equations (10)-(19).

2.4.1. *Diagnostic tests*

To fulfill the basic assumptions, one underlines ARDL, which emphasizes that the model must not suffer from serial correlation. That is, no autocorrelation must exist with the error terms, data should not have heteroscedasticity. This implies that the variances and means must be constant over time, and the data in question must follow normal distribution. Finally, cumulative sum (CUSUM) test was also employed to know the fit-

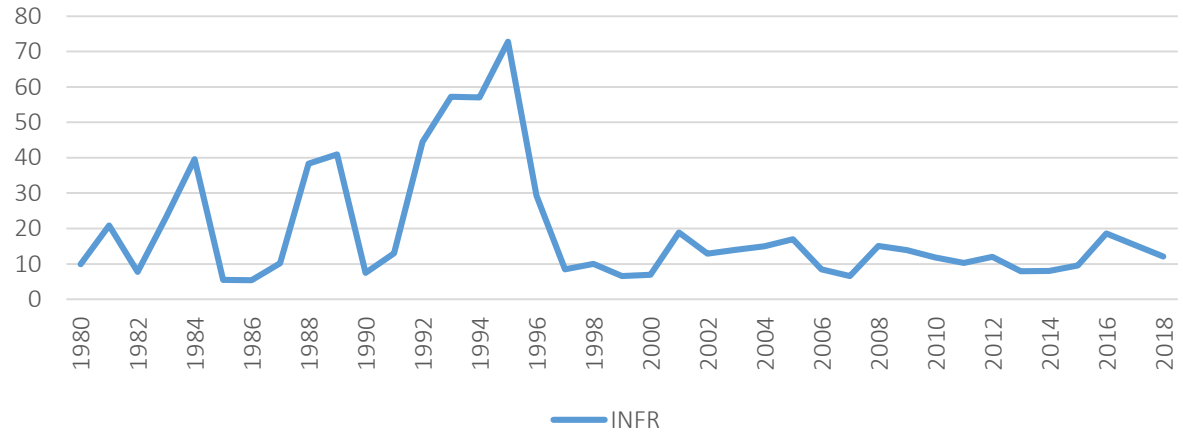

Figure 1. Inflation trend in Nigeria

ness of the model. The study conducts four diagnostic tests using normality test, serial correlation LM test, heteroscedasticity test, and cumulative sum (CUSUM) test to fulfill all these conditions.

3. RESULTS

This section begins with descriptive statistics of the variables. This is followed by analyzing inflationary trend in Nigeria, while the time series property using test statistics of Augmented Dickey Fuller (ADF) to provide the basis for the analysis was also considered.

Table 2 reports the descriptive values of all the variables employed and shows that the mean value of gross domestic product, inflation rate, interest rate, real exchange rate, degree of openness, money supply, and government consumption expenditures is 10.28, 2.68, 2.81, 3.46, –1.22, 6.44, and 5.43. The series that measures the level of discrepancy as shown in the standard deviation result is money supply, while interest rate shows the lowest level. Skewness indicates the rate of asymmetry or discrepancy of the variables. Accordingly, INFR, EXGR, DOP, MS, and GCE have long left tail. This is because the variables exhibit negative values, while RGDP and INFR have long right tail.

Kurtosis measures the pawedness and flatness of the series. The result shows that only INTR is leptokurtic relative to its normal distribution because its value is greater than 3. While other variables have their kurtosis value lesser than 3, this shows that the peak of their distributions are less than normal, thus, referred to as platykurtic distribution. Jarque-Bera statistical test indicates the variables that are normally distributed as its measures the differences in the skewness and kurtosis. The result shows that Jarque-Bera statistic rejects the null hypothesis of no normal distribution for all the variables. Thus, it is concluded that they are all normally distributed.

Table 2. Descriptive statistics

Statistics	RGDP	INFR	INTR	EXGR	DOP	MS	GCE
Mean	10.28	2.68	2.81	3.46	–1.22	6.44	5.43
Median	10.07	2.56	2.86	4.53	–1.15	6.44	6.11
Maximum	11.15	4.29	3.39	5.78	–0.53	10.13	8.64
Minimum	9.53	1.69	2.01	–0.52	–2.23	2.22	1.49
Std. dev.	0.56	0.69	0.31	2.07	0.40	2.62	2.43
Skewness	0.29	0.73	–0.87	–0.86	–0.66	–0.08	–0.31
Kurtosis	1.58	2.60	3.67	2.24	2.74	1.59	1.68
Jarque-Bera	3.78	3.73	5.71	5.77	2.97	3.29	3.47
Probability	0.15	0.16	0.06	0.06	0.23	0.19	0.18
Sum	401.03	104.54	109.53	134.88	–47.54	251.02	211.93
Sum sq. dev.	11.94	18.32	3.66	163.23	6.16	259.92	223.73
Observations	39	39	39	39	39	39	39

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Table 3. Unit root test of ADF value

Variables	Critical values 5%	ADF *t*-statistics	Prob.	Order of integration
RGDP	–2.94	–28.32	0.00	I(1)
INFR	–2.94	–3.68	0.01	I(0)
EXGR	–2.94	–5.42	0.00	I(1)
INTR	–2.94	–3.20	0.03	I(0)
DOP	–2.94	–7.49	0.00	I(1)
MS	–2.94	–4.36	0.00	I(1)
GCE	–2.94	–8.28	0.00	I(1)

Inflation rate denoted in Figure 1 is the annual percentage growth rate of consumer price index (CPI). Data from the Statistical Bulletin indicate that inflation rate in Nigeria stood at 9.9% in 1980. This digit could not be sustained, with another increase of 20.9% in the following year. Since that period till 2018, inflationary trend in Nigeria has reached double digit in 1983, 1984, 1987, 1988, 1989, 1992, 1993, 1994, 1995, 1996, 2001, 2002, 2003, 2004, 2005, 2008, 2009, 2010, 2011, 2012, 2016, 2017, and 2018, with values of 23.2%, 39.6%, 10.2%, 38.3%, 40.9%, 13%, 44.5%, 57.2%, 57%, 72.8%, 29.3%, 10%, 18.9%, 12.9%, 14%, 15%, 17%, 15.1%, 13.9%, 11.8%, 10.3%, 12%, 18%, 55%, 15.37%, and 12.1%, respectively. This trend shows that inflation reaches the highest level in 1995 with a value of 72.8%. The increase in the value of inflation is due to the weak nature of the monetary authorities in curtailing this trend. Increase in inflation is also caused by many factors such as inconsistent governance arising from both military and civilian administration, global financial crises, increase in salaries of workers, among other factors.

Table 3 reveals the result of the unit root; it shows that variables such as inflation rate and interest rate were integrated at order zero, while real gross domestic product, exchange rate, trade openness, money supply, and government consumption expenditures were found stationary at first difference. The result of the unit root provides the basis for the study to use autoregressive distributed lag for both short- and long- run estimation of the model.

Table 4 reveals the lag selection criterion suggested by LR, FPE, AIC, SC, HQ. The result shows that the optimum number of lag suitable for this analysis is 1. The suggestion is taken into consideration when analyzing ARDL model.

Table 5. ARDL result

Model	*F*-statistic	No. of regressors (K)
f (INFR, INTR, EXGR, DOP, MS, GCE)	74.72337	6
Bounds test result		
Significance	**I(0) Bound**	**I(1) Bound**
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

The bounds test result in Table 5 shows that the *F*-statistic (74.7) approximately is beyond all the significance levels. It, therefore, indicates clearly the long-run relationship among the variables.

Table 4. Lag length selection

Lag	LogL	LR	FPE	AIC	SC	HQ
0	–90.12	NA	5.20	5.40	5.70	5.50
1	150.85	374.85*	1.28	–5.27*	–2.81*	–4.41
2	226.83	88.64	3.96	–6.77	–2.15	–5.16
3	319.54	72.11	9.64*	–9.20	–2.42	–6.83*

Note: * Indicates the selected lag order by criterion, Likelihood Ratio test (LR), Final Prediction Error criteria (FPE), Akaike Information Criteria (AIC), Schwarz Information Criteria (SC) and Hanna-Quinn Information Criterion HQ.

Table 6. ARDL long-run (a) and short-run relationships (b)

Variable	Coefficient	*t*-statistic	Prob.
Long-run relationships			
INFR	–0.05	–2.40	0.02
INTR	0.52	5.42	0.00
EXGR	–0.17	–6.01	0.00
DOP	–0.03	–0.50	0.62
MS	0.41	7.42	0.00
GCE	–0.09	–1.39	0.18
C	7.42	27.74	0.00
Short-run relationships			
D(INFR)	–0.03	–2.92	0.01
D(INTR)	0.16	4.43	0.00
D(EXGR)	–0.04	–1.38	0.18
D(DOP)	–0.02	–0.71	0.48
D(MS)	–0.00	–0.03	0.98
D(GCE)	–0.05	–1.76	0.09
CointEq(–1)	–0.71	–27.19	0.00

Table 6b explains the short-run relationship that shows whether inflation is detrimental to economic growth of Nigeria. Firstly, the significance of error correction mechanism (ECM) result and the negative sign of the coefficient lend credence to the establishment of co-integration among variables in this study. This coefficient indicates –0.71 and suggests that about 71% of previous year disequilibrium is corrected in the current year. Hence, the ECM adjusts rapidly to changes in the long run.

In terms of the signs and magnitude of the coefficients, the long-run result indicates that inflation and exchange rate are negative and significantly related to gross domestic product. The result shows that a unit increase in inflation and exchange rate will lead to 0.05 and 0.17 units decrease in gross domestic product, respectively. The coefficient of interest rate and money supply are positive and significant on gross domestic product with 0.52 and 0.41 units, respectively, the result shows that a unit increase in interest rate and money will lead to 0.52 and 0.41 units increase in gross domestic product. Degree of openness and government consumption expenditures show a negative and insignificant influence on the growth of the economy with a value of –0.03 and –0.09 units, respectively. It implies that a unit increase in both degree of openness and government consumption expenditures will lead to –0.03 and –0.09 units decrease, respectively, on the growth of Nigeria's economy.

Table 7. Causality result

Causality direction	Obs	*F*-statistic	Prob.
Flows from INFR to RGDP	38	0.23	0.63
Flows from RGDP to INFR		0.54	0.47
Flows from INTR to RGDP	38	12.51	0.00
Flows from RGDP to INTR		0.39	0.54
Flows from EXGR to RGDP	38	30.41	3.06
Flows from RGDP to EXGR		0.77	0.39
Flows from DOP to RGDP	38	1.55	0.22
Flows from RGDP to DOP		1.01	0.32
Flows from MS to RGDP	38	171.69	5.15
Flows from RGDP to MS		0.37	0.55
Flows from GCE to RGDP	38	89.20	4.11
Flows from RGDP to GCE		0.62	0.44

Table 7 indicates the causality test result conducted to examine whether inflation is detrimental to economic growth or not. Evidence from this result shows no causal relationship between inflation and gross domestic product, between degree of openness and gross domestic product, while unidirectional relationship was found between interest rate and gross domestic product, between exchange rate and gross domestic product, between money supply and gross domestic product, and between government consumption expenditures and gross domestic product. The direction of the flow comes from interest rate, exchange rate, money supply, and government consumption expenditures to gross domestic product.

Table 8. ARDL diagnostic estimations

Statistics	Values	Probability
Normality test		
Jarque-Bera	0.68	0.71
Serial correlation LM test		
Obs**R*-squared	3.76	0.15
Heteroskedasticity test		
Obs**R*-squared	13.88	0.18

Table 8 presents the post-estimation test to examine the suitability of the model using serial correlation LM test, normality test, and heteroscedasticity test. From the three estimates, variables are normally distributed; there is no problem of serial correlation and the variables show homoscedasticity.

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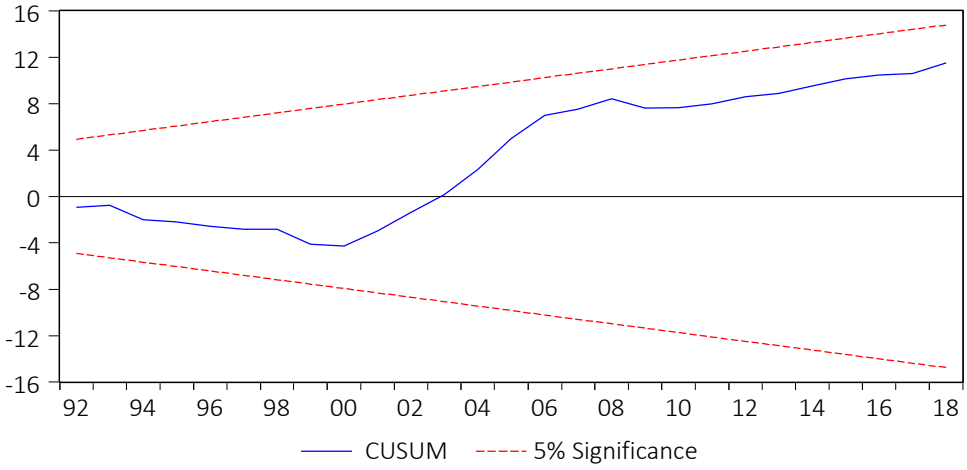

Figure 2. Cumulative sum (CUSUM) test

In an attempt to ensure that the ARDL model is well fitted, the study employs cumulative sum (CUSUM) test developed by Durbin, Brown, and Evans (1975). The test decision is that, if the plotted CUSUM statistics lies within 5% significance level, the coefficient estimates are accepted. Figure 2 shows that the CUSUM plot falls within the 5% level of significant (indicated by the two red lines). This shows that the model is stable and not spurious.

4. DISCUSSION

The ARDL long-run result for the focal variable (inflation rate) reveals significant negative relationship with the growth of the economy. This clearly supports the works of Al-Taeshi (2016), Denbel et al. (2016), Idris and Suleiman (2019), Kasidi and Mwakanemela (2015), Manoel (2010), Mkhatshwa et al. (2015) and also agrees with the structuralist view. This result implies that inflation undermines the growth of the economy in the long run. This is because inflation reduces the purchasing power of money, thereby discouraging investment, which could have induced growth prospects of the economy. The result negates the monetarist view and the works of Anidiobu et al. (2018), D. Chude and N. Chude (2015), Enejoh and Tsauni (2017). This result is consistent with a priori expectation earlier stated in this study.

Considering the positive and significant value of interest rate, it negates Idris and Suleiman (2019) and a priori expectation. The coefficient of exchange rate is negative and significantly related on the growth of the economy. This result implies that unfavorable variation in exchange rate is inimical to economic growth. The coefficient of money supply (MS) is positive and significantly related to the growth of the economy. This result implies that an increase in the flow of money in the circulation will enhance the financial resources available in the economy thus increasing economic growth. This result is supported by the work of Gatawa, Abdulgafar, and Olarinde (2017).

Other variables such as the degree of openness and government consumption expenditures are not significant in explaining the economic growth of Nigeria. The Granger causality test reveals no causality relationship between inflation and gross domestic product, between the degree of openness and gross domestic product, while interest rate, exchange rate, and government consumption expenditures indicate the unidirectional relationship with gross domestic product.

CONCLUSION

The study begins with descriptive statistics of the variables to ensure that they are normally distributed. This is followed by trend analysis on inflation rate in Nigeria from 1980 to 2018, while time series

properties of the data were explored using Augmented Dickey-Fuller (ADF) unit root test. This is a pre-condition for autoregressive distributed lag (ARDL) bound test approach to co-integration. After that, Granger causality test to examine the direction of relationship was also employed. Finally, diagnostic tests were performed using serial correlation test, heteroscedasticity test, normality test, and cumulative sum (CUSUM) test in order to validate the result.

The study shows that inflation is one of the macroeconomic variables that undermine the growth of an economy. Efforts by the monetary agencies to tackle this menace have not yielded positive long-run response. Findings from the study indicate that inflation and real exchange rate exert a significant negative impact on economic growth, while interest rate and money supply indicate a positive and significant impact on economic growth. Other variables in the model depict no influence on economic growth of Nigeria. The causality result shows unidirectional relationship between interest rate, exchange rate, and government consumption expenditures and gross domestic product. However, inflation and degree of openness show no causal relationship with gross domestic product. As a result, the study recommends that a more pragmatic effort is needed by the monetary authorities to target the inflation vigorously to prevent its adverse effect by ensuring a tolerable rate that would stimulate the economic growth in Nigeria.

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