

Inflationary Effect on Nigeria Economic Growth: The ARDL Bound Test Approach

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JEMT/2021/v27i630349

Editor(s):

(1) Dr. Alfredo Jimenez Palmero, University of Burgos, Spain.

Reviewers:

(1) Sanmugam Annamalah, SEGi University, Malaysia.

(2) Mohammad Salem Oudat, Applied Science University, Bahrain.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/72498>

Original Research Article

Received 07 June 2021

Accepted 11 August 2021

Published 12 August 2021

ABSTRACT

The expectation of any country is to experience a high output but in the presence of increasing inflation such expectation becomes blurring because high inflation is a sign of a low working economic system. In this research the impact of inflation rate (InfR) on Nigeria economic growth (EcoG) is studied for the period of 1986 to 2018 using an Autoregressive Distributed Lag (ARDL) Bounds test approach to determine the co-integration existence between InfR and EcoG and determine the long run effect through the approach of Error Correction Model (ECM). The results obtained showed that an ARDL (2, 2) model was the best fitted model for the sampled data based on the smallest Akaike's Information Criterion (AIC) value obtained. Also, it was found that InfR significantly impacted on Nigeria EcoG negatively on the long and short run dynamics with a stable estimation as portrayed by the CUSUM square chart.

Keywords: ARDL; inflation; economic growth; co-integration; error correction model; AIC.

1. INTRODUCTION

Macroeconomic policies main objective is to improve economic growth (EcoG) and to keep inflation rate (InfR) on a minimal level. Any increase in the Gross Domestic Product (GDP) of a particular country can be seen as EcoG. Inflation is an essential macroeconomic variable which is proficient in fluctuating, transmuted and relaying the pattern of growth in the economy of a country. The capability of sustaining a good level of EcoG with low levels of InfR is a vital objective of macroeconomics of any country. Hence the behavior inflation to a great magnitude affects the economic growth of a country [1]. [2] attributed that one of the fundamental objective of macroeconomic policies in both the developed and developing economics is to maintain high EcoG together with very low InfR which implies InfR is one-digit InfR. This is because when InfR is at high level it upsets the stable running of an economic market.

Conceptually, InfR is generally seen as a consistent escalation in the overall price rate of goods and services in a country in a particular period of time. According to [3] inflation is broadly defined as an economic condition when rise in money supply grows more rapidly than the new creation of goods and services in the same economy. [4] says inflation is a onetime increase in prices or when there are price increases in a narrow group of economic goods or services.

Also, InfR is estimated as the percentage disparity in price index (consumer price index, wholesale price index, producer price index, etc). In the works of [5], consumer price index (CPI) measures the prices of goods and services bought by a consumer and estimated on the grounds of intermittent survey on consumer prices. Owing to the diverse basket weights, changes in the prices of goods and services have control on measured InfR with different degrees. [6] opined that inflation occurs when there is an escalation in the price of goods and services. This upsurge in price is seen as inflation when it is obstinate and beyond the definite target. Hence, an upturn in money supply can lead to a higher price level in a matter of time.

There are different types of inflation identified from literature they include: 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 which

occurs when a decrease in supply is caused by an upsurge in the cost/price of the produced product [7]. It can also be structural inflation, which arises as a result of variations in monetary policy and it is generally referred to as built-in inflation [6]. Contained by these types, inflation can be "hyper, extremely high, chronic, high, moderate, and low inflation" [8].

[9] defined inflation as variations in the total level of prices within an economy, which subsequently leads to fall in value of the local currency. In an inflationary retro, price level rises, this means that the purchasing power of money falls and money as a means of exchange declines in real value, and if unimpeded would have hostile effect on the economy. [10] argue that most macroeconomic policies in most economies have often fixed on attaining bearable EcoG and attaining price firmness (firming the purchasing power of money). Firmness here, according to [11], does not mean a situation where price will remain static but it is a situation where variation in prices over a long period is negligible. There are three main methodologies to gauging InfR. These include the CPI, wholesale price index and the gross national product implicit deflator. Amongst the three, CPI is the direct measure of InfR.

[12] argued that the controversy regarding InfR and EcoG is not only about whether a positive or negative relationship exist between them, but the need to establish the causal direction between these two variables is contentious. Some studies advocate a unidirectional causality, whereas some divulge bidirectional, or even no causality between them.

On the other hand, GDP is uniform as an economic gauge by United Nations System of National Accounts, determining the total yield of goods and services of a state throughout a definite period of time [13]. Erstwhile to its espousal, GDP was officially known as the Gross National Product (GNP) and it work almost a similar purpose(s) as the GDP. At the early part of the 20th century, in the time of the Great Depression in the United States (US), states within the US were obliged to calculate their economic growth based on insufficient data, such as freight car loadings, stock price indices and economic indicators that were not all-inclusive in nature [14]. As a gauge, the GDP functions as a quantity for evaluation, growth and enlargement of a state, health status of the populace, procuring power of the populace, happiness of

the populace, etc. The world of data in which we live in today warrants that decision making progressions by policy makers and individuals always take into knowledge the current state of the GDP of the country [13].

Notably, GDP characterizes the entire market value of all finished goods and services manufactured in a given time period by elements of production situated within a country. It does not comprise transitional goods, but only new merchandises and services. The reason is to avoid dual counting. There are three ways in computing GDP and these are by value added (or production) method, which adds up the gross output of different industries and then deducts transitional inputs, to evade dual counting. It can also be estimated by income (by type) method, which measures the income gotten by different variables of production. Finally, the GDP can be estimated by closing demand (or expenditures) method, which measures the activities, such as investment and consumption across different industries and imports deducted from exports. However, all three methods produce the same results [14].

1.1 The Monetarists Theory

This research hinge on the monetarism philosophy because it clearly depicts the actual state of Nigeria. The term "Monetarism" got its coinage from [15], where he mentioned several key long run properties of the economy including the theory of money quantity and the neutrality of money. He opined that inflation was the product of a rise in the supply or speed of money at a rate greater than the rate of economic growth. If the objectivity of money holds then inflation will not have a negative impact on growth. Monetarist is of the view that prices is mainly affected by money growth rate in the far future, while having no actual impact on growth and if the supply growth of money is greater than the economic growth, then inflation will arise [16]. In Nigeria presently, the Naira has been devaluated in spite the country's lowest state of production due to collapsed industries. This has led to high inflation rate in household commodities, services, scarce foreign currency for international trade, high foreign exchange rates, high unemployment rate, and abject poverty amongst many.

According to the monetarists, the capacity of money is the main basis of price level, or the worth of money, such that any alteration in the capacity of money yields an exactly straight and

comparable change in price level. This can be verified mathematically using the Irving Fisher's well-known equation of exchange thus $MV=PQ$, where M is the stock of money; V is velocity of money circulation; Q is volume of transactions which took place within the specified period; while P is the overall price rate in the economy. Transforming the equation by replacing Y (overall amount of goods and services traded for money) for Q, the equation of exchange turns out to be: $MV=PY$. The introduction of Y offers the connection between the monetary and the actual flank of the economy. In this context, however, P, V, and Y are endogenously estimated within the structure. The variable M is the policy variable, which is exogenously determined by the monetary establishments. The monetarists highlighted that any modification in the amount of cash affects only the price level or the monetary lateral of the economy, with the actual sector of the economy totally protected. This shows that variations in the supply of money do not disturb the actual output of goods and services, but their values or the prices at which they are traded only. An important feature of the monetarist's model is its emphasis on the far future supply-side possessions of the economy as opposed to near future dynamics [17].

2. LITERATURE REVIEW

One of the most common technique used for forecasting GDP growth which depends linearly on its previous values is a univariate time series model [18]. According to [19], the univariate time series model fares well in periods of stable growth. And in periods of volatile growth, the performance of the univariate time series models for forecasting is mostly poor. So, short-term prediction tries to fetch the information that is available in different high-frequency indicators, which are typically published prior to the GDP data [18].

Among recent studies, [20] validated the effectiveness of the Survey of Professional Forecasters (SPF) and the Purchasing Managers' Index (PMI) in antedating US real EcoG. They performed a real time forecasting of out-of-sample exercise connecting these surveys to US GDP and industrial manufacturing growth for a long sample period of above 40 years. It was discovered that both indicators conveyed relevant evidence for evaluating current EcoG. Also, the merging evidences included in both surveys also increases the precision of both, the SPF and the PMI prediction. They further

discovered that the non-manufacturing indices have contributed significant value in nowcasting GDP.

[21], again evaluated the expediency of Institute for Supply Management (ISM) indices in forecasting US GDP when a large mass of macroeconomic data set that is unbalanced are used in real time to produce the predictions. Given the overabundance of variables that are likely to be used for that purpose at which they are ask: what is the marginal impact of the ISM variables, given all the other evidence that exist in real time? Using data from 1965 to 2011, they based their suppositions on a simple indicator model according to [22], and the more advanced mixed-data sampling (MIDAS) regressions and dynamic factor models (DFMs). They found proof revealing that the PMI indicators is relevant in improving the nowcasts of current quarter GDP growth, as the quarter reveals in real time.

[23] applied unrestricted MIDAS (U-MIDAS) regression to assess the effectiveness of a multiple range of indicators for forecasting short-term real GDP growth. The prediction carried out compared pseudo out-of-sample forecasts of quarter-over-quarter real GDP growth carried out with the help of U-MIDAS model. Firstly, the pseudo real-time data set is collected with the aid of final-vintage data as of Q1 2013. Secondly, the U-MIDAS regression model was estimated over the sample for the period Q1 1999 to Q4 2009, and the predicted of real GDP growth for two quarters ahead was made. Applying the expanding window technique, out-of-sample forecasts for the period Q1 2010 and Q1 2013 was obtained. These results is in line with previous studies, it suggested that the PMI ranks among the leading performing signs for the prediction of real GDP growth in the EU zone.

[24] reported that in toting to official data, survey indicators usually improved forecasts for the UK. Based on their study, as the recession amplified the volatility output considerably, the biggest error from the standard model takes place in Q4 2008, when the output shrink sharply. Nowcasts that fused data from business surveys had better performance in the more volatile retro. However, Bank of England (BoE) staff produced nowcasts which on average outperformed the ones from the weighted survey model and the ones from a simple AR model for the period 2004–2013. This is due to the fact that the estimates of BoE have

reduced weightage on surveys in periods when the surveys may have been officiated to be above or below the actual GDP growth.

[25] analyzed the performance of the IMF “World Economic Outlook” predictions for world output EcoG and GDP growth of developed economies with the developing and emerging economics. They focused on the prediction of current and future years by assessing whether IMF predictions can be strengthened by using foremost indicators with monthly data. For the world indicators they selected Global Composite PMI, Global Manufacturing PMI, and OECD Leading Indicators. GDP growth dataset based on real-time, it was found that some simple single-indicator predictions at higher occurrence significantly performed better than the IMF predictions for a publication that is only a few months old.

Empirically, [8] examined the effect of InfR on EcoG and development in Nigeria between 1970-2010 through the application of Augmented Dickey-Fuller technique in testing the unit root property of the series and Granger causality test of causation between GDP and InfR. The results of unit root test suggested that all the variables in the model were stationary and the results of causality test suggested that GDP causes inflation and not inflation causing GDP. They discovered from the results that InfR possessed a positive impact on EcoG through boosting productivity and output level and on progression of overall productivity factors. A worthy performance of an economy in terms of per capita growth may therefore be attributed to the InfR in the country.

[26] investigated the causal bond between InfR and EcoG using a broad cross country data from 140 countries over the period 1970-2005. The results indicated that, inflation retards growth, whereas the effect from growth to inflation is beneficial. Moreover, he divided the cross national data set into low income, developing, and high income countries, and the results showed that, the negative impact of inflation on growth in low income countries is greater than in developing and high income countries. Conversely, he exploited the difference in the effect of growth on inflation in different income level countries. Higher EcoG did not result in the increase of InfR in high and low income countries. On the contrary, rapid EcoG induces higher inflation in low income sampled countries.

[12] conducted a study among 13 Sub-Saharan Africa (SSA) countries from 1969 to 2009 on how InfR affected their EcoG. The study employed panel regression analysis (PRA) on the variables, which includes InfR, investment, population, and GDP. The study shows that the InfR and EcoG are inversely related, while Granger causality reveals that the InfR in the countries can be used to predict the EcoG rate among the countries.

[27] examined the nature of connection between InfR and EcoG in Nigeria from 1979 to 2010. The method of the OLS approach was adopted in examining the bond among the variables while the causalities were evaluated using GCT. To achieve this, Johansen and Juselius cointegration technique was used while the variables were attuned for stationarity using the ADF tests for unit root. It was found that InfR is negatively related with real GDP while ExcR and InfR are positively related with InfR though not to a very significant range. On causality, at both lag 2 and lag 4, the study shown no causality between InfR and real GDP. However, at lag 2, there was unidirectional causality flowing from InfR to IntR and also a unidirectional causality flowing from IntR to real GDP. At lag 4, there is a unidirectional causality flowing from IntR to InfR and from IntR to ExcR and also a unidirectional causality flowing from ExcR to real GDP.

[28] conducted an empirical exploration on the directional causality between oil price (oil imports cost), GDP and CPI for the period 1990-2011 in Jordan. The Johannes-Juselius co-integration test, Granger-causality test (GCT), and VECM were used to check the far-term bond, the near-term bond and the velocity of adjustment toward far-term stability between the variables. The results indicated a far-term equilibrium bond between GDP exists. Also, a far-run stability bonds between log of GDP, log of oil cost and log of InfR. The estimation of the adjustment velocity indicates that fifty-eight percent of any previous year's deviation in GDP from its far-run stability path will be corrected in the current year. The VECM reveals the presence of a significant, negative and weak causation bond in the near-run between GDP and oil cost running from oil cost to GDP.

[29] analyzed how InfR affects both EcoG and agricultural growth (AgriG) in Swaziland for the period 1980–2013. They employed autoregressive distributed lag (ARDL) technique and their result indicated that InfR depicts a

negative relationship, while AgriG produced a positive relationship on the growth of Swaziland. The causality test shows unidirectional relationship between EcoG and InfR while no causal relationship was found between AgriG.

Employing Johansen co-integration and Granger causality test (GCT), [30] explored the existence of any relationship among broad money supply (BMS), InfR, and EcoG in Ethiopia. Their results from Johansen co-integration backed the work of [29], while the direction of causality indicates a run from EcoG to InfR and from BMS to EcoG.

[31] studied InfR impacts on Malaysia EcoG from 1970 to 2014 by employing co-integration analysis and GCT. Evidence from the results suggested an inelastic response between EcoG and InfR was found. The pact about the adversative effect of InfR on real EcoG has elucidated little and left the bulky part of the occurrence vacillating.

Using the panel regression analysis (PRA), [32] studied InfR threshold on EcoG in some selected African countries. The result indicates a nonlinear relationship between InfR and EcoG. Also, it showed that low InfR enhances EcoG in the middle-income countries, while it has no effect on the entire sample used. The result also showed that InfR beyond the threshold negatively influences the EcoG in all the countries studied.

[33] studied the moderating impact of Nigeria InfR on FDI and EcoG relationship from 1981 to 2017. Their result revealed that between the three variables studied a positive long-run relationship was found. Also the result showed that there exist a nonlinear relationship, meaning Nigerian economy is at its highest growth rate when InfR is less than or equivalent to 2.80 per cent threshold level of InfR and exceeding it becomes harmful to growth. Unfortunately, the minimum level of InfR in Nigeria was found to be 5.38 per cent and it is above the threshold level of 2.8 percent, suggesting that the negative effect of InfR outweighs the positive effect of FDI. This has hindered the capacity of FDI to effectively enhance EcoG in Nigeria. Further, they found that the marginal effect of FDI at less than threshold level of InfR is positive to growth while at higher rate than threshold level of InfR is negative to growth. Their study was poised to determine the collaborative impact of FDI and InfR on EcoG, and to evaluate the threshold level of InfR. Only InfR and BMS were negatively

related to EcoG but only BMS was statistically significant at 5%. However, FDI, ExcR, lending IntR, government expenditure (GovExp) and gross capital formation (GCF) had positive relationship with EcoG but at 5% significance level ExcR, GovExp and GCF had significant impact on EcoG. Based on their findings they concluded that Nigeria government should harness all resources, develop them appropriately in order to stabilize the macro economy to avoid foreign investors from investing in the country by upholding InfR at threshold level or less.

In this research the effect of inflation on the economic growth of Nigeria is examined through the application of Autoregressive Distributed Lag (ARDL) Bounds test methodology. The reason for its adoption is the flexibility it shows in handling small sample size studies and unit root test on the data to account for stationarity is unnecessary. The objective of the research is to identify the best far and near run model that best describe the effect of Nigeria inflation on her economic growth.

3. METHODOLOGY

The objective of this section is to examine the directional impact between EcoG and InfR in Nigeria. This study will use both descriptive and econometric analysis. The descriptive approach will be used to show the trend and variation of InfR and growth so as to give a clear view on how the variables change over time for Nigeria. Also, the econometric approach will be used to investigate the directional impact of InfR on EcoG. The Auto-Regressive Distributed Lag (ARDL) bounds test methodology for testing the existence or absence of co-integration between the variables and Error Correction Model (ECM) will be used to investigate the causal bond between InfR and GDP. The ARDL is adopted due to the following advantages over [34] and [35] co-integration tests.

- ✓ Endogeneity complications and failure to test hypotheses on the estimated coefficients in the far-run associated with [35] method is avoided.
- ✓ The far and near run parameters of the model in question are obtained simultaneously.
- ✓ The liability of creating the order of integration amongst the variables and pre-testing for unit root is removed.

- ✓ Testing the presence of a far-run connection between the variables in levels is appropriate even though the regressors are purely I(0), purely I(1), or fractionally integrated.
- ✓ For small sample size say 30 to 80, [36] stated that the small sample properties of bounds testing approach are greater to that of multivariate co-integration. This is because the approach transforms the ARDL structure while overpowering the insufficiencies related to the existence of a mixture of I(0) and I(1) regressors in a Johansen-type structure.

The study employs a secondary data. The annual time series data are collected from Nigeria Bureau of Statistics (NBS), Central Bank of Nigeria (CBN) and other journals and articles which covers the period 1986-2018.

3.1 Model Specification

On a general form, the model specification is a formulation of GDP as a function of variability (relationship) with InfR. The representation of the model specification is presented below as follows.

$$GDP = \varphi(\text{InfR}); \varphi_1 < 0 \quad (1)$$

A priori expectation of InfR for this study is negative or less than zero. This is because in a far-run InfR effect on EcoG is paramount. If it go higher than required threshold of tolerance its impact will definitely be of concern. On the near-run the effect could be positive and greater than zero but it's not a reliable point to classify InfR impact as adverse. Theoretically, it is expected that a low and stable InfR supports EcoG and vice versa.

3.2 ARDL Model for GDP and InfR

Based on the model specification as formulated in equation (1), the research model is a formulation of the ARDL model which captures GDP and InfR. Therefore, the research model is as follows,

$$\Delta \ln(GDP) = \beta_0 + \beta_1 \ln(GDP)_{t-1} + \beta_2 \ln(\text{InfR})_{t-1} + \sum_{i=1}^j \theta_{1i} \Delta \ln(GDP)_{t-i}$$

$$+ \sum_{i=1}^j \theta_{2i} \Delta \ln(\text{InfR})_{t-i} + \varepsilon_t \quad (2)$$

where, Δ is the first difference operator, $\ln(\text{GDP})$ is the logarithm of GDP, β_0 is the intercept, β_1 and β_2 are constant elasticity coefficient with respect to logarithm of GDP and InfR and ε is the error term. The apriori expectations for the model parameters are $\beta_0 > 0$, $\beta_1 > 0$ and $\beta_2 < 0$.

3.3 Bounds Test

Next is the bounds test hypothesis for testing the long-run effect between the independent variable and the dependent variable based on the F-test which tests the combined significance of the parameter estimates at one period lagged level of the variables in equation (2). The test hypothesis is $H_0: \beta_1 = \beta_2 = 0$ verse $H_1: \beta_1 \neq \beta_2 \neq 0$. The asymptotic distribution of critical values is gotten for cases in which all regressors are strictly $I(1)$ and when the regressors are strictly $I(0)$ or jointly co-integrated.

[37] as well as in [38] reported two sets of critical values. The two sets of critical values give critical value bounds for categorizing the regressors into purely $I(1)$, purely $I(0)$ or mutually co-integrated. However, [37] and [38] sets of critical values were for large sample sizes. A correction was made and offered by [39] and [36] for small sample sizes ranging from $n = 31$. The null hypothesis of no co-integration is rejected if the computed F statistics is greater than the upper bound of the critical values. Also, if the bounds test confirms the existence of a co-integration bond between the variables then it implies that there is a far-run relationship between GDP and InfR In determining the far-run relationship, an error correction model is to be established and implemented.

3.4 Error Correction Model (ECM)

In this study, the error correction model within bivariate relationship system is used to examine the direction of impact between GDP and InfR . Also, the ECM has an interesting property of capturing the velocity of adjustment of growth and the independent variables considered for this research. The ECM is chosen over other alternative techniques because of its favorable response to both large and small samples.

3.5 Error Correction Model for GDP against InfR

If GDP and inflation rate are co-integrated, the bivariate co-integration in ECM can be represented in the following form,

$$\Delta \text{GDP}_t = a_0 + \sum_{i=1}^n a_{1i} \Delta \text{GDP}_{t-i} + \sum_{i=1}^n a_{2i} \Delta \text{InfR}_{t-i} + a_3 \text{EC}_{t-1} + \mu_t \quad (3)$$

where, EC_{t-1} is a one period lagged error correction term captured from the integration regression, GDP_t is the gross domestic product at time t and InfR_t is inflation rate at time t .

4. RESULTS AND DISCUSSION

Table 1 shows the descriptive statistic of the variables before logarithm transformation. Real GDP shows a positive skewness while InfR is highly leptokurtic since the kurtosis is greater than three (3). The result of Jarque-Bera statistic revealed that the Real GDP is normally distributed since the p-value is greater than 5% while InfR is not normally distributed as the p-values is less than 0.01.

Table 1. Empirical analysis of Real GDP and InfR

Statistic	Real GDP	InfR
Mean	36832.50	19.33303
Median	28957.71	12.20000
Maximum	70536.35	72.73000
Minimum	15237.99	5.420000
Std. Dev.	19717.32	17.31068
Skewness	0.576463	1.754400
Kurtosis	1.767269	4.937039
Jarque-Bera	3.917186	22.08772
P-Value	0.141057	0.000016
Observations	33	33

Fig. 1A and 1B below shows the empirical plots of the variables. The plots show that GDP is on a geometric increase while InfR is on a stationary pattern.

4.1 Bound Test for GDP and Inflation

The bound test result is to examine the existence of co-integration between GDP and InfR. The result of the bound test for the relationship between GDP and InfR as shown in Table 2 indicates that the computed F-statistic is 4.629438. This value exceeds the upper bounds critical value of 4.16 at 5% significance level. This implies that GDP and InfR are co-integrated. Thus, we can infer that there exist a long run relationship between GDP and Inflation since the F-Statistic computed = 4.629438 is greater than the 5% F-Statistic = 4.16.

4.2 Estimated ARDL Model for GDP and InfR

The ARDL Model selection for GDP and Inflation is ARDL (2, 2) as displayed in Figure 2 since it has the smallest Akaike's information criterion (AIC), value. The result in Table 2 shows that there are significant effects of the lags of InfR on GDP. There is a significant effect of current InfR, first lag of InfR, and second lag of InfR. Also, the

first and second lags of GDP have significant effect on the GDP, signifying that the current Real GDP would still affect GDP in the next 2 years. The short run ECM in Table 3b shows the estimated coefficient of the lagged value of the residual (ECM_{t-1}) -0.022707 is negative and statistically significant at 5% significance level. This implies that approximately 2.27% of the deviation from the long-run equilibrium in the previous year is adjusted for by the current year. The short run coefficients shows that the coefficient of current InfR has a significant negative impact on GDP (p -value = 0.0027) but at one period lagged value of InfR there is a significant positive impact on GDP at 5% significance level (p -value = 0.00001). This indicates that a unit increase in current InfR would lead to a corresponding decrease in GDP by 2.8138%.

The CUSUM test reveals that the parameters of the GDP and InfR in the ARDL model are stable. Clearly, the CUSUM of squares line is in the area between the two critical lines at 5% level of significance. This CUSUM Square parameter stability tests indicate that the parameters are stable during the sample period (1986-2018). Also, the Durbin-Watson value in Table 3b indicates that the selected model has no serial autocorrelation.

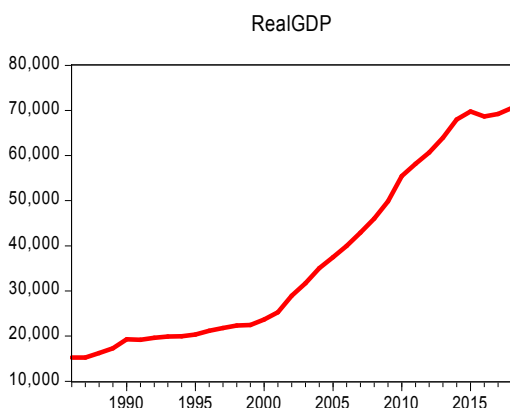


Fig. 1A. Plot of GDP against Years

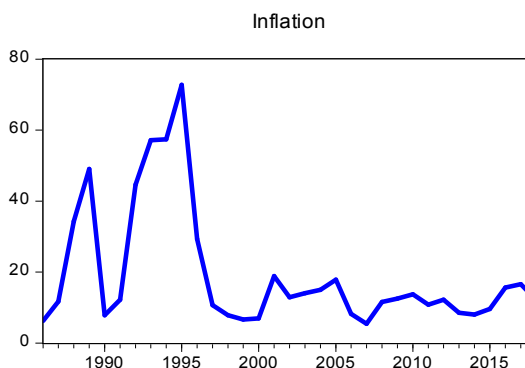


Fig. 1B. Plot of InfR against Years

Table 2. Bounds Test for GDP and InfR Relationship

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	4.629438	10%	3.02	3.51
K	1	5%	3.62	4.16
		2.5%	4.18	4.79
		1%	4.94	5.58

Table 3a. Estimated long run (ARDL) Model for GDP and InfR

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
C	0.333561	0.128441	2.597007	0.00155*
RGDP(-1)	1.531104	0.132704	11.53774	0.0000*
RGDP(-2)	-0.553811	0.132330	-4.185085	0.0003*
INF	-0.028138	0.009495	-2.96331	0.0066*
INF(-1)	0.039064	0.010956	3.565596	0.0015*
INF(-2)	-0.039191	0.008961	-4.373562	0.0002*
R-squared	0.997997			
F-statistic	2491.648	Durbin-Watson stat		2.204553
Prob(F-statistic)	0.0000			

Table 3b. Estimated short run ECM for GDP and InfR

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
D(RGDP(-1))	0.553811	0.107282	5.162202	0.0000*
D(INF(-1))	-0.028138	0.08434	-3.336385	0.0027*
CoIntEq(-1)*	-0.022707	0.005863	-3.872903	0.0007*
R-squared	0.608867			
Durbin-Watson stat	2.204553			

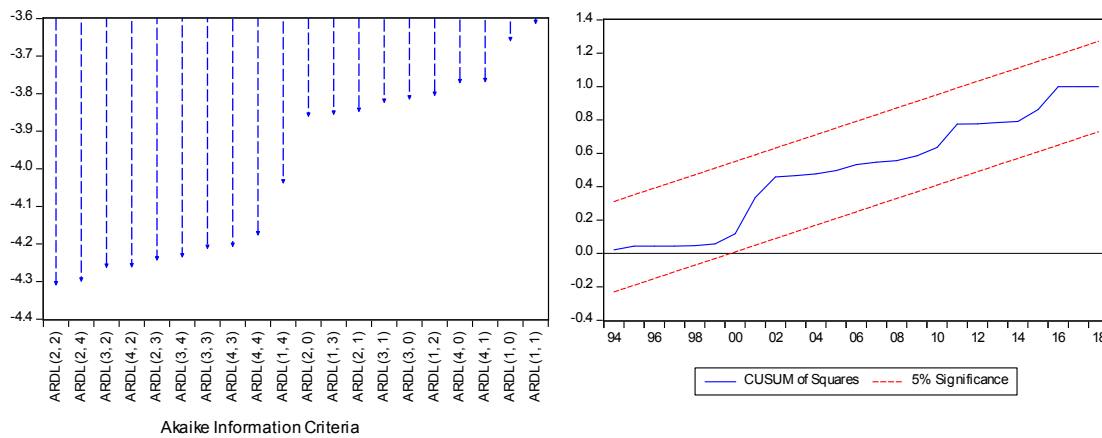


Fig. 2. ARDL Model and CUSUM of Squares Charts for GDP and InfR

5. DISCUSSION OF FINDINGS

In this research an Autoregressive Distributed Lag (ARDL) model and CUSUM Square parameter stability test was fitted and plotted respectively for GDP versus InfR. The results obtained from the analysis performed for the research data that span from 1986 to 2018 showed that an ARDL (2, 2) model was selected as the best fitted model using the Akaike’s Information Criterion (AIC) as the selection method. However, infR has a negative significant effect on GDP at current and at second lag but significantly positive at first lag. But the ECM showed that on the near run at lag one, InfR has a significant negative effect on GDP. This findings corroborates with that of [26,29,31,32]. Also, the first and second lags of GDP have significant

effect on GDP, signifying that the current Real GDP would still affect GDP in the next 2 years but negatively. Finally, the CUSUM Square parameter stability test for the fitted model showed that the estimated parameter values are stable during the sample period of 1986 to 2018.

6. CONCLUSION

This paper reconnoiters the effect of inflation on Nigeria economic growth from a sample period of 1986 to 2018 with the application of Autoregressive Distributed Lag (ARDL) approach for determining the existence of co-integration, long run, and short run dynamics through the use of Error Correction Model (ECM). Also, A CUSUM square chart approach was used to determine the stability of the estimated

parameters. The results from the bonds test suggests a co-integration existence between GDP and InfR while the ARDL long run model of ARDL(2, 2) was selected as the best model due to its smallest AIC value. The impact of InfR on EcoG was found to be significantly negative at current and second lag rates in the long run and first lag rate in the short run with a stable estimate as suggested by the CUSUM square chart. This implies that inflation in Nigeria is hiding the economic growth of the country in a stable rate with the sample period studied. A major policy implication of this result is that combined effort from policy makers in both the private and public sectors is needed to increase the level of output in all vital sectors of the economy in Nigeria by improving on productivity through labour intensive system due to the large labour force in the country. This will not only reduce cost of goods and services but reduce the high unemployment rate in the country. Non-oil sectors like agriculture, mining, etc, should be adequately explored through technological investment in combination with the vast labour force so as to reduce unnecessary capital intensive cost. Security issues rocking almost every part of the country need to be addressed with systematic approaches that will not result in further disintegration of the populace in the line of religion, culture, and ethnicity. Finally, a sufficient policy that is necessary to reduce inflation in the country is needed for the reduction of high rate of imported goods that can be adequately produced in the country. This policy will encourage local production and reduce prices of commodities and in turn reduce the over dependence of being a consuming nation than a productive country. If all these recommendations are put into function then inflation rate will reduce and the country output will increase.

ACKNOWLEDGEMENT

We acknowledge the editor the constant feedback on every issue we raised during the submission and review process. Also, the thorough review comments from anonymous reviewers which helped improved the research is highly appreciated.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Okpe. Interest Rate and Savings mobilization: An Empirical Investigation of Financial Repression. An Unpublished M.Sc Thesis, Department of Economics, Ahmadu Bello University, Zaria; 1998.
2. Graham EM, Krugman PA. Foreign direct investment in the United State, 3rd edition. Washington DC: Peterson Institute for International Economics; 1995.
3. Hamilton A. Exploding Inflation; 2001. Retrived Febuary 2021 from Available:<http://www.usagold.com/gildedopinon/hamiltoninf.html>
4. Piana V. Consumer decision rules for agent based models. Economic Web Institute; 2002. Available:www.economicwebinstitute.org
5. Essien EA. Exchange rate pass-through to inflation in Nigeria. West African Journal of Monetary and Economic Integration, 2002; 5(1):89–103.
6. Adaramola OA, Dada O. Impact of inflation on economic growth: Evidence from Nigeria. Investment Management and Financial Innovations. 2020;17(2):1-13.
7. Anochiwa LI, Maduka A. Inflation and economic growth in Nigeria: Empirical evidence? Journal of Economics and Sustainable Development. 2015;6(20):113-121.
8. Umaru A, Zubairu J. The effect of inflation on the growth and development of the nigerian economy: An empirical analysis. International Journal of Business and Social Science. 2012;3(10):183–191.
9. Ahlgrim K, D'Arcy SP. The effect of deflation or high inflation on the insurance industry. Casualty Actuarial Society, Canadian Institute of Actuaries & Society of Actuaries Research Projects in Finance; 2012. Available:https://www.casact.org/research/NAACCRG/final_report.pdf
10. Kasidi F, Mwakanemela K. Impact of inflation on economic growth: A case study of Tanzania. Asian Journal of Empirical Research. 2015;3(4):363-380.
11. Anyanwaokoro M. Theory and policy of money and banking. Enugu, Nigeria: Hosanna Publications; 1999.
12. Mamo FT. Economic growth and inflation: A panel data analysis. Published Master Thesis Submitted to the Department of Economics, Södertörns University; 2012.

- Available:<http://sh.diva-portal.org/smash/get/diva2:576024/FULLTEXT01.pdf>
13. Tjukanov T. Gross domestic product as a modern-day economic indicator. Bachelor's Thesis, Helsinki Metropolia University of Applied Sciences, Finland; 2011.
Available:<http://urn.fi/URN:NBN:fi:amk-2011121217979>
 14. Landerfeld JS, Seskin EP, Fraumeni BM. Taking the Pulse of the Economy: Measuring GDP; 2008.
Retrieved 6th January, 2021
Available:http://www.bea.gov/about/pdf/jep_spring2008.pdf
 15. Friedman M. A Monetary History of the United States. Princeton; 1963.
 16. Gokal V, Hanif S. Relationship between Inflation and Economic Growth. Working paper, Reserve Bank of Fiji; 2004.
 17. Dornbusch R, Fischer S, Startz R. Macroeconomic. Sydney: The McGraw-Hill Companies, Inc; 1996.
 18. Bose S. Is the purchasing managers' index a reliable indicator of GDP growth? Some Evidence from Indian Data. ICRA Bulletin, Money & Finance; 2015.
 19. Mitchell J. Where are we now? The UK recession and nowcasting GDP using statistical models. National Institute Economic Review. 2009;209:60–69.
 20. D'Agostino A, Bernd S. Survey-based nowcasting of US growth: A real-time forecast comparison over more than 40 years. Working Paper Series 1455, European Central Bank; 2012.
 21. Lahiri K, George M. Nowcasting US GDP: The role of ISM Business Surveys. International Journal of Forecasting, 2013; 29(4):644–658.
 22. Koenig EF. Using the purchasing managers' index to assess the economy's strength and the likely direction of monetary policy. Federal Reserve Bank of Dallas Economic and Financial Policy Review. 2002;1(6).
Available:http://dallasfedreview.org/pdfs/v01_n06_a01.pdf.
 23. Leboeuf M, Louis M. Forecasting short-term real GDP growth in the euro area and Japan using unrestricted MIDAS regressions. Bank of Canada Discussion Paper 2014–3; 2014.
 24. Bell V, Lai WC, Sophie S, Gavin W. Nowcasting UK GDP Growth. Bank of England, Quarterly Bulletin, 2014 Q1; 2014.
 25. Drechsel K, Sebastian G, Axel L. Outperforming IMF Forecasts by the Use of Leading Indicators. Halle Institute for Economic Research, IWH Discussion Papers 4; 2014.
 26. Chuan-Yeh C. The inflation growth nexus across countries under simultaneous equation model. Academic Research International. 2012;2(2):18–32.
 27. Oliver II. Does inflation weaken economic growth? Evidence from Nigeria. European Journal of Accounting Auditing and Finance Research. 2013;1(4):139–150.
 28. Hussein AA. An investigation of granger causality between oil-price, inflation and economic growth in Jordan. Global Journal of Management and Business Research: B Economics and Commerce. 2014;14(6): 32–42.
 29. Mkhathshwa ZS, Tijani AA, Masuku MB. Analysis of the relationship between inflation, economic growth and agricultural growth in Swaziland from 1980-2013. Journal of Economics and Sustainable Development. 2015;6(18):189-204.
 30. Denbel FS, Ayen YW, Regasa TA. The relationship between inflation, money supply and economic growth in Ethiopia: Cointegration and causality analysis. International Journal of Scientific and Research Publications. 2016;6(1):556-565.
 31. Al-Taeshi HTA. The impact of inflation on economic growth: Evidence of Malaysia from the period 1970-2014 (Published Master Thesis Submitted to Near East University Graduate School of Social Sciences Economics Master's Programme); 2016.
Available:<http://docs.neu.edu.tr/library/6429447589.pdf>
 32. Nduricimpa A. Threshold effects of inflation on economic growth in Africa: Evidence from a dynamic panel threshold regression approach (Working Paper Series No 249, African Development Bank, Abidjan, Cote d'Ivoire); 2017.
Available:<https://www.afdb.org/fileadmin/uploads/afdb/Documents>
 33. Kelvin KK, Ogbonna OE. Moderating effect of inflation on foreign direct investment and economic growth relationship in Nigeria. Journal of Economics and Allied Research, 2019;3(2):69-80.
 34. Johansen S, Juselius K. Maximum Likelihood Estimation and Inference on

- Cointegration with Application to the Demand for Money. Oxford Bulletin of Economics and Statistics. 1990;52(2):169-210.
35. Engle RF, Granger CWJ. Cointegration and error correction representation: estimation and testing. *Econometrica*, 1987;55:251-276.
36. Narayan PK. The saving and investment nexus for China: Evidence from cointegration tests. *Applied Economics*. 2005;37:1970-1990.
37. Pesaran MH, Pesaran B. Working with Microfit 4.0: Interactive Econometrics Analysis. Oxford University Press: Oxford; 1997.
38. Pesaran MH, Shin Y, Smith RJ. Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*. 2001;16(3):289-326.
39. Narayan PK. () Fiji's Tourism Demand: The ARDL approach to cointegration. *Tourism Economics*. 2004;10(2):193-206.

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Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle4.com/review-history/72498>