

An Analytical Study of the Impact of Inflation on Economic Growth in Nigeria (1970-2016)

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Abstract *Inflation discourages savings and investment, it favours debtors at the expense of creditors, fixed income earners are worse off during inflation and it leads to unfavourable balance of payment as the export becomes dearer while import becomes cheaper. The objective of this paper is to analyse the impact of inflation on economic growth in Nigeria for the period 1970 to 2016. The unit root properties of the series were tested. The result shows that the variables are I(0) and I(1). Therefore, the paper employed ARDL approach to co-integration and error correction mechanism (ECM) to test both the short and long run impact of inflation on economic growth. The result shows that inflation and foreign exchange have positive impact on economic growth both in the short and long run. The impact of foreign exchange on economic growth became negative at lag 1 and 2 in the short run. The model is free from auto correlation and heteroscedasticity and the model is stable. The Granger causality shows that inflation and foreign exchange rates do not Granger cause economic growth. The paper recommends inflationary targeting at single digit.*

Key words Inflation, foreign exchange rate, granger causality, economic growth, Autoregressive Distributive Lag model

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1. Introduction

Parts of macroeconomic objectives of any Nation are to achieve price stability and economic growth. Inflation is seen as persistent and appreciable rise in general level of price in an economy (Jhingan 2009). Aminu and Anono (2012), opined inflation as a persistence rise in the general price level of broad spectrum of goods and services in a country over a long period of time, they attributed inflation to a popular say that inflation is too much money chasing too few goods. The structuralist argued that inflation is crucial for economic growth while the monetarist posit that it is harmful to economic growth (Doguwa, 2012). Nell (2000) opined that single – digit inflation may be beneficial, on the other hand, double digit inflation imposes slower growth. Anochiwa and Maduka (2015) said ability to manage the growth of inflation to single digit may be an important factor to accelerate economic growth. Too much money in circulation, increase production cost, declines in exchange rates, decrease in the availability of limited resources such as food or oil etc. are the causes of inflation. Inflation is a sign that the economy is growing, but excess economic growth may be detrimental as it can lead to hyperinflation, at the other extreme, an economy with no inflation has essentially stagnated. The right level of economic growth, and thus the right level of inflation, some were in the middle. Creeping or mild inflation can be viewed as having favourable impacts on the economic growth. On the other hand, zero inflation is harmful to other sectors in the economy with falling price, profit, and employment.

In general, galloping inflation has unprecedented effects on an economy because it distorts and disrupts the price mechanism, and discourages investment and savings leading to the break down on morals (Hossain *et al.*, 2012). Nigeria is currently experiencing high inflation. Nigerian inflation rate grew to 13.7 percent in April 2016, 0.9 percent higher than the previous month level of 12.8 percent. The cost-push inflation is driven primarily by the severe scarcity of petroleum products which had forced increases in transportation cost and consequently, arbitrary increases in cost of all other commodities and services consistently for several months. Inflation has further increased to 17.6 percent in August, a fresh 11-year

higher and the seven monthly increases in a row. NBS (2016) reported that in the second Quarter of 2016, the nation's Gross Domestic Product (GDP) declined by -2.06 (year on year) in real terms. This was lower by 1.70% points from growth rate of -0.36% recorded in the first Quarter (NBS, 2016).

2. Literature review

Theoretical Literature

Gokal and Hanif (2004) identified the following theories that explain the relationship between inflation and economic growth.

(i) Classical Growth Theory

The foundation of classical growth model was laid by Adam Smith who postulated a supply side driven model of growth and his production function was as follow: $Y=f(L, K, T)$. Whereby, Y is output, L is labour, k is capital and T is the level of technology. He argued that profit decline not because of decreasing marginal productivity rather because the competition of capitalist for workers will bid wages up.

(ii) Keynesian Theory

The Traditional Keynesian model comprises of the Aggregate Demand (AD) and Aggregate Supply (AS) curves, which explains the inflation-growth relationship. According to this theory, in the short run, the AS curve slopes upward rather than vertical. If the AS curve is vertical, changes on the demand side of the economy affect only prices. However, if it is upward sloping, changes in AD affect both prices and output (Dornbush *et al.*, 1996). This holds with the fact that many factors drive the inflation rate and the level of output in the short run. These include changes in: expectation; labour force; prices of other factors of production, fiscal and/or monetary policy.

(iii) Neo Keynesian Model

One of the major developments under Neo-Keynesians was the concept of 'potential output', which is also called natural output. This is a level of output where the economy is at its optimal level of production, given the institutional and natural constraints. This level of output also corresponds to the natural rate of unemployment or what is called non-accelerating inflation rate of unemployment (NAIRU). NAIRU is the unemployment rate at which the inflation rate is neither raising nor falling. According to this theory, inflation depends on the level of actual output (GDP) and natural rate of unemployment. Firstly, if GDP exceed it potential and unemployment is below the natural rate of unemployment, other things being equal, inflation will accelerate as Suppliers increase their prices as built-in inflation worsen. Secondly, if the GDP falls below its potential level and unemployment is above the natural rate of unemployment, other things being equal, the inflation rate will decelerate as Suppliers attempt to fill excess capacity, reducing prices and undermining built-in inflation. Finally, if GDP is equal to its potential and the unemployment rate is equal to NAIRU, the inflation rate will not change, as long as there are no supply shocks.

(iv) Endogenous Growth Theory

Endogenous growth theory describes economic growth which is generated by factors within the production process, for example; economies of scale, increasing return or induced technological change; as opposed to outside (exogenous) factors such as population. In endogenous growth theory, the growth rate depends on one variable; the rate of return on capital. Variables like inflation that decreases the rate of return, which in turn reduces capital accumulation and decreases the growth rate.

Empirical Literature

Hossain *et al.* (2012) examined the inflation and economic growth in Bangladesh. The study used time series data from 1978 to 2010. The objective of the study was to find out the long run relationship between inflation and economic growth. The variables used in the study include GDP deflator (GDPD) as a proxy for inflation and GDP as a proxy for economic growth. The study employed co-integration and granger causality test. The Johansen – Juselius co-integration result shows that there was no co-integration

between inflation and economic growth in Bangladesh. The result of causality at lag two (2) shows unidirectional causality was seen running from inflation to economic growth. Further test at lag four (4) supported the first by showing unidirectional causality running from inflation to economic growth.

The major limitation of this study is that it failed to capture necessary post estimation to determine the robustness of the model.

Ziaur (2013) examined relationship between inflation and economic growth in Bangladesh. The study used time series data between 1976 to 2011. The objective was to investigate the empirical relationship between inflation and economic growth in Bangladesh. The variables include GDP growth (GDPgr), inflation, trade openness and remittance growth. The study used several econometric techniques which includes unit root test, stationary test, co-integrated test, VAR model, VAR Granger Causality test, impulse response function and variance decomposition of error term. The result shows statistical significant negative relationship between inflation and economic growth in Bangladesh. The negative relationship between economic growth and inflation is in line with the finding of Ferdinand and Isadora (2014), and Inyama (2013).

Max and Mark (2008) examined the effect of inflation on Growth using panel of transition countries. The study used panel data evidence for 13 transition countries from 1990 to 2013. The objective was to examine the effect of inflation on growth in transition countries. The variables used in the study include. Real GDP Growth in local currency units (LCU) Natural log of GDP deflator percentage growth rate $\ln(\pi)$, m_2/GDP : income normalized money demand (money demand), product of normalized money demand and in (inflation rate) i.e. $\ln(\pi)_1$ (money demand), Czech/other (real GDP, Czech republic/real GDP, other country) I/GDP i.e. investment/GDP at market prices each in LCU, PopGr (population Growth Rate: each in LCU). The result shows a negative influence of inflation on economic growth. This finding is in line with Rahman (2013). The major limitation of this study is that the time frame is not sufficient to give better analysis.

Manoel (2010) investigated relationship between inflation and economic growth in Latin America. The study used panel data from 1970 to 2007 for four Latin American countries, namely Argentina, Bolivia, Brazil and Peru. The objective of this study was to investigate the role of macroeconomic performance, in terms of inflation rates, in determining economic growth in panel of Latin American countries that experience hyperinflation episode in the 1980s and early 1990s. The variables used in the study include GROW which is the growth rate of real GDPs and it serves as a dependent variable. While the independent variables include: inflation (INFLAT), government's share in the real GDP (Gov), which proxies for the size of government, the ratio of exports and imports to real GDP (OPEN), as proxy for economic openness, the ratio of investment to real GDP (INN), measure of financial development i.e. the ratio of liquid liabilities to GDP (M_2), index of structural development (DEV) which is measured by the level of education and urbanization, political regime (POL) which consist of common factors of DEMOC, XCONST and POLCOMP. The study employed pooled ordinary least square, fixed effect (FE) and random coefficient estimators (RC). The result shows a significant negative relationship between inflation and economic growth. This is in line with the finding of Rahman (2013). The major limitation of this study is inability to carry out necessary post estimation test to determine the robustness of the model.

Jaganath (2014) examined the impact of inflation on economic growth in six South Asian countries. The study used time series data for the period 1980 to 2012. The main objective of this study was to investigate the impact of inflation on economic growth in six South Asian countries. The variables include GDP as an indicator of economic growth and CPI as a proxy for inflation. The study used co-integrated test and error correction mechanism, causality test and unrestricted VAR model. It also employed correlation analysis. The result shows that there is high positive correction between inflation and economic growth for all the countries in this study. The co-integration result suggests that there is long run relationship exist for Malaysia. However, the rest of the countries have no long run relationship between inflation and economic growth.

The Granger causality result shows that there is unidirectional causality run from GDP to CPI for Bangladesh, Bhutan, and India. It also shows unidirectional causality run from CPI to GDP in the context of Nepal. However, there is no causality between GDP and CPI for Maldives and Sri Lanka. The use of correlation does not really explain the effect of inflation on economic growth, rather a regression analysis would have been used, the time frame for this study is not sufficient to give better analysis.

Ferdinand and Isidore (2014) examined short – run and long run inflation and Economic Growth nexus in Ghana using quarterly data from 1986Q₁ to 2012Q₄. The major objective was to examine the link between inflation and economic growth in Ghana. The variables include economic growth (y) as a dependent variable, while the independent variables include stock of labour (L), stock of capital, (K), government expenditure (GEXP), interest rate (INT), money supply (M2) and consumer price index (CPI). The study employed co -integration and error correction mechanism. The result shows a negative relationship between economic growth and inflation. Interest was also found to have negative impact on economic growth. The granger causality test shows there was no causation between economic growth and inflation. The result of negative relationship between inflation and economic growth and also no causality between inflation and economic growth are in line with Kasidi and Mwakanmela (2013). The major limitation of this study is that it fails to carry out post estimation test in order to determine the robustness of the model.

Kasidi and Mwakanmela (2013) examine the impact of inflation on economic growth in Tanzania using annual time series data for the period of 1990 to 2011. The objectives of the study were to examine the impact of inflation on economic growth in Tanzania, to measure the degree of responsive of economic growth in Tanzania to change in general price level and to establish relationship between inflation and economic growth in Tanzania. The variables used in the study include GDP which served as a dependent while inflation served as independent variable. The study used reduced form regression equation to investigate the impact of inflation on economic growth. Co-integration was applied to measure whether the two variables moved together in the long run. The result from regression analysis revealed that inflation has negative impact on economic growth in Tanzania. Correlation coefficient and co-integration test using Johansen Co-integrating relationship between inflation and economic growth shows that there is no significant long-run relationship between inflation and economic growth in Tanzania. Only short term negative statistical significant. The negative relationship between inflation and economic growth is in line with the finding of Inyiama (2013). The limitations of this study are: the period covered by this study is not enough to give better analysis. The study also failed to establish the causation between inflation and economic growth.

Aminu and Anono (2012) carried out empirical analysis of the effect of inflation on the Growth and Development of the Nigerian economy. The study used time series data from 1970 to 2010. The objective was to investigate the impact of inflation on economic growth and development in Nigeria. The variables used in the study include GDP which is the Gross Domestic product (output) and also serves as a dependent variable while inflation serves as independent variable. The study used Augmented Dickey – fuller technique in testing the unit root property of the series and Granger causality test of causation between GDP and inflation. The result shows that inflation is statistically insignificant and positive. The positive impact of inflation on economic growth in Nigeria is in line with the finding of Olu and Idih (2015). The result of causality suggests that GDP causes inflation and not inflation causing GDP.

The unidirectional causation of GDP causing inflation is in contrast with other finding, such as Inyiama (2013). The model was not robust as autocorrelation was visible due to very low Durbin-Watson statistic of 0.031. The unit root test shows that the variables are I (1), this means loss of long run information. The right model for this study is Johansen co integration test.

Inyiama (2013) investigated whether inflation weakens Economic Growth? Using evidence from Nigeria from 1970 to 2010. The objective was to evaluate the link between inflation and Economic Growth in Nigeria. It also examined the nature and form of association between inflation rate and exchange rate as well as interest rate. The variables used are GDP, inflation, interest rate and exchange rate. Ordinary least square approach in the form of multiple regressions was adopted in examining the relationship among the variables while causality was evaluated using Granger causality test. Johansen Co-integrated test was also adopted to check whether short term relationship would be maintained in the long run. It was found that inflation is negatively related with the real GDP. This is sustained even in the long run. On causality, at both lag 2 and lag 4, the study revealed that there is no causality between inflation rate and real GDP.

Oladipo *et al.* (2015), examined the inflation, interest rate and economic growth in Nigeria using annual time series data from 1981 to 2014. The variables used for this study includes Real Gross Domestic Product (RGDP), Inflation at consumer prices, Interest Rate (INTR), Net Domestic Credit (NDC), Transfer Payment (TRF). This used Augmented Dickey Fuller test to test the unit root properties of the series. The

result of the unit root shows that all the variables are stationary at first difference but inflation is stationary at level. The study adopts the Ordinary Least Square (OLS) method. The long run relationship among the variables was tested using Johansen co integration test and causality test was also carried out. The OLS result shows that both inflation and interest rate have negative impact on the economic growth. Johansen co integration shows that there is long run relationship among the variables under consideration. The Granger causality test shows that both inflation and interest rate do not Granger cause the economic growth in Nigeria. The limitations of this study: It did not carry out post estimation test to ascertain the robustness of the model, Johansen co integration test used to test long run relationship is not the appropriate model for I (0) and I (1). The right model for this is Autoregressive Distributive Lag (ARDL).

Bakare, Kareem and Oyelekan (2015), examined the effects of inflation rate on economic growth in Nigeria (1986-2014). The variables used for this study are: Gross Domestic Product (GDP) as a dependent Variable and inflation rate as an independent variable. The Augmented Dickey Fuller unit root test was used to test the stationarity of the variables. The study used regression analysis to determine the effect of inflation on economic growth, while Granger causality test was used to test the causation between inflation and economic growth. The result shows that inflation has negative impact on the economic growth. The Granger causality shows that GDP cause inflation but inflation does not cause GDP. The major limitation of this study is that the variables were differenced which leads to loss of long run inflation but this study did not consider long run relationship.

Olu and Idih (2015), investigated the nature of the relationship between inflation and economic growth in Nigeria using annual time series data from 1980 to 2013. The variables used for the study are Gross Domestic Product (GDP) as a dependent variable, while the independent variables are: Inflation rate, Exchange Rate (EXCHR), input of labour and Capital. The study used the Ordinary Least Square to capture the impact of the dependent variable on the independent variables. The result shows that inflation has positive impact on the economic growth in Nigeria. The positive impact of inflation on economic growth is in line with the finding of Aminu and Anono (2012). The major limitation of this study is that it fails to test unit root properties of the series.

3. Methodology of research

3.1. Research Design

The paper used causal research design to capture the effect of inflation and unemployment on economic growth in Nigeria. Causal research design is a type of research design in which there is a dependent variable and independent variables, whereby dependent variable response to the changes in independent variables.

3.2. Sources of Data

This paper employed annual secondary data from CBN bulletins and NBS between the period 1970 and 2016.

3.3. Model Specification

On the relationship between inflation and economic growth, endogenous growth model is used. In endogenous theory, growth rate is determined by the rate of return on capital, variables, like inflation, which decreases the rate of return, in turn reduces capital accumulation and decrease the rate of output growth. The paper adopts Olu and Idih (2015) type model, which is shown below:

$$\text{GDPGR} = (\text{INFR}, \text{EXCHR}, \text{INPL}, \text{INPC}) \quad (1)$$

Where:

GDPGR= Gross Domestic Product Growth rate, INFR=inflation rate, EXCHR= Naira exchange rate to Dollar, INPL=Input of labour, INPC=Input of capital.

The above model is modified to come up with:

$$\text{GDP} = F(\text{Inf}, \text{forex}) \quad (2)$$

The mathematical form of this relationship is shown below:

$$\text{Gdp} = \beta_1 + \beta_2 \text{Inf} + \beta_3 \text{forex} \quad (3)$$

The econometric form of the relationship is shown as:

$$\text{Gdp} = \beta_1 + \beta_2 \text{inf} + \beta_3 \text{forex} + \mu_t \quad (4)$$

3.4. Measurement of Variables

Real Gross domestic product (GDP): This refers to national GDP that has been adjusted for inflation or deflation, that is, GDP divided by price deflator (price of the base year). Real GDP is used as a proxy for economic growth, percentage change in the consumer price index is used as inflation rate, forex as the official foreign exchange rate of Naira to US dollar. μ_t is error term. The model is thus transformed into log linear model where β_2 , and β_3 are all expected to be negative.

$$\text{Lgdp} = \beta_1 + \beta_2 \text{lginf} + \beta_3 \text{lforex} + \mu_t \quad (5)$$

3.5. Estimation Techniques employed

(i) Unit Root Test

When data exhibit unit root, it means they are non-stationary. When non-stationary series data is regressed on another non-stationary data, it will lead to spurious or non-sense regression. In order to avoid non-sense regression, this study adopts the Augmented Dickey Fuller Test (ADF) with structural break. Testing unit root without considering the presence of structural break when there are one or more breaks in the series under consideration, either in the intercept or slope of the regression would bring out wrong result in terms of performance of f and t statistics. This makes it difficult to reject the null hypothesis, that is absence of unit root or to say that the model is stationary. The unit root model is written as:

$$\text{GDP} = \alpha_0 + \alpha \text{DU}_t + d(\text{DTB}) + \text{YDT} + \text{B}_t + \rho \text{GDP}_{t-1} + \sum_{i=1}^p \phi \Delta \text{GDP}_{t-1} + \varepsilon_t$$

$$\text{Inflation rate} = \alpha_0 + \alpha \text{DU}_t + d(\text{DTB}) + \text{YDT} + \text{B}_t + \rho \text{inflationrate}_{t-1} + \sum_{i=1}^p \phi \Delta \text{inflationrate}_{t-1} + \varepsilon_t$$

$$\text{Forex} = \alpha_0 + \alpha \text{DU}_t + d(\text{DTB}) + \text{YDT} + \text{B}_t + \rho \text{forex}_{t-1} + \sum_{i=1}^p \phi \Delta \text{forex}_{t-1} + \varepsilon_t$$

$\text{DU}_t =$ intercept Dummy, $\text{DU}_t = 1$ if $(t > \text{TB})$ and zero otherwise

$\text{DT} =$ slope Dummy, which represents a change in the slope of the trend function, $\text{DT} = t - \text{TB}$, if $t > \text{TB}$, and zero otherwise.

$\text{DBT} =$ crash Dummy $= 1$ if $t = \text{TB} + 1$, and zero otherwise. TB is the break dat. (Glynn *et al.*, 2007).

(ii) Autoregressive Distributive Lag Model (ARDL)

ARDL is used test long run relationship among variables which are $I(1)$ and $I(0)$.

The ARDL model for this paper is shown below.

$$\Delta \text{IGDP}_t = \alpha + \sum_{i=1}^p \phi \Delta \text{IGDP}_{t-i} + \sum_{i=1}^p \theta_1 \Delta \text{inflationrate}_{t-1} + \sum_{i=1}^p \theta_2 \Delta \text{lforex}_{t-1} + \gamma_1 \text{IGDP}_{t-1} + \gamma_2 \text{inflationrate}_{t-1} + \gamma_3 \text{lforex}_{t-1} + \varepsilon_t$$

In the model above, the part with summation signs represent error correction while the part that contains $\gamma_1 \gamma_2 \gamma_3$ represents long run relationship. The parameters for estimation are α , ϕ , θ_1 , θ_2 , θ_3 , γ_1 , γ_2 and γ_3 . ε_t is the white noise error term. The null and alternative hypotheses for bound test concerning the test for co-integration are:

$H_0: \gamma_1 = \gamma_2 = \gamma_3 = 0$ (No long run relationship).

$H_1: \gamma_1 \neq \gamma_2 \neq \gamma_3 \neq 0$ (there is long run relationship).

(iii) Lag Selection Criteria

The paper used the following lag selection criteria

$$\text{AIC} = \ln(\hat{\sigma}^2) + 2k/T$$

$$\text{SBIC} (\ln(\hat{\sigma}^2) + k/T \ln T$$

$$\text{HQIC} = \ln(\hat{\sigma}^2) + 2k/T \ln(\ln T)$$

Where:

$\hat{\sigma}^2$ is the residual variance, K is the total number of parameters estimated and T is the sample size (Brooks, 2014). Out of these criteria, the AIC is selected as it over fits the model because over fitted model is better than under fitted one.

(iv) Post Estimation Check

(a) Serial Correlation test

Breuch – Godfrey Lm – Test

$$Lm = (n-p) R^2 \chi^2_p$$

H₀: $P_1 = P_2 \dots P_p = 0$ (No Serial correlation)

H₁: $P_1 = P_2 \dots P_p \neq 0$ (Presence of Serial correlation)

(b) Heteroscedasticity test

Breush Pagan (1979) Lm test

$$Lm \text{ State} = nr^2$$

$$\chi^2 (P - 1)$$

H₀: $2_1 = 2_2 \dots 2_n = 0$ (Homoscedasticity)

H₁: $2_1 = 2_2 \dots 2_n \neq 0$ (Heteroscedasticity)

(v) Stability Diagnostic Check

In order to test the stability of the model, Cumulative Sum of Recursive Residuals (CUSUM) and Cumulative Sum of Recursive Square Residuals (CUSUMSQ), proposed by Brown et al (1975) is used. If the CUSUM and CUSUMSQ statistics are within the 5% level of significant, it means there is a significant and stable relationship among variables.

(vi) Causality Test

Although regression analysis deals with the dependence of one variable on the other variables, it does not necessarily, imply causation (Gujarati, 2012). The Granger causality test is used to determine the causality between variables under study. The Granger causality of any of the independent variables causing economic growth is shown below

$$LGDP_t = \alpha_1 + \phi_1 LGDP_{t-1} + \dots + \phi_p LGDP_{t-p} + \beta_1 \text{inflationrate}_{t-1} + \dots + \beta_p \text{inflationrate}_{t-p} + \theta_1 \text{lunemprate}_{t-1} + \dots + \theta_p \text{lunemprate}_{t-p} + \gamma_1 \text{forex}_{t-1} + \dots + \gamma_p \text{forex}_{t-p} + \epsilon_t$$

Bound test is used to test the Granger causality involves the following hypotheses.

H₁: $\beta_1 = \dots = \beta_p = 0$ (inflation rate does not Granger cause GDP).

H₂: $\gamma_1 = \dots = \gamma_p = 0$ (forex does not Granger cause GDP).

4. Results and discussions

Table 1. Unit root test

Variables	Level			First difference		
	Intercept and trend			Intercept and trend		
	Test sta.	1%	5%	Test sta.	1%	5%
LGDP	-4.38	-5.72	-5.18	-8.48	-5.72	-5.18
Linflationrate	-6.49	-5.72	-5.18			
Lforex	-5.74	-5.72	-5.18			

Source: Authors' computation from E-views software

From Table 1, the log of GDP became stationary at first difference, while the log of inflation and forex were stationary at level. This shows the model is co-integration of I(1) and I(0). The best model in this case is the Autoregressive Distributive lag.

Table 2. F bound test - Null Hypothesis: No long run relationship

Test sta.	Value	Signif.	1(0)	1(1)
F	19.44020	10%	2.63	3.35
K	2	5%	3.1	3.87
		2.5%	3.55	4.38
		1%	4.13	5

Source: Authors' computation from E-views software

From Table 2, F statistic value 19.44020 is more than the upper bound of Pesaran table at 1%, 5%, 2.5% and 1%, meaning that there is a long run relationship among GDP, the Inflation and for long run coefficient.

Table 3. long run coefficient of ARDL (1, 1, 3) model

Variable	Co-eff.	Std. error	T statistic	Prob.
C	13.29055	1.408589	9.435368	0.0000
Linflationrate	0.264351	0.569682	0.464032	0.6454
Lforex	1.089939	0.136388	7.991448	0.0000

Source: Authors' computation from E-views software

From Table 3, inflation has a positive and statistical insignificant impact on economic growth in the long run. The positive impact of inflation on economic growth is in line Philip's curve which believed that the output increases with the expansion of money supply. The positive impact of inflation on economic growth in Nigeria is line with the findings of Olu and Idih (2015) and Aminu and Anono (2012). The result shows that foreign exchange has a significant positive impact on economic growth in Nigeria.

Table 4. Error Correction Representation of the ARDL (113) model

ARDL model based on Akaike Information Criteria (AIC)				
Dependent variable: LGDP				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INFLATIONRATE)	0062463	0.033581	1.860089	0.0711
D(LFOREX)	0.018379	0.026876	0.683821	0.4985
D(LFOREX(-1))	-0.065862	0.031813	-2.070302	0.0457
D(LFOREX(-2))	-0.053396	0.027726	-1.925819	0.0621
ECM(-1)	-0.085115	0.009274	-9.178282	0.0000
ECM= LGDP-(0.264351*Linflationrate + 1.0899*Lforex + 13.2906)				
R-SQUARE= 0.306680				
ADJUSTED R-SQUARE= 0.235570				

Source: Authors' computation from E-views software

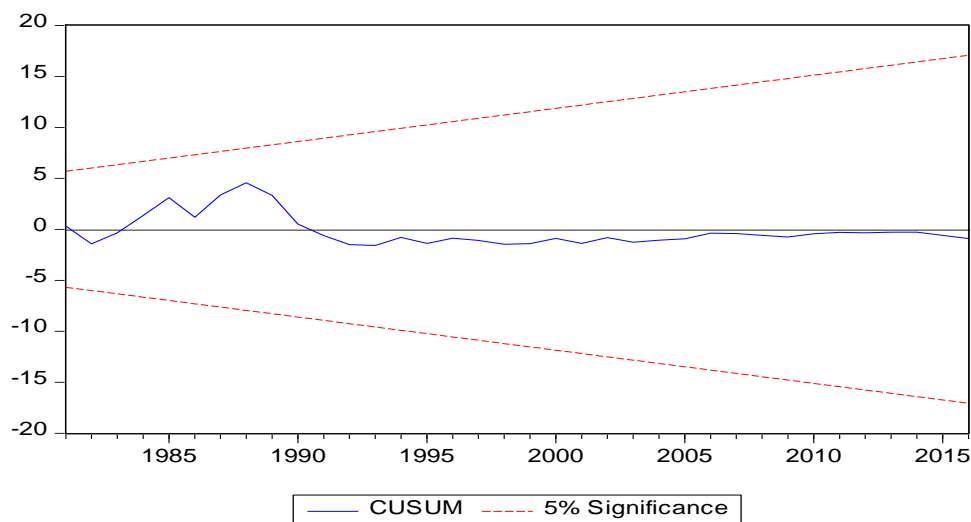
Table 4 shows that, in the short run, inflation has a positive and insignificant impact on economic. Foreign exchange has an insignificant positive impact on economic growth but the impact turns negative at lag1 and lag2. The R² is 0.306680, meaning that 30.6680% change in economic growth is explained by the inflation rate and the foreign exchange rate. The Error Correction Term (ECT) measures the speed of adjustment towards equilibrium after the initial deviations are corrected. The ECT coefficient is -0.085115 and significant at the 5% level of significant. This indicates that at 8.5% of the dis-equilibrium due to the shock in the previous years is adjusted back to the long run equilibrium in the current year.

From Table 4.5, we have two Null Hypotheses. The first Null Hypothesis is residuals are not serially correlated. The second Null Hypothesis is that residuals are not Heteroscedastic. The first part shows that the p values are more than 5%, meaning that we accept the null hypothesis and conclude that the model is free from auto correlation. The second part also has p value less than 5%, meaning that we accept the second Null Hypothesis and conclude that the model is free from heteroscedasticity.

Table 5. Test for Autocorrelation and Heteroscedasticity

Test	Serial correlation Lm test	Prob.
F-Stat	0.744713	0.4825
Observed R ²	1.846600	0.3972
Test	Heteroscedasticity	Prob.
F-stat	0.822845	0.5749
Observed R ²	6.068909	0.5317

Source: Authors' computation from E-views software



Source: E-views software

Figure 1. CUSUM plot for stability diagnostic test

From Figure 1, the CUSUM plot is within the 5% level of significant. This means that the model is stable. This shows that there is no chance of having spurious regression or nonsense regression, as all the variables are stationary.

Table 6. Granger causality test

Variable	Test statistic	Df	Prob.
Linflationrate	f-stat 1.082550	(2,36)	0.3495
	chi square 2.165100	2	0.3387
Lforex	f-stat 1.706537	(4,36)	0.1699
	chi square 6.826148	4	0.1454

Source: Authors' computation from E-views software

From Table 6, the first Null Hypothesis is that the inflation rate does not granger causes GDP, thus, the hypothesis is accepted as the probability value of chi square is more than 5%. Therefore, we conclude that inflation does not cause economic growth in Nigeria. The second Null Hypothesis is that foreign exchange does not granger cause GDP. This hypothesis is accepted and hence the paper concludes that foreign exchange does causes GDP as the p value of the chi square is more than 5%.

5. Conclusions and recommendations

This paper used ARDL as the variables are I(1) and I(0). The bound test shows that there is a long relationship among GDP, inflation and foreign exchange rates. The result shows that inflation has a positive and statistical insignificant impact on economic growth in Nigeria both in the short run and long run. This is in line with Philip's curve that with the expansion of money supply, it leads to an increase in price and output given that labour does not demand for an increase in wages. But this finding is contrary to monetarist view that inflation is harmful to economic growth. The result of a positive impact of inflation on

economic growth in Nigeria is in line with the other studies, such as Olu and Idih (2015) and Aminu and Anono (2012). Another finding also shows that foreign exchange has a significant positive impact on economic growth in the long run unlike in the short run. The impact of foreign exchange turns negative at lag 1 and 2 in the short run. The ECT coefficient is -0.085115 and significant at the 5% level of significant. This indicates that at 8.5% of the dis-equilibrium due to the shock in the previous years is adjusted back to the long run equilibrium in the current year. The paper therefore, recommends that monetary authority should embark on inflationary targeting based on a single digit inflation rate.

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