INFLATION AND ECONOMIC GROWTH IN NIGERIA: AN ARDL ANALYSIS

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Abstract

The Autoregressive distributed lag model estimate technique was used in the study to investigate how inflation affected Nigeria's economic growth. The research used yearly time series data from 1970 to 2022 in order to produce a solid outcome. According to evidence from the estimated models, Nigeria's economic growth is negatively impacted by inflation. Specifically, the short-term findings indicate that inflation has a substantial detrimental effect on economic growth, with an average increase of 1 percentage point in inflation resulting in a short-term decline of -0.12% in real production growth. Long-term model evidence points to a slight but negligible impact of inflation on economic growth during the studied period. Over 63% of the disequilibrium between short-term and long-term equilibrium is rectified annually, according to the error correction coefficient, which also indicates a speed of adjustment towards long-term equilibrium of roughly 63% each year.

Keywords: *Inflation, Economic growth, ARDL, Cointegration, GDP*

INTRODUCTION

Given Nigeria's twin issues of low and stagnating growth records as well as high and rising inflation rates, researchers have worked hard to determine how inflation affects the country's economy in order to propose sound policy measures (Olu & Idih (2015); Onwubuariri, Oladeji, & Bank-Ola (2021); Bawa and Abdullahi (2022). A clear understanding of this relationship is seen as crucial in informing policies that will ultimately launch the economy on a trajectory of sustained and robust economic growth.

Evidence indicates that Nigeria's inflation rate has been on an upward trajectory in recent years. Data from the Central Bank of Nigeria (CBN) Statistical Bulletin 2023 reveals that since 2016, overall inflation has consistently exceeded 10%, reflecting a persistent rise in prices. Inflation, which stood at 9% in 2015, surged to 16% in 2016, dropped to approximately 11% in 2019, and then climbed to around 19% by 2022 (CBN, 2023). Recent monthly statistics from the National Bureau of Statistics show that inflation surpassed the 20% threshold, reaching approximately 26.7% in October 2023 and escalating further to 34% by December 2024. Amid this rising inflation, Nigeria's economic growth performance has been dismal. The GDP growth rate stood at -1.67% in 2016, increased to about 2% in 2019, but contracted to -1.7% in 2020 as the economy grappled with the effects of the COVID-19 pandemic. Although the economy has posted positive growth rates since then,

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output growth has remained sluggish, averaging 3%, as it continues to contend with high and accelerating inflation. The adverse effects of inflation are well-documented. For example, Jayathileke and Rathnayake (2013) highlighted that uncertainties caused by frequent price changes disrupt the efficient allocation of scarce resources. Similarly, Bawa and Abdullahi (2012) observed that inflation discourages savings and investment by creating uncertainty about future prices. Moreover, Mankiw (2003) noted that inflation heightens uncertainty for both creditors and debtors, leading to arbitrary and potentially significant redistributions of wealth. Barro (2013) emphasizes that economic agents, such as firms and households, tend to perform poorly in environments of high and unpredictable inflation.

Given Nigeria's historically high inflation rates, numerous studies have explored the relationship between inflation and economic growth in the country. However, these studies have yielded conflicting findings, underscoring the need for further research on the inflation-growth nexus in Nigeria. While some studies, in line with structuralist perspectives, suggest that inflation supports economic growth (Anidiobu, Okolie, & Oleka, 2018; D. Chude & N. Chude, 2015; Enejoh & Tsauni, 2017), others argue that inflation hampers growth (Al-Taeshi, 2016; Denbel, Ayen, & Regasa, 2016; Idris & Suleiman, 2019). Additionally, research such as that by Anochiwa and Maduka (2015) found no clear evidence of either a positive or negative relationship between inflation and economic growth in Nigeria.

These inconsistent findings on the relationship between inflation and economic growth in Nigeria call for further investigation, particularly given the current context of unprecedented inflation and persistently low and volatile economic growth. This study aims to examine the inflation-growth nexus in Nigeria using the Autoregressive Distributed Lag (ARDL) estimation technique. The ARDL approach is particularly advantageous as it accommodates variables with mixed orders of integration. Moreover, the coefficients of the ARDL model provide insights into both short-run and long-run effects and the speed of adjustment towards long-run equilibrium, making it a highly informative tool (Pesaran, Shin, & Smith, 2001).

Annual time series data are used to analyze the model. The study will specifically use annual data from 1970 to 2022. Inflation, GDP growth, exchange rates, government spending, gross fixed capital formation, and money supply are the variables of interest in this study. The ARDL model will be estimated, the results of the regression outputs will be discussed, and some post estimation tests will be performed.

2. Empirical literature

Over the past two decades, there has been a growing interest in studying the relationship between inflation and economic growth. These studies, conducted across various contexts, have yielded intriguing findings, as summarized below:

Barro (2013) conducted a panel study using macroeconomic data from 100 countries to explore the inflation-growth nexus over the period 1960 to 1990. The study revealed that while the short-run effects of inflation on living standards are negligible, the long-run impact is more detrimental than previously assumed. Holding country characteristics constant, the regression results suggested that a 10% increase in

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inflation could reduce real GDP per capita by 0.2% to 0.3% and lower the investment-to-GDP ratio by 0.4 to 0.6 percentage points in the short run.

Chude and Chude (2015) investigated the relationship between inflation, proxied by the Consumer Price Index (CPI), and economic growth in Nigeria using macroeconomic data from 2000 to 2009. Employing the Ordinary Least Squares (OLS) method, the study found that inflation positively and significantly influenced economic growth during the period under review, suggesting that rising price levels enhanced Nigeria's economic growth.

Onwubuariri, Oladeji, and Bank-Ola (2021) used the Autoregressive Distributed Lag (ARDL) estimation technique to examine the inflation-growth relationship in Nigeria. The study incorporated variables such as inflation, exchange rate, government expenditure, and economic growth, analyzing time series data spanning 1980 to 2019. Results from the ARDL model indicated that inflation had a statistically significant negative impact on economic growth in Nigeria during the study period, highlighting that inflation adversely affects economic performance.

Doguwa (2021) examined Nigeria's inflation threshold. Three distinct approaches to threshold estimate were used in the study: Drukker et al. (2005), Khan and Senhadji (2001), and Sarel's (1996) approach. According to the study, Nigeria's inflation threshold, above which inflation is detrimental to economy, is projected to be between 10.5% and 12%. The study suggested that there is a threshold level of inflation above which money is not super-neutral since it could not find sufficient evidence to support the null hypothesis of money's super neutrality using the estimated two threshold point model.

Bawa & Abdullahi (2022) estimated a threshold level of inflation for Nigeria using quarterly time series data for the years 1981–2009 in a modified empirical analysis of Doguwa (2021). The study calculated a threshold inflation level of 13% for Nigeria using a threshold regression model created by Khan and Senhadji (2001). Increases in the general price level have a negligible impact on overall economic activity below this threshold. On the other hand, inflation had a significant detrimental effect on output growth above the 13% mark. These results were found to hold up well when the estimate method was changed, the number of explanatory variables increased, and the frequency of the data was altered.

METHODOLOGY

ARDL Model

To estimate the relationship between inflation and economic growth in Nigeria, the study uses the Autoregressive Distributed Lag (ARDL) model. The potential for the dependent variable's historical value to influence its current value led to the selection of ARDL. Additionally, ARDL will be employed in this study because previous research has demonstrated that OLS estimation of models with some variables of I(0) and others of I(1) would not produce desired results. Additionally, we can determine the short- and long-term effects of inflation on Nigeria's economic growth according to the findings of the ARDL estimation.

The specification of the symmetric ARDL model follows the standard framework of Pesaran et al. (2001) as given below:

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$$\Delta GDPgrth_t = \alpha_0 + \alpha_1 GDPgrth_{t-1} + \alpha_2 Inf_{t-1} + \alpha_3 X_{t-1} + \sum_{i=1}^{N_1} \lambda_1 \Delta GDPgrth_{t-i} + \sum_{j=0}^{N_2} \lambda_2 \Delta inf_{t-j} + \sum_{j=0}^{N_3} \lambda_3 \Delta X_{t-j} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

In this model, GDPgrth represents the growth rate of real gross domestic product, serving as a proxy for economic growth, while inf denotes the inflation level, proxied by the consumer price index. Additional variables, such as the exchange rate, interest rate, gross fixed capital formation, and government expenditure, are included to analyze their relationship with economic growth.

The optimal lag length is selected using criteria such as the Akaike Information Criterion (AIC), Hannan-Quinn Information Criterion (HIC), or Schwarz Information Criterion (SIC). The lag combination with the smallest value of the chosen criterion is considered optimal. Once determined, the preferred ARDL model is used to test for a long-run relationship using the Bounds testing approach.

This cointegration test involves comparing the calculated FFF-statistic to critical values representing the upper and lower bounds. If the FFF-statistic exceeds the upper bound, cointegration exists. If it is below the lower bound, there is no cointegration. If it lies between the bounds, the result is inconclusive.

In the spirit of our model, the null hypothesis of no cointegration can be expressed as $H_0 : \alpha_1 = \alpha_2 = 0$ while the alternative of cointegration is symbolized as $H_1 : \alpha_1 \neq \alpha_2 \neq 0$. The equation (1) can be re-specified to include an error correction term as follows:

$$\Delta GDPgrth_t = \delta v_{t-1} + \sum_{i=1}^{N_1} \lambda_i \Delta GDPgrth_{t-i} + \sum_{j=0}^{N_2} \lambda_j \Delta \quad inf_{t-j} + \varepsilon_t \ldots\ldots\ldots (2)$$

Where v_{t-1} is the symmetric error correction term; the parameter δ is the speed of adjustment..

Data and data Source

This study will utilize annual time series data obtained from the Central Bank of Nigeria and the World Bank databases for the variables included in the model. Covering the period from 1970 to 2022, the analysis uses real GDP growth rate as the dependent variable. Inflation serves as the primary independent variable of interest, while other independent variables supporting the analysis of the inflation-growth nexus include broad money supply, exchange rate, lending interest rate, and government expenditure.

DATA PRESENTATION, ANALYSIS AND DISCUSSION OF FINDINGS

Unit Root Test

To examine the stationarity properties of these variables, Table 4.3 presents the Augmented Dickey fuller (ADF) unit roots test at both levels and first differencing.

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Table 4.3: Unit roots test (ADF)

	Level	First Diff	Remark
Government_expenditure_growth	-7.443***		I(0)
Inflation	-3.563**		I(0)
Real_GDP_growth	-5.813**		I(0)
Lending_interest_rate	-1.8730	-10.4027***	I(1)
Money_supply_growth	-6.374**		I(0)
Exchangerate	3.577**	-10.2498***	I(0)

Note: ***, **, * denotes significance at 1 percent, 5percent and 10perdect respectively.
Source: Researcher's computation.

At their levels, the real GDP growth rate (Real_GDP_growth), growth rate of broad money supply (money_supply_growth), and growth rate of government expenditure were found to be stationary, indicating the absence of unit roots. This means these variables are integrated of order zero, I(0). In contrast, all other variables were nonstationary at their levels. However, after first differencing, the inflation rate, lending interest rate, and exchange rate became stationary, suggesting they are integrated of order one, I(1). Therefore, the unit root analysis indicates that the variables in the empirical analysis exhibit mixed orders of integration, with some being I(0) and others I(1).

Bounds Testing

Further investigation into a potential long-term cointegration relationship between the variables may be necessary when variables with various stationarity qualities are combined, as in this instance. The Pesaran, Shin, and Smith (2001) limits test is used in this study to determine whether or not there is a cointegrating relationship between the variables in the model. Table 4.4 displays the test's outcome.

Table 1: Bounds Test

	10%		5%		1%		p value	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
F	2.396	3.65	2.861	4.262	3.944	5.668	0.001	0.006
t	-2.514	-3.82	-2.858	-4.224	-3.549	-5.027	0	0.003

Source: Researcher's computation.

The absence of cointegration is the null hypothesis. There is a long-term link between the variables in the model if the null hypothesis is rejected at the 5% significance level. The p value from the boundaries test is less than 0.05, according to evidence from the estimated bounds test in table 4.4. This suggests that there is no cointegration, which is the null hypothesis. Thus, we draw the conclusion that the variables in the model have a long-term relationship. As a result, we estimated Nigeria's inflation and economic growth using the ARDL model.

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Impact of Inflation on Economic Growth.
ARDL Short run Estimates

Table 2 ARDL Short run (SR) result

VARIABLES	(1) ADJ	(2) SR	(3) SR	(4) SR
	-0.633***			
	(0.114)			
ΔInflation		-0.0983*	-0.123**	-0.110*
		(0.0582)	(0.0611)	(0.0613)
Δexchangerate			-0.0771	-0.0759
			(0.0488)	(0.0481)
ΔLending_interest_rate			0.386	0.231
			(0.284)	(0.289)
ΔMoney_supply_growth			-0.0678*	-0.0459
			(0.0400)	(0.0424)
ΔLag_Money_supply_growth				0.191
				(0.127)
ΔGovernment_expenditure_growth			0.00914	-0.00511
			(0.0210)	(0.0221)
Constant	2.589*		-1.720	-1.536
	(1.328)		(2.158)	(2.239)
Observations	52	52	52	50
R-squared	0.460	0.606	0.606	0.622

The variables Money_supply_growth and Government_expenditure_growth measures the growth rate of Money supply and government expenditure respectively. Other variables are used in their level forms. ADJ is the error correction coefficient or the speed of adjustment, Δ is the first difference operator and SR represent short run coefficients. Standard errors in Parentheses. *** p<0.01, ** p<0.05, * p<0.1

The ARDL short-run estimates presented in Table 4.2 reveal the short-run coefficients of the variables in the model and the error correction or speed-of-adjustment coefficient. The negative speed-of-adjustment coefficient, denoted as −α-\alpha−α, is reported in the output column labeled "ADJ." This coefficient measures how quickly economic growth in Nigeria responds to deviations from the equilibrium relationship and how rapidly such distortions are corrected. For the estimated ARDL model, the error correction coefficient is -0.633, indicating that approximately 63% of the disequilibrium between the long-run and short-run is corrected each year.

The short-run ARDL estimates suggest that inflation has a statistically significant and negative impact on economic growth in Nigeria. Specifically, a 1% increase in inflation is expected to reduce economic growth by about 0.12%, on average, in the short run. This adverse relationship is consistent with the understanding that inflation negatively affects economic activities. For example, Jayathileke and Rathnayake (2013) observed that frequent price changes create uncertainties, disrupting the efficient allocation of scarce resources. Similarly, Bawa and Abdullahi (2012) noted that inflation discourages

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savings and investment by creating uncertainty about future prices. Mankiw (2003) highlighted that inflation increases uncertainty for both creditors and debtors, leading to arbitrary redistributions of wealth, while Barro (2013) emphasized the detrimental effects of high and unpredictable inflation on economic agents such as firms and households.

The finding of a significant negative effect of inflation on economic growth contrasts with the structuralist view, which asserts that inflation can support economic growth. Previous studies on Nigeria, such as those by Umaru, Zubairu, & Adama (2012); Chude & Chude (2015); and Anidiobu, Okolie, & Oleka (2018), provide evidence supporting the structuralist hypothesis. However, this study aligns with Onwubuariri, Oladeji, & Bank-Ola (2021), who also found a significant negative relationship between inflation and economic growth using an ARDL model.

To ensure the robustness of this finding, an ARDL model was estimated with inflation as the sole explanatory variable. The results reaffirmed a negative relationship between inflation and economic growth, further validating the earlier estimates.

Regarding the control variables, the study found that lending interest rates and government expenditure growth had positive but statistically insignificant impacts on economic growth during the review period. Conversely, the exchange rate exhibited a negative but statistically insignificant effect on economic growth.

For the growth rate of broad money supply, the study found a negative impact at zero lag but a positive and insignificant effect at lag 1. The negative short-run impact of broad money supply contradicts Keynesian theory, which posits that increases in money supply boost income and output in the IS-LM framework. However, in the context of low output growth and structural rigidities in Nigeria, increases in money supply have led to situations where excess money chases too few goods, thereby hindering economic growth. This finding aligns with studies like Omodero (2019), which also identified a negative relationship between money supply growth and economic growth in Nigeria

Long run estimates

Table 3 **ARDL long run (LR) estimates**

VARIABLES	(2) LR	(5) LR
Inflation	-0.0404	-0.0816
	(0.0788)	(0.0965)
exchangerate		0.0197
		(0.0147)
Lending_interest_rate		0.244
		(0.216)
Money_supply_growth		0.0695
		(0.0794)
Government_expenditure_growth		0.0458
		(0.0497)

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Observations	52	52
R-squared	0.460	0.606

The variables Money_supply_growth and Government_expenditure_growth measures the growth rate in Money supply and government expenditure respectively. LR represent Long run coefficients. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3 presents the ARDL long-run effects of inflation and other selected variables on economic growth in Nigeria. Consistent with the short-run estimates, the long-run results indicate a negative relationship between inflation and economic growth. However, the effect is statistically insignificant, suggesting that inflation has no significant long-run impact on economic growth in Nigeria.

This finding aligns with the classical argument that inflation does not influence output growth in the long run, implying the neutrality of money prices over time. Even when adjusting for variations in explanatory variables, inflation continues to exhibit a negative but statistically insignificant effect in the long run. Empirically, this result is consistent with studies by Onwubuariri, Oladeji, & Bank-Ola (2021) and Jallo & Bah (2023), both of which identified a negative relationship between inflation and economic growth.

Regarding the control variables, the results show positive but statistically insignificant long-run effects of broad money supply, exchange rate, and lending interest rate on economic growth in Nigeria.

CONCLUSION

The Autoregressive distributed lag model estimate technique was used in the study to investigate how inflation affected Nigeria's economic growth. The research used yearly time series data from 1970 to 2022 in order to produce a solid outcome. According to evidence from the estimated models, Nigeria's economic growth is negatively impacted by inflation. Specifically, the short-term findings indicate that inflation has a substantial detrimental effect on economic growth, with an average increase of 1 percentage point in inflation resulting in a short-term decline of -0.12% in real production growth. The model's results points to a slight but negligible long-term negative impact of inflation on economic growth throughout the studied period. Additionally, according to the error correction coefficient, the rate of adjustment towards long-term equilibrium is approximately 63% each year, meaning that more than 63% of the short- and long-term disequilibrium is rectified each year.

Given Nigeria's historically high rates of inflation, the study adds to the body of knowledge on the relationship between inflation and growth in Nigeria by assessing the immediate and long-term effects of inflation on the country's real output growth. Additionally, the study examines the relationship between inflation and growth in Nigeria while controlling for the exchange rate, lending rate, money supply growth rate, and government spending growth rate. Additionally, using a reasonably long annual times series data set (1970–2021) allows us to make inferences that might not have been possible with a shorter time frame. It is impossible to overstate the study's significance. For example, policymakers would find it crucial to show that inflation has a detrimental short- and long-term impact on economic growth when creating policies for the Nigerian economy's sustainable growth.

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