



AN EMPIRICAL ANALYSIS OF THE IMPACT OF INFLATION ON ECONOMIC GROWTH: NEW EVIDENCE FROM NIGERIA

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Abstract

The study undertakes a crucial investigation into the impact of inflation on economic growth in Nigeria from 1970 to 2021. Through a robust analytical framework encompassing descriptive analysis, correlation assessment, and the application of the Autoregressive Distributed Lag (ARDL) model, the research delves into the intricate dynamics of these pivotal variables. The findings underscore the compelling negative impact of inflation on economic growth, corroborating established economic theories. In response, the study provides strategic recommendations that encompass adept inflation management, imperative export diversification, steadfast exchange rate stability, a visionary long-term economic outlook, and continuous monitoring. By navigating the intricate interplay between inflation and economic growth, this study equips policymakers and stakeholders with actionable insights for prudent decisions that artfully balance inflation control and the pursuit of enduring economic growth.

Keywords: Inflation, Economic Growth, Nigeria, ARDL Model, Export Diversification, Exchange Rate Stability.

1. Introduction

The relationship between inflation and economic growth has, over the years, been a source of concern for policymakers, economists and even governments of both the developed and developing countries, including Nigeria. Specifically, in Nigeria, one of the Monetary Policy Committee mandates of the Central Bank of Nigeria, is promoting and maintaining price stability and ensuring a sound and efficient financial system in the country (CBN Act, 2007). This is because it is believed that monetary policies help encourage sustained growth in the economy by increasing the value of money and preventing inflation and other macroeconomic uncertainties, which will further boost the economy. On September 22, 2020, the Central Bank decreased the Monetary Policy Rate (MPR) by 100 basis points, from 12.5 per cent to 11.5 per cent, in order to lower the economy's money supply (CBN Statistical Bulletin, 2020). This reduction was made to address the rise in domestic prices and attract capital into the economy, thereby increasing the level of external reserves.

However, some have argued that to achieve rapid economic growth, as well as low inflation rate are the main goals of macroeconomic policies in any economy

zero inflation is not healthy for an economy and as a result should be discouraged. At least a single digit inflationary situation could stimulate the growth process of an economy. This is because; deflation has serious negative effects on economic growth and development of a country. Thus, moderate inflation enhances nation's domestic economy, while high inflation is inimical to the growth and development of the domestic economy. In view of the above, the policymakers, as well as the monetary authorities are advised to work toward achieving low rate of inflation in an economy, as that would help to maximize the overall economic well-being of citizens in their countries (Mubarik & Riazuddin, 2005).

Despite these efforts, inflation has continued to pose significant challenges to the Nigerian economy's growth and development. The prices of goods and services have been on the sustain increase. There has also been little or no production of goods and services. In other words, the situation of having aggregate demand to be more than aggregate supply; thereby causing more money to chase fewer goods. This creates inflationary pressure on the purchasing power parity of the people in the country that will translate to low standard of living. The relationship between inflation and economic growth has been a controversial issue in

macroeconomic theory and has remained a deliberated subject among policymakers. They can be traced back to the Latin American context in the 1950s.

In Nigeria, high inflation has been one of the major challenges facing the nation's economy. The inability of the government to proffer a lasting solution to this problem indicates the inevitability of inflation in the economy; hence, it shows that government lacks capacity and the political will to eliminate the persistent rising prices of goods and services in the domestic economy (Taiwo, 2011). Inflation in the country can be traced to 1950s, though not prevalent then. Scholars have argued that during an inflationary period, domestic currency finds it difficult to act as medium of exchange and a store of value without adversely affecting output level, income distribution and employment level of the country (CBN Act, 2007).

However, the corresponding rate of inflation in 1981 stood at 20.8% in Nigeria; and in 1986, the inflation rate declined to 5.7%, and increased to 13.0% in 1990. By 1996, the rate of inflation again rose to 29.3%; in 2001 and 2006, the rates of inflation were 18.9% and 8.2% respectively; and it was 10.8% and 9.0% in 2011 and 2015 respectively (CBN, 2015). More so, the growth rate of real gross domestic product (RGDP) in 1981 was -20.4%; in 1986, the growth rate of RGDP rose to 1.9%, and declined to 0.01% in 1991. By 1996, 2001, 2006, 2011 and 2015, the growth rates of the RGDP were 4.1%, 9.8%, 6.0%, 7.4% and 3.9% respectively. The inflationary trends of the country in recent time increased sharply from 17.34 to 22.20% in 2017 and 2022 Q2 (CBN, 2020; National Bureau of Statistics, 2022).

The intricate relationship between inflation and economic growth has attracted substantial research attention, yielding diverse and often contradictory findings (Saeed, 2007; Sweidan, 2004; Fakhri, 2011). Such disparities stem from disparate macroeconomic contexts across nations, distinct datasets and timeframes for analysis, as well as varying analytical methodologies and model specifications. Despite the multitude of studies striving to address the inflation challenge, its persistence underscores a critical gap in understanding. This study recognizes the urgency to unravel the complexities of this persistent problem.

In this context, the focus of this study is to comprehensively examine the impact of inflation on Nigeria's economic growth. Leveraging the robust Autoregressive Distributed Lag Model (ARDL), the research delves into this multifaceted relationship. The pivotal outcome underscores the noteworthy negative and significant effect of inflation on the economy. Against this backdrop, this research is organized into five discernible sections: introduction, literature review, methodology, results and discussion, and, ultimately, conclusion and policy recommendations. In essence, this study aims to rigorously analyse the correlation between inflation and economic growth in Nigeria, thereby contributing to a refined understanding of their trends and patterns across time

2. Literature Review

2.1 Conceptual Issues

Inflation is one of the oldest and widely used concepts in macroeconomic analysis globally and various scholars have given their diverse definitions to the concept. For instance, Jhingan (2002) as cited in Jibrilla and Bawuro (2016) conceptualized inflation as a persistent and appreciable rise in the general level of prices. According to him, a rise in the general price level can only be considered as an inflationary, when it is persistent, continuing and sustained. Demberg and McDougall are much more explicit in their definition of inflation where they saw it as a continue rising in prices as measured by an index such as the Consumer Price Index (CPI) or by the implicit price deflator for Gross National Product (Muritala, 2012).

Therefore, in an inflationary economy, it is difficult for the national currency to act as appropriate medium of exchange and a store of value without having an adverse effect on income distribution, output and employment (CBN, 2020). This is because; the domestic currency stands to depreciate against other international currency which places the country at a disadvantageous position on the balance of trade. Inflation is often characterized by a fall in the value of the country's currency and a rise in her exchange rate with other nation's currencies.

A generally adopted proxy for Economic Growth is the Gross Domestic Product (GDP) which is the measure of a country's level of productivity within a specified

period time usually a year; Nominal GDP is the monetary worth of goods and services of country in year. While as real GDP is the material census of goods and services produced by all the citizen of an economy usually within a period of a year (Boniface, 2016).

2.2 Theoretical Review

Theories of Inflation (Quantity Theory of Money)

Quantity theory of money belief that the quantity of money in circulation is the main factor that determines prices level in any economy. If the quantity of money in circulation changes, it will lead to change in the price level of goods and services. The theory historically, was propounded by Irving Fisher in his famous equation of exchange: $MV=PQ$, where M is stock of money, V is the velocity of circulation of money, Q is the volume of transactions generated internally, while P is the general price level. Transforming the equation by substituting Y, which is the total amount of goods and services exchanged for money for Q, the equation of exchange becomes $MV=PY$.

The introduction of Y provides the relationship between the monetary and the real side of the economy. However, P, V and Y are endogenously determined internally. The variable M is the policy variable, which is exogenously determined by the monetary authorities. The monetarists argued that change in quantity of money affects price level only or the monetary side of the economy with the real sector totally excluded. This implies that variations in the supply of money do not affect the real output of goods and services, rather, their values or the prices at which they are exchanged. The main trust of the monetarists' model is its focus on long run supply side properties of the economy as against the short run dynamics (Dornbusch, Fischer & Kearney, 1996).

2.3 Empirical Review

Numerous studies have been undertaken to examine the relationship between inflation and economic growth over the years (Doguwa, 2012; Sweidan (2004; Saeed, 2007). These studies have not been able to reach a consensus especially in the context of Nigeria. Sweidan (2004) investigated the relationship between inflation and economic growth in Jordan from 1970 to 2003 using chow breakpoint test. The results indicate that

inflation has positive and significant influence on economic growth of Jordan, and that structural breakpoint effect occurs at an inflation rate of 2%. Above the threshold level of 2%, inflation affects economic growth negatively.

Ahmed and Mortaza (2005) in their research examined the nexus between inflation and economic growth in Bangladesh for the period 1980-2005 by employing cointegration test and error correction model. The study employed consumer price index (CPI) and gross domestic product (GDP) in the investigation. The results revealed that long run relationship exists between inflation and economic growth. Similarly, the results showed that inflation has negative relationship with economic growth in Bangladesh for the period studied.

Saaed (2007) studied the relationship between inflation and economic growth in Kuwait from 1985 to 2005 using cointegration approach. The results of the study indicate long run relationship between real gross domestic product (GDP) and consumer price index (CPI) in Kuwait

Erbaykal and Okuyan (2008) examined the connection between inflation and economic growth in Turkey between 1987 to 2006 and also deployed the applications of cointegration test and Toda-Yamamoto approach to causality test. Their findings showed that inflation does not have significant long run relationship with economic growth in Turkey. Additionally, the results of the Toda-Yamamoto approach to causality test indicated a unidirectional relationship between inflation and economic growth, with causality running from inflation to economic growth.

Frimpong and Oteng-Abayie (2010) studied the threshold effect of inflation on economic growth in Ghana for the period 1960-2008 using threshold regression models. The result shows an inflation threshold level of 11% at which inflation begins to have adverse effect on economic growth in Ghana. Below the threshold level of 11%, inflation will affect economic growth positively, while above the threshold level of 11%, inflation will have adverse effect economic growth in Ghana.

Mohanty, Chakraborty, Das and John (2011) investigated the nexus between inflation and growth in

India using quarterly data series and found that the inflation rate of 4% to 5.5% can be considered as an inflation threshold in the economy. Hence, the study concluded that inflation rate less than 5.5% would have positive impact on Indian economic growth, while inflation rate above 5.5% threshold level will have negative impact on the economy.

Fakhri (2011) investigated the possibility of threshold effect of inflation on economic growth in Azerbaijani economy from 2000 to 2009. The estimated threshold model indicates that threshold level of inflation for GDP growth in Azerbaijan is 13%. Thus, below this threshold level, inflation will have significant and positive effect on GDP growth, while a threshold level above 13% will have negative effect on the growth of Azerbaijan.

Furthermore, Mwakanemela (2013) investigated the impact of inflation on economic growth in Tanzania from 1990 to 2011 through the applications of cointegration approach, ordinary least square (OLS) technique and correlation coefficient analysis. The results of the cointegration test indicate no cointegration between inflation and economic growth. Similarly, the results of the correlation coefficient indicate that strong relationship exist between inflation and gross domestic product (GDP) in Tanzania. The results also showed that inflation has a negative impact on economic growth in Tanzania.

Chimobi (2010) investigated the impact of inflation on economic growth in Nigeria for the period 1970- 2005, using co-integration and Granger causality tests. Consumer price index (CPI) was used as a proxy for inflation and the GDP as a perfect proxy for economic growth to examine the relationship. A stationarity test was carried out using the Augmented Dickey-Fuller test (ADF) and Phillip-Perron test (PP), and stationarity was found at first difference. More so, Johansen-Juselius cointegration technique employed in the study showed no evidence of cointegration between inflation and economic growth in Nigeria. The VAR-Granger causality employed in the investigation indicated unidirectional relationship between inflation and economic growth, with causality running from inflation to economic growth in the economy.

Sani and Abdullahi (2011) utilized a quarterly time series data for the period 1981-2009 to estimate a threshold level of inflation for Nigeria. The study used a threshold regression model developed by Khan, Senhadji, and Smith (2006) and found a threshold inflation level of 13% for Nigeria. Below the threshold level, inflation will have positive effect on economic growth, and therefore, has negative effect on the growth when the threshold level exceeds 13%. The negative and significant relationship between inflation and economic growth for inflation rates both below and above the threshold levels is robust with respect to changes in econometric methodology.

Osuala, Osuala and Onyeike (2013) investigated the impact of inflation on economic growth in Nigeria from 1970 to 2011 using Augmented Dickey-Fuller (ADF) and Philip-Perron (PP) tests, Granger causality test in the analysis. The variables used in the study include real gross domestic product (GDP) and inflation rate. The results showed that bi-directional relationship exists between inflation and economic growth in Nigeria.

Ilyas et al (2014) investigated the relationship among economic growth, savings and inflation; and as well estimated the threshold level of inflation for Pakistani economy. Simultaneous equation model was utilized in the study. The variables used in the study include GDP growth rate, inflation rate, savings rate, depreciation of exchange rate, total debt servicing, interest rate, unemployment rate and indirect taxes. Three equations were employed including 2SLS technique; OLS model was used for investigating the suitable rate of inflation for the economic growth. Inflation, savings and economic growth were endogenous variables while unemployment, depreciation rate, foreign direct investment, total debt servicing, real interest rate, indirect taxes, total investment, dependency ratio were exogenous variables. The results of 2SLS showed that inflation and real interest rate negatively and significantly affect economic growth, whereas economic growth, unemployment and real interest rate negatively affect inflation rate. More so, indirect taxes had positive impact on inflation. The results also showed that economic growth, dependency ratio and foreign direct investment were beneficial for enhancing the savings of a country, while depreciation rate is harmful for savings.

Jibrilla and Bawuro (2016) who also studied the connection between Inflation and Economic Growth in Nigeria using annual time series data from 1961 to 2014. Their study adopted the use of Ordinary Least Squares (OLS) and Johansen Cointegration methods. Also, Error Correction Mechanism (ECM) and Granger Causality method to ascertain both the impact of inflation on economic growth as well as the relationship between the two variables. The result of the OLS regression analysis revealed a negative impact of inflation on economic growth in Nigeria, although the coefficient is statistically insignificant which implied that inflation does not influence economic growth in the country over the sample period. The cointegration test result indicated the existence of a long-run equilibrium relationship between inflation and economic growth in Nigeria. The error correction term was correctly signed and statistically significant which confirmed that the two variables under study converge towards a long run equilibrium relationship but the speed of adjustment appeared to be slow as only 17% of the error was being corrected each year. The Granger causality test result showed that there was no either unidirectional or bidirectional causality between inflation and economic growth in Nigeria from 1961 to 2014.

Adaramola and Dada (2020) examined the influence of inflation on the Nigerian economy's growth prospects. The study findings indicated that inflation and real exchange rate significantly negatively impact economic growth, while the interest rate and money supply indicate a positive and significant impact on economic growth. The causality result also shows the unidirectional relationships between interest rate, exchange rate, government consumption expenditures and gross domestic product, while inflation and the degree of openness show no causal relationship with gross domestic product. As a result, the study recommended that the monetary authorities need a more pragmatic effort

Haliru (2021) in his study assesses the impact of inflation on economic growth for the period of (1973-2019). He used multiple linear regression (OLS) and correlation as the analytical method for the study. The findings of the study revealed that INFR has a negative significant effect on LnGDP while EXR has a positive significant effect on LnGDP. The hypothesis of the

study confirmed that inflation and economic growth are negatively correlated.

2.4 Theoretical Framework

The study essentially deploys two theoretical frameworks- the Quantity Theory of Money (QTM) and the traditional Keynesian Model. This is premised on the fact that these theories have established a direct link between inflation (money supply) and output Y of the economy which is the GDP. The relevance of the theories is based on their arguments that money influences output in the short-run, but only prices in the long-

The traditional Keynesian model comprises of the Aggregate demand (AD) and Aggregate Supply (AS) curves, which aptly illustrates the inflation growth relation ship. According to this model, in the short run, the (AS) curve is upward sloping rather than vertical, which is its critical features. If the AS curve is vertical. Changes on the demand side of the economy affect only prices. 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 expectations, labor force, prices of other factors of production, fiscal and /or monetary policy. In moving from the short-run to the hypothetical long-run, the above-mentioned factors and its shock on the steady state of the economy are assumed to balance out. In this steady state situation, nothing is changing, as the name suggests.

The dynamic adjustment of the short-run AD and AS curve yields an adjustment path which exhibits an initial positive relationship between inflation and growth, however, turns negative towards the later part of the adjustment path. Therefore, even if the prices of goods in the economy have increase, output would not decline, as the producer has to fulfil the demand of the consumer with whom the agreement was made. The aggregate supply and aggregate demand (AS_AD) framework also postulated a positive relationship between inflation growths whereas growth increased, so did inflation. In the 1970's however, the concept of stag inflation gained permanence, and the validity of the positive relationship was questioned. Widely accepted at that time, the Philips curve relationship had appeared to not hold. This was evidenced by periods of low or negative output growth, and inflation rates that were

historically high. During this period, prices rose sharply, while the economics around the world experienced massive unemployment.

3. Methodology

This section presents the comprehensive methodology employed to investigate the intricate relationship between inflation and economic growth in Nigeria, with a specific focus on the period from 1970 to 2021. The research approach encompasses a mix of descriptive analysis, correlation assessment, and advanced econometric techniques to derive insightful conclusions.

3.1 Data Collection and Variables

$$\Delta(\text{Annual GDP growth})_t = a_0 + a_1\Delta(\text{Inflation rate})_{t-1} + a_2\Delta(\text{Exchange rate})_{t-1} + a_3\Delta(\text{Manufactures export})_{t-1} + \vartheta\text{ECM}_{t-1} + u_t$$

Where:

$\Delta(\text{Annual GDP growth})$ represents the first difference of the annual GDP growth rate.

$\Delta(\text{Inflation rate})$ represents the first difference of inflation.

$\Delta(\text{Exchange rate})$ represents the first difference of the exchange rate variable.

$\Delta(\text{Manufactures export})$ represents the first difference of the manufactures export variable.

ECMECM is the error correction mechanism term.

u represents the error term.

3.3 Method of Data Analysis

While the major technique of analysis employed was the Autoregressive Distributed Lag (ARDL) method, other preliminary analyses were conducted using descriptive method, correlation matrix and Augmented Dickey Fuller Method of unit root test.

Descriptive Analysis

Descriptive statistics were applied to comprehensively examine the study variables. Summary statistics, including means, medians, standard deviations, minimum and maximum values, skewness, kurtosis, as well as Jarque-Bera tests for normality, were computed. This rigorous exploration provides a clear overview of the central tendencies, variability, and distribution

Data for this study were meticulously gathered from the World Bank Development Indicators database. The variables of interest encompass the annual GDP growth rate, inflation rate, manufactures exports as a percentage of merchandise exports, and the official exchange rate. The dataset covers the temporal span from 1970 to 2021, offering a rich foundation for analysis.

3.2 Model Specification

To empirically examine the impact of inflation on economic growth in Nigeria, ARDL model specification was used which has been specified as follows:

characteristics of the variables, setting the stage for subsequent analyses.

Correlation Assessment

The degree of linear relationship between variables was assessed using correlation analysis. By quantifying the strength and direction of associations, this method revealed potential patterns and dependencies that illuminate how variables interact with each other. This step enriches the understanding of preliminary relationships, offering a foundation for further investigation.

Preliminary Unit Root Test: Augmented Dickey-Fuller (ADF) Method

Prior to the core econometric analysis, a preliminary unit root test was conducted using the Augmented Dickey-Fuller (ADF) method. This test aids in determining the order of integration of the variables, an essential consideration when establishing the appropriate modelling approach. This step ensures that the variables under investigation possess stationary properties, a critical assumption for accurate analysis.

Analytical Framework: Autoregressive Distributed Lag (ARDL) Model

The core of the analysis revolves around the Autoregressive Distributed Lag (ARDL) model. This methodological approach is adept at accommodating variables with differing orders of integration and

capturing both short-term and long-term relationships. The ARDL framework enables a nuanced exploration of how inflation influences economic growth in Nigeria over time.

Diagnostic Tests

Diagnostic tests were meticulously applied to validate the integrity of the ARDL model:

Breusch-Godfrey Serial Correlation LM Test: To ascertain the absence of serial correlation in residuals, thereby affirming model adequacy.

Heteroskedasticity Test: White: To assess the presence of heteroskedasticity and ensure reliable coefficient estimates.

Normality Test: Jarque-Bera: To confirm the conformity of residuals to a normal distribution, a vital assumption for valid statistical inferences.

CUSUM Test: To evaluate the dynamic stability of estimated coefficients over time, contributing to consistent and reliable predictions.

4. Results and Discussion

The presented summary statistics table 1 provides a comprehensive overview of key economic indicators related to the impact of inflation on economic growth in Nigeria over the observed period from 1970 to 2021. These indicators include the annual GDP growth rate, inflation rate, the proportion of manufactured exports to total merchandise exports, and the official exchange rate. In order to draw meaningful interpretations, it's essential to analyse these statistics in the context of relevant economic theories and historical trends.

Table 1: Summary Statistics (Sample: 1970 2021)

	Annual GDP growth rate (economic growth)	Inflation rate	Manufactures export (as a percentage of merchandise exports)	Official Exchange rate
Mean	3.825028	18.17202	2.127929	85.40447
Median	4.217446	12.94178	0.622086	21.89065
Maximum	25.00724	72.83550	10.74753	403.5808
Minimum	-13.12788	3.457650	0.022718	0.546781
Std. Dev.	6.283492	15.32531	2.673880	107.1378
Skewness	0.142374	1.993646	1.386346	1.269665
Kurtosis	5.178705	6.229699	4.087059	3.831380
Jarque-Bera Probability	10.46032 0.005353	57.04716 0.000000	19.21728 0.000067	15.46868 0.000438
Sum	198.9015	944.9452	110.6523	4441.033
Sum Sq. Dev.	2013.596	11978.12	364.6312	585403.9
Observations	52	52	52	52

Starting with the annual GDP growth rate, the mean of 3.83% suggests a relatively moderate level of economic expansion on average over the observed period. The wide range, however, between a minimum of -13.13% and a maximum of 25.01%, indicates a significant variability in economic performance. This fluctuation could be attributed to various factors, including changes in fiscal and monetary policies, external shocks, and structural

issues within the Nigerian economy. Economic theory suggests that sustained high inflation can hinder economic growth by reducing purchasing power and eroding investment incentives. Therefore, it's important to examine how inflation interacts with these fluctuations in GDP growth.

Moving on to the inflation rate, the mean of 18.17% reveals a considerable inflationary environment during this period. The skewness and kurtosis values of 1.99 and 6.23, respectively, along with the Jarque-Bera probability close to zero, indicate a distribution that deviates from a normal distribution and is more prone to extreme values. This highlights the presence of inflationary spikes and potentially hyperinflationary episodes. Economic theories like the Quantity Theory of Money and the Phillips Curve can help explain the relationship between inflation and economic growth. A moderate level of inflation may initially stimulate economic activity, but high and volatile inflation can lead to uncertainty and hinder long-term investment and planning.

The manufactures export as a percentage of merchandise exports provides insights into the diversification of Nigeria's export basket. The relatively low mean value of 2.13% suggests a dominant reliance on other sectors like oil and raw materials. Economic diversification is crucial for reducing vulnerability to external shocks, and theories like the Export-Led Growth Theory emphasize the role of export diversification in promoting economic growth and stability.

Finally, the official exchange rate statistics exhibit a wide range of values, with a substantial mean and standard deviation. This variability could be linked to fluctuations in global oil prices, as Nigeria is a major oil exporter.

Exchange rate stability is important for attracting foreign investment and maintaining external competitiveness. The observed variability underscores the challenges associated with managing exchange rate dynamics, and theories like the Purchasing Power Parity and Interest Rate Parity can offer insights into exchange rate determination.

In conclusion, the presented summary statistics shed light on the complex interplay between inflation and economic growth in Nigeria. The interpretations provided here, along with insights from relevant economic theories, highlight the need for policymakers to address inflationary pressures while fostering a conducive environment for sustainable economic expansion through diversification, stable exchange rates, and prudent monetary policies. The observed trends and fluctuations emphasize the importance of a comprehensive approach to ensure long-term economic stability and growth in Nigeria.

Correlation Analysis Result

Table 2 presents the correlation analysis of the variables related to the impact of inflation on economic growth in Nigeria. This analysis provides insights into the strength and direction of relationships between these variables and helps us understand how they interact.

Table 2: Correlation Analysis

Covariance Analysis: Ordinary				
Sample: 1970 2021				
Included observations: 52				
Correlation	Annual GDP growth	Inflation rate	manufactures exports (as a % of merchandise exports)	official exchange rate
Annual GDP growth	1.000000			
Inflation rate	-0.226624	1.000000		
manufactures exports (as a percentage of merchandise exports)	0.120628	-0.146824	1.000000	
official exchange rate	0.008475	-0.236839	0.708987	1.000000

Starting with the correlation between annual GDP growth and inflation rate, the coefficient of -0.226624 indicates a negative correlation between these two variables. This aligns with economic theory; as higher inflation rates are generally associated with lower

economic growth. The negative correlation implies that periods of high inflation are often accompanied by slower economic expansion. This finding is in line with the Quantity Theory of Money, which suggests that excessive growth in the money supply (leading to

inflation) can hinder real economic output and growth. This negative correlation also corresponds with the idea discussed earlier that high and volatile inflation can create uncertainty and reduce long-term investment incentives, thereby impacting economic growth.

Moving on to the correlation between annual GDP growth and the proportion of manufactured exports as a percentage of merchandise exports, the coefficient of 0.120628 suggests a weak positive correlation. This implies that, to some extent, when the manufacturing sector's exports contribute more to the overall merchandise exports, there might be a slight association with higher economic growth. This links back to the diversification argument discussed earlier. A more diversified export basket can contribute to economic stability and growth, and a positive correlation, even if weak, indicates that some positive relationship might exist between export diversification and economic growth.

The correlation between annual GDP growth and the official exchange rate is quite weak, with a coefficient of 0.008475. This suggests that, during the observed period, changes in the official exchange rate had minimal direct impact on GDP growth. However, this correlation might not fully capture the potential indirect effects of exchange rate fluctuations on economic growth. For instance, a more depreciated currency could impact inflation through increased import costs, which, as discussed earlier, could subsequently influence economic growth.

Finally, the correlation between inflation rate and the proportion of manufactured exports as a percentage of merchandise exports is -0.146824. This negative correlation implies that higher inflation might be associated with a smaller share of manufactured exports in the total merchandise exports. This connection could be due to the inflation-induced increase in production costs, which might affect the competitiveness of manufactured goods in international markets. This finding underscores the importance of managing inflation to support export-oriented manufacturing sectors.

In conclusion, the correlation analysis further emphasizes the complex dynamics between inflation and economic growth in Nigeria. The correlations, when interpreted alongside the previous summary statistics and relevant economic theories, provide a nuanced understanding of how these variables interact. Policymakers should consider these relationships when formulating strategies to promote sustainable economic growth while addressing inflationary pressures and export diversification.

Unit Root Test

Table 3 provides the results of the unit root tests conducted on the variables relevant to the impact of inflation on economic growth in Nigeria. Unit root tests are crucial to determine the order of integration of time series variables, which is essential for selecting the appropriate econometric method.

Table 3: Unit Root Test Result

VARIABLE	ADF Test Statistic	Critical Value (5%)	Probability (p-value)
Annual GDP growth	-5.724219	-3.500495	0.0001
Inflation rate	-4.131582	-3.502373	0.0106
Manufactures exports as percentage of merchandise exports	-4.740227	-3.504330	0.0020
Official exchange rate	0.914987	-3.500495	0.9998
First difference of official exchange rate	-5.244865	-3.502373	0.0004

The Augmented Dickey-Fuller (ADF) test statistics are compared against critical values to determine whether the null hypothesis of a unit root (non-stationarity) can be rejected. A p-value less than a predefined significance level (e.g., 0.05) indicates that the null hypothesis can be rejected.

For the variable "Annual GDP growth," the ADF test statistic of -5.724219 is significantly below the critical value of -3.500495 at the 5% level, with a p-value of 0.0001. This implies that the null hypothesis of a unit root is rejected, suggesting that the variable is stationary and integrated of order 0, or I(0).

Similarly, for the "Inflation rate" and "Manufactures exports as a percentage of merchandise exports" variables, the ADF test statistics are -4.131582 and -4.740227, respectively, both significantly below their respective critical values. This indicates that the null hypothesis of a unit root is rejected for these variables as well, suggesting they are also stationary and integrated of order 0.

However, for the official exchange rate variable, the ADF test statistic is 0.914987, which is higher than the critical value of -3.500495. In this case, the null hypothesis of a unit root cannot be rejected, indicating that the variable is non-stationary. Nevertheless, the

first difference of the official exchange rate becomes stationary, as evidenced by the ADF test statistic of -5.244865, which is significantly below the critical value indicating it is integrated of order 1, or I(1).

In conclusion, the unit root test results indicate that annual GDP growth, inflation rate, and manufactures exports as a percentage of merchandise exports are integrated of order 0, while the official exchange rate variable is integrated of order 1. This mixture of integration orders necessitates an econometric method that can handle variables with different integration levels. The Autoregressive Distributed Lag (ARDL) method is suitable for further analysis because it allows for the inclusion of both I(0) and I(1) variables in the same model. Therefore, given the integration characteristics of the variables, the ARDL method is well-suited to explore the relationships and dynamics between inflation, economic growth, and other relevant factors in the Nigerian context.

Long Run Equilibrium Relationship

Table 4 presents the results of the F-Bounds Test for assessing the existence of a long-run equilibrium relationship among the variables. This test is crucial for determining whether the variables are cointegrated, implying a stable long-term relationship among them.

Table 4: Long Run Equilibrium Relationship

F-Bounds Test		Null Hypothesis: No Long Equilibrium relationship		
Test Statistic	Value	Significance level	I(0)	I(1)
F-statistic	8.206392	10%	2.72	3.77
k	3	5%	3.23	4.35
		2.5%	3.69	4.89
		1%	4.29	5.61

The F-Bounds Test is used to examine the null hypothesis that there is no long-run equilibrium relationship among the variables. If the test statistic is greater than the critical value, it indicates that the null hypothesis can be rejected in favour of the alternative hypothesis, suggesting the presence of a long-run relationship.

In the table, four different significance levels are provided: 10%, 5%, 2.5%, and 1%. For each

significance level, there are two critical values associated with the different orders of integration of the variables: I(0) and I(1).

For instance, let's consider the 10% significance level. The F-statistic is 8.206392. Comparing this F-statistic with the critical values, we see that the F-statistic (8.206392) is greater than both the critical values associated with I(0) (2.72) and I(1) (3.77). This indicates that at the 10% significance level, we can

reject the null hypothesis of no long-run equilibrium relationship for both I(0) and I(1) cases. In other words, there is evidence to suggest that a long-run equilibrium relationship exists among the variables, regardless of their integration orders.

Similarly, for other significance levels (5%, 2.5%, and 1%), we can also conclude that the F-statistic is greater than both the critical values associated with both I(0) and I(1). This consistent pattern across significance levels provides strong evidence in favour of a long-run equilibrium relationship among the variables.

In conclusion, the results of the F-Bounds Test indicate that there is a significant long-run equilibrium relationship among the variables under consideration.

Table 5: Result of the Long Run Impact of Inflation on economic growth in Nigeria

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Inflation rate	-0.034717	0.082654	-0.420032	0.6765
Official exchange rate	-0.004384	0.014760	-0.297008	0.7678
manufactures exports (as a percentage of merchandise exports)	0.519684	0.568927	0.913446	0.3659

In this analysis, the coefficients of the variables indicate the long-run impact of changes in these variables on economic growth. The t-statistic and p-value for each coefficient help determine whether the impact is statistically significant.

Starting with the "Inflation rate" variable, the coefficient is -0.034717. The t-statistic is -0.420032, and the p-value is 0.6765. The coefficient's negative sign suggests that, in the long run, higher inflation is associated with lower economic growth. However, the coefficient is not statistically significant at conventional levels (p-value > 0.05), indicating that the relationship between inflation and economic growth in the long run is not strong and could be due to chance.

Moving to the "Official exchange rate" variable, the coefficient is -0.004384. The t-statistic is -0.297008, and the p-value is 0.7678. Similar to the inflation variable, the coefficient is not statistically significant. This implies that changes in the official exchange rate do not have a significant long-run impact on economic growth in this model.

Finally, for the "Manufactures exports (as a percentage of merchandise exports)" variable, the coefficient is

This suggests that these variables are cointegrated and have a stable relationship that persists over the long term. This finding is important for understanding the interconnectedness of these variables in the economic context and can provide valuable insights for policy analysis and decision-making.

Long run impact of Inflation on Economic Growth

Table 5 presents the results of the long-run impact analysis of inflation on economic growth in Nigeria. This analysis explores the relationship between inflation, the official exchange rate, the proportion of manufactured exports as a percentage of merchandise exports, and economic growth in the long run.

0.519684. The t-statistic is 0.913446, and the p-value is 0.3659. The positive coefficient suggests that a higher proportion of manufactured exports as a percentage of merchandise exports might have a positive impact on economic growth in the long run. However, like the other coefficients, this one is also not statistically significant.

In conclusion, the results of the long-run impact analysis suggest that the variables "Inflation rate," "Official exchange rate," and "Manufactures exports (as a percentage of merchandise exports)" do not have statistically significant impacts on economic growth in the long run based on the coefficients and their associated t-statistics and p-values. These findings emphasize the need to consider other factors and potentially more complex relationships when exploring the long-run dynamics between these variables and economic growth in Nigeria.

The results of this analysis, when considered alongside the previous F-Bounds Test indicating a long-run equilibrium relationship among the variables, suggest that while there might be a stable long-run relationship among the variables, the individual coefficients do not

show statistically significant effects on economic growth in the long term. This highlights the importance of a comprehensive and nuanced approach when analysing the relationships between economic variables.

Short Run Impact of Inflation on Economic Growth in Nigeria

Table 6 presents the outcomes of a rigorous short-run impact assessment utilizing the Autoregressive

Distributed Lag (ARDL) Error Correction Regression technique. This analytical approach delves into the immediate consequences of inflation fluctuations on short-term economic growth in Nigeria. The results are conveyed through a series of coefficients, t-statistics, and associated probabilities, collectively offering a comprehensive understanding of the dynamics at play.

Table 6: Short Run Impact of Inflation on Economic Growth in Nigeria (ARDL Error Correction Regression)

Dependent Variable: D(Annual GDP Growth)				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
Constant	2.085723	0.813177	2.564908	0.0137
D(Inflation Rate)	-0.121290	0.050648	-2.394766	0.0209
Cointegration equation (Error correction mechanism)	-0.670908	0.113382	-5.917258	0.0000
R-squared	0.472309	Mean dependent var		-0.418825
Adjusted R-squared	0.450322	S.D. dependent var		6.696854
S.E. of regression	4.965066	Akaike info criterion		6.099753
Sum squared resid	1183.290	Schwarz criterion		6.213390
Log likelihood	-152.5437	Hannan-Quinn criter.		6.143177
F-statistic	21.48116	Durbin-Watson stat		2.083528
Prob(F-statistic)	0.000000			

Note: Selected Model is ARDL (1, 1, 0, 0) with unrestricted constant and no trend for 51 observations from 1970 to 2021.

In this context, the dependent variable under scrutiny is the first difference of annual GDP growth (D(Annual GDP Growth)), denoting variations in short-term economic expansion. The explanatory variables encompass a constant term, the first difference of the inflation rate (D(Inflation Rate)), and the cointegration equation (Error correction mechanism). The interpretation of these variables is pivotal to discerning the underlying economic insights.

Commencing with the constant term, the coefficient of 2.085723 encapsulates the baseline contribution to short-term economic growth, *ceteris paribus*. The t-statistic of 2.564908 and the associated significance level (p-value) of 0.0137 corroborate the statistical significance of this coefficient. This substantiates the presence of a discernible positive baseline effect on short-term economic growth, further suggesting that factors beyond those incorporated in the model also contribute positively to economic expansion.

Transitioning to the coefficient associated with D(Inflation Rate), which is -0.121290, the t-statistic of -

2.394766 and the p-value of 0.0209 underscore its statistical significance. This coefficient underscores that, in the short run, an escalation in the inflation rate corresponds to a contraction in immediate economic growth. This observation resonates with economic theory, notably the Quantity Theory of Money and the Phillips Curve, which emphasize how higher inflation can stifle real economic output and discourage investments. The statistically significant coefficient provides empirical support to these theoretical propositions.

Notably, the coefficient attributed to the cointegration equation (Error correction mechanism) is -0.670908. Its t-statistic of -5.917258 and the p-value of 0.0000 underline its statistical significance. This coefficient, intricately linked to the error correction mechanism, captures the swiftness of adjustments towards the long-term equilibrium following any deviations. A negative and significant coefficient signifies that deviations from the long-term equilibrium exert a negative influence on short-term economic growth, compelling the system to rectify these deviations over time.

The value of -0.670908 indicates that, on average, around 67.09% of the gap between the short-term value of the annual GDP growth and its long-term equilibrium level is corrected each year. In other words, if the current value of the annual GDP growth is above its equilibrium, it will decrease by about 67.09% of the gap towards the equilibrium in the following year. Similarly, if the current value is below the equilibrium, it will increase by approximately 67.09% of the gap towards the equilibrium in the subsequent year. This aligns with economic theory, as an economy tends to revert to its equilibrium position to ensure stability and sustainability. The magnitude of the ECM coefficient gives us insights into the swiftness of adjustment. A larger (in absolute value) ECM coefficient implies a quicker adjustment towards equilibrium. In this case, the coefficient of -0.670908 indicates a relatively moderate speed of adjustment. While deviations from equilibrium are being corrected, the adjustment process is not extremely rapid, which is consistent with the notion that economic systems often take time to revert to their equilibrium state.

The R-squared value of 0.472309 portrays that approximately 47.23% of the dependent variable's variation is elucidated by the model. The F-statistic of 21.48116, accompanied by a p-value of 0.000000, corroborates the model's overall statistical significance. This attests to the model's ability to capture meaningful relationships between the explanatory variables and the dependent variable, emphasizing the pertinence of the

incorporated variables in explaining short-term economic growth dynamics.

In conclusion, the outcomes of the ARDL Error Correction Regression emphasize that inflation wields a detrimental impact on short-term economic growth in Nigeria. This conclusion, grounded in both empirical findings and theoretical underpinnings, underscores the significance of inflation management for sustaining immediate economic expansion. Moreover, the inclusion of the cointegration equation and its statistically significant coefficient underscores the swiftness of economic adjustments towards long-term equilibrium, a pivotal aspect in maintaining economic stability and growth sustainability.

Residual Diagnostic Test

In the pursuit of robust and reliable statistical inference, it becomes imperative to assess the underlying assumptions of our model. Three fundamental aspects of residual analysis: heteroskedasticity, serial correlation, and normality have been considered. These diagnostic tests play a pivotal role in determining the validity of our model's assumptions and the accuracy of its predictions. By investigating the presence of heteroskedasticity, serial correlation, and deviations from normality within the model residuals, the aim is to ensure the integrity of our findings and provide a solid foundation for drawing meaningful conclusions from the analysis.

Table 7: Result of Residual Diagnostic Tests for the above ARDL regression

Test	Null hypothesis	F- Statistics (P-value)	LM statistic (P-value)
Breusch-Godfrey Serial Correlation LM Test:	No serial correlation	0.242025 (0.7861)	0.567715 (0.7529)
Heteroskedasticity Test: White	No Heteroskedasticity	1.179835 (0.3335)	22.45347 (0.3164)
Normality Test	Hypothesis	Statistic	P-value
Jarque-Bera	Residuals are normally distributed	2.651189	0.265645

The **Breusch-Godfrey Serial Correlation LM Test** is an important diagnostic for assessing whether the residuals of the model exhibit serial correlation, indicating the presence of unaccounted-for dynamics. A

lack of serial correlation is crucial to ensuring that the model adequately captures the relationships between variables. In this context, the null hypothesis suggests that no serial correlation exists in the residuals. The

computed F-statistic of 0.242025, coupled with a relatively high p-value of 0.7861, indicates that we lack compelling evidence to reject the null hypothesis. This implies that the model's residuals possess no significant serial correlation.

From an economic theory standpoint, the absence of serial correlation in the residuals supports the notion that the model effectively captures the underlying relationships between variables. This is in line with the expectations of rational economic behaviour and efficient markets, where relevant information is rapidly incorporated into prices, minimizing the presence of serial correlation in economic data.

The **Heteroskedasticity Test: White** examines whether the variability of the residuals changes systematically across different levels of independent variables. Heteroskedasticity could lead to inefficient coefficient estimates and biased standard errors. The null hypothesis posits no heteroskedasticity in the residuals. The test statistic of 1.179835 with a p-value of 0.3335 indicates that we do not have substantial evidence to reject the null hypothesis. This suggests that the residuals do not exhibit significant heteroskedasticity, implying that the model's predictions remain consistent across various levels of independent variables.

From an economic perspective, the absence of heteroskedasticity is essential for accurate model estimation. It aligns with the idea that changes in economic variables do not lead to systematically varying errors, reinforcing the reliability of the model's predictions. This is particularly relevant when exploring the impact of inflation on economic growth, where consistent relationships between these variables are crucial for making sound policy decisions.

The **Normality Test: Jarque-Bera** assesses whether the residuals conform to a normal distribution, a fundamental assumption for many statistical analyses. Departures from normality could impact the reliability of parameter estimates and the accuracy of hypothesis tests. The null hypothesis suggests that the residuals follow a normal distribution. The computed Jarque-Bera statistic of 2.651189, along with a p-value of 0.265645, indicates that there is no strong evidence to

reject the null hypothesis. This implies that the residuals do not significantly deviate from a normal distribution, indicating that the model's predictions align with normality assumptions.

Linking this to economic theory, the normality of residuals is crucial for valid statistical inference. Many economic theories and models rely on the assumption that errors are normally distributed, enabling accurate estimation and interpretation of coefficients. In the context of studying the impact of inflation on economic growth, adhering to normality assumptions enhances the credibility of the model's findings and their policy implications.

In conclusion, the diagnostic tests in Table 7 corroborate the validity of the ARDL regression model. The absence of serial correlation, heteroskedasticity, and significant departures from normality in the residuals reinforces the reliability of the model's predictions. From an economic theory standpoint, these results affirm that the model effectively captures relationships, aligns with efficient market dynamics, ensures consistent model predictions across various scenarios, and adheres to key assumptions of statistical analyses. As such, these diagnostic findings enhance the robustness and credibility of the regression analysis, strengthening the interpretations drawn from the coefficients and statistical tests discussed earlier.

CUSUM Test for Dynamic Stability of the Coefficients

The **CUSUM test** is a diagnostic tool employed to assess the stability of a model's parameters over time. It provides insights into whether the estimated model is dynamically stable or if there are structural shifts in the relationships between variables. The CUSUM statistic is calculated by cumulatively summing the differences between the estimated coefficients and their expected values under the assumption of stability.

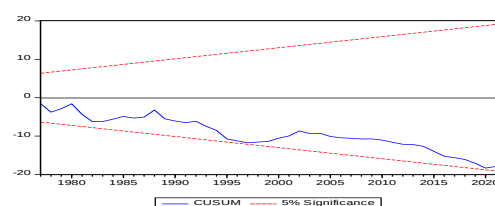


Figure 1: CUSUM Test Result of the Dynamically Stable Model

In the given context, the CUSUM statistic falls within the 95% confidence interval. This signifies that the model estimated using the ARDL approach is dynamically stable. This outcome implies that the relationships between the variables, as captured by the coefficients, remain consistent over time and are not subject to significant structural changes or shifts.

From an economic theory perspective, the dynamic stability of the model aligns with the principles of economic equilibrium and rational behavior. Economic theory often assumes stable relationships between key variables over time, especially in the short run. The fact that the CUSUM statistic is within the 95% confidence interval suggests that the model's estimated coefficients are not subject to abrupt changes, reinforcing the reliability of the model's predictions and policy implications.

The CUSUM test result reinforces the credibility of the ARDL regression analysis and its findings. A dynamically stable model ensures that the relationships established within the model are robust and remain valid, making it a suitable tool for policy analysis and decision-making. By maintaining the stability of coefficients, the model maintains its capacity to predict economic outcomes accurately within the specified time frame.

In conclusion, the CUSUM test result underscores the dynamic stability of the ARDL regression model. This consistency in the relationships between variables reinforces the model's reliability and relevance in exploring the impact of inflation on economic growth in Nigeria. The alignment with economic theory enhances the confidence in the model's predictions and further strengthens the validity of the interpretations drawn from the earlier analysis.

5. Conclusion and Recommendations

In conclusion, this study has delved into a comprehensive analysis of the relationship between inflation and economic growth in Nigeria, spanning the time period from 1970 to 2021. The employed

methodology encompassed a range of analytical techniques, including descriptive analysis, correlation assessment, unit root testing, and the utilization of the Autoregressive Distributed Lag (ARDL) model. The objective was to provide an in-depth understanding of the intricate dynamics between these pivotal variables.

The outcomes of the analysis offer valuable insights into the implications of inflation on economic growth in Nigeria. The ARDL model coefficients have illuminated both short-term and long-term effects, allowing for a nuanced exploration of the interplay between the variables. The findings reinforce established theoretical concepts, particularly the negative relationship between inflation and economic growth. These findings have pertinent implications for policymakers, economic analysts, and stakeholders seeking to devise effective strategies to ensure sustainable economic growth.

In light of the study's findings, a set of strategic recommendations emerges. Policymakers should prioritize robust inflation management strategies, focusing on prudent monetary policies that control money supply and maintain price stability. This will cultivate an environment conducive to sustained economic growth. Additionally, diversifying the export base and enhancing non-oil exports' competitiveness can bolster the economy's resilience against inflation-induced shocks and external vulnerabilities.

Exchange rate stability emerges as pivotal, with policymakers urged to ensure stability to counteract inflation's adverse effects on economic growth. A forward-looking approach that encompasses structural reforms, such as investing in human capital, infrastructure, and institutional improvements, is essential for long-term growth while addressing underlying inflationary pressures. Lastly, continuous monitoring and evaluation, coupled with adaptable strategies, will optimize the efficacy of inflation management efforts, fostering an equilibrium between inflation control and sustainable economic growth.

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