



AMERICAN JOURNAL OF ECONOMICS AND BUSINESS INNOVATION (AJEBI)

ISSN: 2831-5588 (ONLINE), 2832-4862 (PRINT)

VOLUME 2 ISSUE 3 (2023)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

Nigeria's Inflation in the Era of Liquefied Natural Gas Exports: Insights from 2000-2021 ARDL Cointegration Analysis

Kufre Jerome Udoudo^{1*}, Koyejo Oduola², Ijeoma Emele Kalu³

Article Information

Received: October 25, 2023

Accepted: November 28, 2023

Published: December 01, 2023

Keywords

*LNG Exports, Inflation Rate,
ARDL Model, Nigeria*

ABSTRACT

This paper presents a comprehensive analysis of the impact of Liquefied Natural Gas (LNG) exports on inflation in Nigeria over the period 2000–2021. Utilizing the Autoregressive Distributed Lag (ARDL) bound co-integration approach, the study investigated both long-term and short-term relationships between LNG exports, natural gas prices, crude oil prices, and inflation in Nigeria. The Augmented Dickey-Fuller (ADF) unit root test indicated a mixed order of integration for the variables, suggesting the appropriateness of the ARDL cointegration method. The empirical results revealed the presence of a long-term relationship among these factors. In the long term, LNG exports, natural gas prices, and crude oil prices exhibited varying effects on inflation. While natural gas prices and crude oil prices had a statistically significant adverse impact on inflation at a 5% significance level, LNG exports did not show statistical significance. In the short term, LNG exports displayed both a negative and statistically insignificant influence, whereas crude oil prices had a positive and statistically significant effect. Natural gas prices, on the other hand, did not impact inflation significantly in the short term. The Granger causality tests revealed that there is no causal relationship between LNG exports and inflation in Nigeria. Although the influence of LNG exports on inflation lacks statistical significance, it is recommended that the government continue its commitment to the LNG sector, focusing on infrastructure and technology investments to enhance competitiveness and efficiency. Expanding into new markets and diversifying the LNG portfolio will ensure a steady revenue stream while prioritising economic diversification beyond the oil and gas sector.

INTRODUCTION

The shift towards achieving net-zero emissions and sustainability represents a significant and transformative change in the global energy sector. Liquefied natural gas (LNG) plays a vital role in facilitating the transition from traditional fossil fuels to renewable energy sources due to its cleaner combustion properties. The dynamics of LNG exports are crucial for energy markets and economic stability, particularly in emerging economies. The transition is motivated by the objective of achieving sustainability and reducing carbon emissions.

According to Udoudo *et al.* (2023), Nigeria has the most substantial natural gas reserves in Africa, amounting to around 200 trillion cubic feet, and has emerged as a notable participant in the market for LNG exports. The growth of Nigeria's LNG exports presents a complex situation with various dimensions. On one hand, it provides the country with a chance to utilise its abundant natural resources to foster economic progress. However, on the other hand, it also presents certain difficulties and uncertainties, particularly concerning its potential influence on domestic inflation. The link between LNG exports and inflation in Nigeria exemplifies a bigger global issue in which natural gas exports have the capacity to impact price levels and economic stability in both exporting and importing nations. Nigeria, a major participant in the LNG export industry, confronts a vital economic quandary: the necessity to evaluate the

potential consequences of domestic inflation as LNG exports grow. Inflation, defined as a sustained increase in the general price level of goods and services over time, is a critical macroeconomic indicator that affects the purchasing power of individuals and the overall stability of an economy (Bassey & Ekong, 2019). Understanding the relationship between LNG exports and inflation in Nigeria is crucial for policymakers, economists, and investors, as it helps shape economic policies, forecast inflationary trends, and manage risks associated with the energy sector.

The study employs the Autoregressive Distributed Lag (ARDL) methodology to examine the correlation between LNG exports and inflation in Nigeria. The objective of this study is to examine the impact of LNG exports on Nigeria's inflationary trends and establish a causal relationship between LNG exports and the inflation rate in Nigeria. It is essential to comprehend the effects of LNG exports on domestic inflation for policymaking and energy market analysis. This research is significant in the current global discourse on energy systems and their impact on macroeconomic factors. Studying the effects of LNG exports on inflation is crucial for comprehending the intricate relationship between energy transitions, economic stability, and achieving a sustainable, net-zero carbon future. To achieve the aforementioned objectives, the remaining parts of this study will explore the literature review, methodology, findings and discussion, and

¹ Emerald Energy Institute, University of Port Harcourt, Nigeria

² Department of Chemical Engineering, University of Port Harcourt, Nigeria

³ Department of Economics, University of Port Harcourt, Nigeria

* Corresponding author's e-mail: kufrej@yahoo.com

conclusion/policy implications about liquefied natural gas (LNG) exports and inflation in Nigeria.

LITERATURE REVIEW

Agu and Nyatanga (2021) explored how projected oil prices affect inflation in Nigeria in response to shocks. The research examined the factors' short- and long-term impacts using Autoregressive Distributed lag (ARDL) and bound testing cointegration. The estimated oil price has a considerable and beneficial influence on Nigerian inflation in the long and near term. Contrary to predictions, the interest rate has a positive and considerable long-term influence on inflation. The government should diversify its resource base and depend less on crude oil, which is more subject to oil price shocks, to reduce Nigeria's inflation. Second, to reduce inflation and boost investment, the monetary authorities may need to implement an effective interest rate strategy. However, a study conducted by Agu and Nyatanga (2020) found that fluctuations in oil prices have a substantial influence on Nigeria's economic growth. The study employed the Hamilton Index and Structural Vector Autoregressive (SVAR) framework to examine the impact of abrupt oil price fluctuations on macroeconomic indicators. The study revealed that negative oil price movements exert a more pronounced impact on economic growth compared to other types of oil price fluctuations. The transmission channel for oil price movement in Nigeria is influenced by exogenously determined shocks that affect the exchange rate, money supply, and inflation rate. The study suggests implementing proactive monetary control measures and optimising interest rate policies as a means to foster economic growth in Nigeria.

Adeleye *et al.* (2019) investigated the determinants of inflationary pressure in Nigeria, specifically focusing on the influence of internal and external factors. External factors, such as exchange rates, imported inflation, and openness, positively influence inflation. Conversely, internal factors, such as government expenditures, net food exports, and lending interest rates, have a dampening effect on inflation. The study revealed that imported inflation leads to a deviation of approximately 33% in the initial five periods, resulting in a cumulative average deviation in inflation exceeding 100%. The findings hold important policy implications for the economic and financial stability of Nigeria. External factors, such as exchange rates, imported inflation, and openness, positively influence inflation. Conversely, internal factors, such as government expenditures, net food exports, and lending interest rates, have a dampening effect on inflation.

In their research on the correlation between energy consumption and economic development in Ghana, Iyke and Odhaimbo (2014) used a trivariate autoregressive distributed lag (ARDL) framework, including the period from 1971 to 2012. The results of their study indicated that, at a significance level of 10 per cent, there exists

a statistically significant relationship between energy consumption (namely, electricity usage) and inflation within the economy of Ghana. The researchers noted that an excessive power demand has the potential to generate inflationary pressures. Given the aforementioned facts, the authors underscored the need to develop suitable monetary policies to proficiently administer and alleviate the prospective inflationary repercussions stemming from escalating power demands in the long run. In a separate study, Iyke (2014) examined a comparable association within the context of Nigeria, focusing on a dynamic causal connection spanning from 1971 to 2012. The results suggested a causal association between inflation and electrical energy use, at least in the near term, as proved by the Granger causality test. The research emphasised the need to implement strong monetary policies to address the increasing trajectory of inflation, which has the potential to negatively affect economic expansion.

Tukur *et al.* (2012) conducted a comparative study on the transportation of natural gas in Nigeria, specifically examining the use of liquefied natural gas (LNG) and pipelines. The findings of their study indicate that LNG is a more competitive as well as sustainable choice compared to pipelines. The study conducted a comparison between the capital cost of six LNG trains and the Trans-Saharan Gas Pipeline (TSGP) systems, which are used for exporting natural gas from Nigeria, with a total cost of \$13 billion. The study employed primary and secondary data collection methods. The study estimated that the construction of TSGP would start in 2015 with a projected cost of \$19.383 billion, and it would be finished by 2020 with a total cost of \$31.943 billion. They recommended prioritising the construction of additional LNG plants in Nigeria due to their higher competitiveness in the gas market, rather than placing emphasis on the proposed trans-Saharan gas pipeline.

Ilmas' study investigates the influence of inflation and exchange rate on exports in five ASEAN countries throughout 2010 to 2020. The study, which took place in Indonesia, Singapore, Thailand, Malaysia, and the Philippines, revealed that inflation and exchange rates exert a notable adverse impact on exports. The study highlights the importance of incorporating macroeconomic factors into international trade, as rising inflation or exchange rates can result in a decline in exports. Hence, comprehending these factors is imperative for the efficient management of international trade.

Anagaw's 2023 study on Ethiopia's economic growth highlights the importance of maintaining price stability and sustainable growth. High inflation levels, particularly in low-income and unemployed countries, can negatively impact long-term growth potential. Inflation leads to increased transaction costs in the money market and is a significant source of economic distortions, resulting in inefficiencies in employment and output. Therefore, achieving sustainable economic growth and maintaining

price stability are crucial objectives for macroeconomic policy in developing countries like Ethiopia.

Using ARDL methodology, Aliraqi's (2022) study investigated the inflation-export nexus in Sudan from 1990 to 2020. The study demonstrated a negative relationship between inflation and exports, with GDP being the most influential factor. The exchange rate had no significant impact in both the short and long term. The study proposes implementing an inflation control policy to promote export development and facilitate the transition of Sudan's economy towards productive initiatives. Targeting inflation can enhance export diversification and bolster the value chain of products.

Ahmed *et al.* (2018) examined the Pakistani economy to look into the correlation between inflation and the trade of exports and imports. The study utilised data from the CPI, imports, and exports, covering the period from July 2001 to June 2017. The analysis found that a 1% rise in both exports and imports corresponded to a 0.63% hike in inflation for exports and a 0.57% spike in inflation for imports. The long-run equilibrium adjustment level of 1.18% suggests that annual adjustments have been made to correct deviations in the inflation rate. Exports had the greatest impact on inflation, but the study did not find evidence to support the idea that monthly fluctuations in exports and imports do not lead to variations in inflation in the Pakistani economy.

Kubo (2011) investigated the effects of exported natural gas on Myanmar's fiscal balance as well as inflation. The study reveals that although natural gas exports have generated substantial foreign currency revenue for the government, their impact on reducing the fiscal deficit and inflation remains uncertain. This is attributed to the presence of a dual exchange rate system in the country, resulting in an undervaluation of revenue when expressed in the local currency. The study proposes that loosening regulations on foreign exchange could be beneficial for utilising revenue to combat inflation.

Anggoro (2022) examined the impact of oil and gas exports, imports, and inflation on the Indonesian economy. The analysis employed secondary data and the Vector Error Correction Approach Model. Indonesia's economy experiences significant growth in both the short and long term due to the exportation of oil and gas. Oil and gas imports have a detrimental impact on both long-term and short-term economic growth. Inflation has adverse effects on both the short-term and long-term economic development of Indonesia. Similarly, Inflation's impact on Surabaya's non-oil and gas exports via Tanjung Perak Port was analysed by Purwoko (2021). The information came from the Bank of Indonesia's Annual Report and the Harbormaster of the Port of Surabaya. The study's data was evaluated using a variety of techniques, including descriptive statistics, traditional assumption tests, and basic linear regression. The research found that inflation boosted non-oil and gas exports via the Port of Tanjung Perak Surabaya significantly from 2017 to 2019.

Kiganda *et al.* (2017) found a significant correlation

between total exports and inflation in Kenya. The analysis utilised autoregressive (VAR) and monthly time series data obtained from the Central Bank of Kenya, covering the period from January 2005 to December 2015. The findings indicate a significant and positive correlation between inflation and total exports in the long run. The coefficient of 1.39 is statistically significant at a 5% level of significance. In the short term, previous total export values had a negative impact on inflation, indicating a one-way causal relationship from total exports to inflation. The study suggests that the Kenyan government should implement trade policies aimed at decreasing total exports to alleviate the shortage of these products in the domestic market. However, Albinia and Sofyan (2023) used information from Badan Pusat Statistik and Bank Indonesia to examine the impact of inflation and exchange value on the worth of non-oil and gas exports from Indonesia between 2015 and 2021. Using Eviews version 12, a multiple linear regression analysis was performed. The study's findings suggest that the export value of non-oil and petrol is impacted by inflation and the exchange rate. Although the value of non-oil and gas exports is unaffected by the exchange rate, it is impacted by the inflation rate.

Arora and Cai (2014) found that the shale gas boom in the United States has the potential to have global impacts by increasing natural gas exports. The study observed a positive correlation between the increase in U.S. natural gas exports and higher levels of global economic activity during the simulation period of 2014-2035. The United States experiences greater advantages when export levels are linked to natural gas production, whereas the economic consequences for other natural gas importers and exporters can vary depending on export levels. The impacts on natural gas prices, consumption, and production exhibit variability based on different scenarios and model parameter values.

In their study on the Indian economy over the period spanning from 1995 to 2020, Jacob *et al.* (2021) found that the exchange rate and inflation have a significant impact on exports. The study employed econometric techniques such as the ADF Test, Johansen's Co-integration Maximum Likelihood Test, and VECM to determine the impact of these variables on export performance, revealing a positive relationship. The findings have policy implications for effectively managing inflation and the exchange rate system to stimulate exports and attain broader economic growth. This study highlights the significance of exports in the Indian economy. Likewise, Sahoo and Sethi (2018) conducted a study examining the correlation between inflation, exports, imports, and foreign direct investment (FDI) in India throughout 1975 to 2017. The researchers employed the Johansen co-integration test, variance decomposition analysis, and impulse response function analysis to examine the dynamic relationship. The findings indicate that exports exert a stronger impact on inflation compared to imports and foreign direct investment (FDI). There were no causal

relationships observed between inflation and foreign direct investment (FDI) during the study period. The decrease in exports in India indicates the current state of the economy, highlighting the necessity for a competitive atmosphere and incentives to encourage local industries to enhance their competitiveness.

Purusa and Istiqomah (2018) conducted a study to analyse the effects of foreign direct investment (FDI), crude oil price, and inflation on exports in five Southeast Asian countries (Indonesia, Malaysia, Philippines, Thailand, and Vietnam) from 2000 to 2015. The results indicate a positive relationship between foreign direct investment (FDI) and crude oil prices with exports, while inflation has a negative impact on exports. This study proposes that the implementation of streamlined bureaucratic processes, along with the adoption of alternative energy sources and innovative production techniques, can enhance productivity levels in these nations. Consequently, this would contribute to the overall prosperity of the ASEAN Economic Community. Inflation's adverse effects on exports underscore the necessity for enhanced efficiency and productivity.

Bernstein *et al.* (2016) conducted a study on the exports of liquefied natural gas (LNG) from the United States. They employed a global natural market model to analyse different scenarios, including the EMF 31 scenario. The study revealed that exports are sensitive to market conditions and lack competitiveness in the short run. However, during periods of demand or supply shocks, they exhibit competitive behaviour. The study's findings suggest that restricting U.S. LNG exports contradicts the simulated uncertainties and should be determined by market forces. However, According to Baron *et al.* (2015), the United States has the potential to fulfil its natural gas demand domestically and at affordable rates, which could lead to the country becoming a net exporter. The Natural Gas Act mandates that the Department of Energy (DOE) assesses whether the exportation of natural gas aligns with the public interest. The Department of Energy (DOE) commissioned a study conducted by NERA to assess the economic effects of different liquefied natural gas (LNG) export scenarios, considering uncertainties related to supply and demand. A subsequent study employed revised assumptions and an improved modelling framework. Also, Moryadee *et al.* (2014) conducted a study to examine the effects of U.S. liquefied natural gas (LNG) exports on both domestic and global markets. The researchers utilised the World Gas Model for their analysis. The study demonstrates that U.S. domestic natural gas prices rose by 10.9% as a result of 123 billion cubic metres of LNG exports, whereas natural gas prices in Europe and Asia experienced substantial decreases. Cheaper U.S. liquefied natural gas (LNG) can effectively compete in the European and Asian gas markets. It displaces suppliers that offer higher-priced gas, resulting in a reduction of natural gas flows to transit countries by more than 50% in the European pipeline scenario. The authors, however, did not take into account

the effect that exporting LNG may have on the rate of inflation in the United States. In the same year, A study by Medlock *et al.* (2014) analysed the international gas industry and the role of the United States in international politics. Despite widespread assumptions that the United States would increase its LNG imports as a result of its upstream renaissance in shale gas exploration, the country has instead increased its LNG exports. Maximising the United States' growing global strength is a contentious topic. To reduce Europe's reliance on Russian natural gas, the report contends that boosting LNG exports from the United States would not be as beneficial as encouraging global gas market liberalisation.

Liu *et al.* (2020) conducted a comprehensive analysis of Australia's LNG export performance by employing an enhanced Constant Market Share (CMS) model and utilising United Nations Comtrade LNG trade data. The study focused on four distinct sub-periods from 1989 to 2017. The analysis indicates that, in addition to the overall negative impact of the Market Effect and the positive impact of the Adaptation Effect, the Competitiveness Effect has been the primary driver of Australia's LNG export performance in the past thirty years, particularly in its established LNG markets. The Competitiveness Effect in Australia is further analysed to measure the direct competition between Australia and its rivals. The findings indicate that the future of Australian LNG exports is likely to encounter difficulties. This study proposes that Australian LNG exporters should adapt to emerging competitors, broaden their current market reach, and anticipate the consequences of alterations in the pricing mechanism.

In their research, Kompas and Che (2016) established an Asia-Pacific Gas Model (APGM) based on a structural, stochastic, along with an optimising framework to estimate LNG commerce in the area. Based on current socioeconomic circumstances, Asia-Pacific LNG imports are predicted to rise 49.1% in 2020 and 95.7% in 2030 compared to 2013. LNG commerce is expected to reach US\$127.2 billion in 2020 and US\$199.0 billion in 2030. Emerging and major importers (China and India) and new supplies from Australia and the US will fuel LNG trade growth. Changes in predicted oil prices, pricing systems, economic development, energy regulations, and unforeseen geopolitical-economic events affect the model's projected outcomes. Earlier, Zhang *et al.* (2018) conducted a study on the global LNG trade from 2004 to 2015. Their findings indicated that economic demand, pipeline natural gas, import prices, and investment in research and development were significant factors influencing the trade. The global model utilised gravity models and indicated that the Asian market exhibited greater sensitivity to these factors. The study's findings have significant implications for policymakers, especially in the context of the Asian LNG trade.

Existing studies primarily focus on the impact of crude oil prices on inflation in Nigeria and other countries. Additionally, some studies examine the relationship

between inflation and energy consumption within and outside of Nigeria. Previous research has not examined the effects of LNG exports on inflation in Nigeria. Previous studies have not extensively examined the relationship between natural gas exports and inflation in Nigeria. Previous reviews have not addressed the potential impact of oil and natural gas prices on inflation in Nigeria. This study aimed to address the aforementioned gap by presenting empirical evidence on the variables under investigation.

METHODOLOGY

The purpose of this research was to assess the effects of liquefied natural gas (LNG) exports on the inflation rate of Nigeria. The data used for the study was annual data but disaggregated into a biannual data set and sourced from reputable databases such as World Development Indicators (WDI), Statista, BP statistics, and the U.S. Energy Information Administration (EIA). The data were obtained throughout the time frame spanning from 2000 to 2021, taking into account the data availability. The variables used for study measurement include Nigeria's liquefied natural gas export (LNG), Brent crude price (COP), Henry Hub natural gas price (NGP), and Nigeria's rate of inflation (INR). The present research used the Autoregressive Distributed Lag (ARDL) bound technique, as originally proposed by Pesaran *et al.* (2001). One key benefit of this methodology is in its utilisation and consideration of the regressor's stationarity at the initial difference of $I(1)$, $I(0)$, or a combination of both. The ARDL technique effectively addresses endogeneity concerns as well. This methodology efficiently assesses the variables, even in cases when they possess distinct optimum lags. The Johansen approach requires a high sample size to analyse cointegration, however, the ARDL test may be used with a small sample size (Javed & Husain, 2020). The ARDL technique involves three key steps: (i) examining the stationarity of variables, (ii) assessing the presence of cointegration, and (iii) analysing causality.

Model Specification

The model used in this investigation is represented by Equation (1) as shown below.

$$INR = \beta_0 + \beta_1 LLNG + \beta_2 LNGP + \beta_3 LCOP + \epsilon_t \quad (1)$$

Where: INR refers to the inflation rate, LLNG represents the natural logarithm of LNG exports, LNGP stands for the natural logarithm of natural gas price, COP denotes the natural logarithm of crude oil price, and ϵ_t indicates the error term in the equation.

Stationarity

The initial step in the ARDL analysis is to examine the stationarity of the series by conducting a unit root test analysis, following the presentation of descriptive statistics. The unit root test is a preliminary test employed to assess the stationarity of time series data, aiming to prevent spurious regression. Unit root analysis involves conducting various tests, such as the augmented Dickey-Fuller (ADF), Kwiatkowski–Phillips–Schmidt–Shin

(KPSS), and Phillips–Perron (PP) tests, among others (Menegaki, 2019). In this study, the ADF unit root test was employed.

Cointegration

For the multivariate model of Equation 1, the given ARDL bound unrestricted error correction model (UECM) is shown below in Equation (2).

$$\Delta INR_t = \beta_0 + \sum_{i=1}^p \beta_1 \Delta INR_{(t-1)} + \sum_{i=0}^{q1} \beta_2 \Delta LLNG_{(t-1)} + \sum_{i=0}^{q2} \beta_3 \Delta LNGP_{(t-1)} + \sum_{i=0}^{q3} \beta_4 \Delta LCOP_{(t-1)} + \gamma_1 INR_{(t-1)} + \gamma_2 LLNG_{(t-1)} + \gamma_3 LCOP_{(t-1)} + \gamma_4 LNGP_{(t-1)} + \epsilon_t \quad (2)$$

Here, Δ is used to present the operator difference, β_0 is the intercept, all β_{1-4} represent coefficients of the short-run dynamics, γ_{1-4} represents the long-run coefficients, p represents the best lag order of the dependent variable, and q represents the best lag order of the independent variable.

Once the presence of cointegration is established in Equations (2), the subsequent step involves estimating the long-run and short-run models, from which both long-run and short-run elasticities may be determined. The formulation of the null and alternative hypotheses in the context of cointegration in the ARDL bounds test technique is as follows:

“H0: $\gamma_1 = \gamma_2 = \gamma_3 = \gamma_4 = 0$ (there is no co-integration)”

“H1: $\gamma_1 \neq \gamma_2 \neq \gamma_3 \neq \gamma_4 \neq 0$ (there is co-integration)”

Cointegration exists when the null hypothesis is rejected.

According to Pesaran *et al.* (2001), the null hypothesis is not rejected when the calculated F-statistics value is less than the lower limit value $I(0)$, indicating that no cointegration occurs between the variables. The converse is true if the calculated F-statistic is larger than the upper limit value $I(1)$; this indicates a long-run relationship and cointegration among the variables under consideration. The results of the test are inconclusive if the estimated F-statistics are between the lower and upper limit values. Once cointegration is detected among the variables, the subsequent step involves estimating the long-run coefficients. Equation (3) presents the ARDL model for the long-run coefficient estimation.

$$INR_t = \beta_{01} + \sum_{i=1}^p \beta_{1i} INR_{(t-1)} + \sum_{i=0}^{q1} \beta_{2i} LLNG_{(t-1)} + \sum_{i=0}^{q2} \beta_{3i} LNGP_{(t-1)} + \sum_{i=0}^{q3} \beta_{4i} LCOP_{(t-1)} + \epsilon_t \quad (3)$$

The final step in the ARDL bound cointegration method involves estimating the short-run coefficient. When cointegration is present, equation (4) represents the establishment of the error correction mechanism (ECM).

$$\Delta INR_t = \beta_{01} + \sum_{i=1}^p \beta_{1i} \Delta INR_{(t-1)} + \sum_{i=0}^{q1} \beta_{2i} \Delta LLNG_{(t-1)} + \sum_{i=0}^{q2} \beta_{3i} \Delta LNGP_{(t-1)} + \sum_{i=0}^{q3} \beta_{4i} \Delta LCOP_{(t-1)} + \lambda ECT_{(t-1)} + \epsilon_t \quad (4)$$

Here, λ represents the speed of adjustment coefficient and it should be statistically significant, less than one, and have a negative sign., ECT shows the Error correction term.

Diagnostic Tests

Robustness is a necessary characteristic for a model to be considered trustworthy. Diagnostic tests will be

conducted to validate the robustness of the estimated ARDL model. The diagnostic tests employed in this study include the Breusch Godfrey serial correlation LM test, the Breusch-Pagan Godfrey Heteroskedasticity test, the histogram normality test, the Ramsey RESET test, and the CUSUM and CUSUM of Squared test.

Causality

The examination of causality is an additional stage within the study of the autoregressive distributed lag (ARDL) model. This procedure is deemed essential in cases when variables exhibit cointegration. Cointegration necessitates the presence of a causal relationship, although without indicating the specific direction of causation. Therefore, it is necessary to do more investigation on causation (Menegaki, 2019). According to Granger (1988), the identification of cointegration may indicate a causal relationship between variables. Consequently, this

research utilises the Granger causality method to examine the causal relationships among the variables.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 1 displays the descriptive statistics of the dataset. The average inflation rate is 6.171591, with the highest and lowest recorded rates being 9.806875 and 0.851875, respectively. The maximum value of LNG exports is 2.677161, whereas the minimum value is 1.020651. The mean value of LNG exports during the specified period is 2.244379. The highest possible price of natural gas was 1.530259, the lowest value was -0.070557, and the mean price was 0.708675. The average price of crude oil was 3.356965, with a maximum of 4.054217 and a minimum of 2.486000. The descriptive statistic table displays the values of Kurtosis, Skewness, Jarque-Bera, and other parameters for the variables.

Table 1: Descriptive Statistics

	INR	LLNG	LNGP	LCOP
Mean	6.171591	2.243379	0.708675	3.356965
Median	6.247813	2.443149	0.694079	3.400700
Maximum	9.806875	2.677161	1.530259	4.054217
Minimum	0.851875	1.020651	-0.070557	2.486000
Std. Dev.	1.916766	0.471463	0.406584	0.481371
Skewness	-0.414699	-1.134865	0.351119	-0.326850
Kurtosis	3.159207	3.053467	2.33798	2.053623
Jarque-Bera	1.307621	9.449971	1.707581	2.425416
Probability	0.52006	0.008871	0.425798	0.297391
Sum	271.55	98.70867	31.18171	147.7065
Sum Sq. Dev.	157.9817	9.557929	7.108355	9.963894
Observations	44	44	44	44

Source: Author's computation using Eviews 10

Unit Root Test

The unit root test result is shown in Table 2. The results reveal a mixed series (I(0) and I(1)). The use of an ARDL model was based on the outcome of the unit root test in this research. This approach is capable of effectively modelling mixed series, as shown by its use in previous studies conducted by Agu and Nyatanga (2021) and Javed and Husain (2020). Subsequently, the study used the ARDL bounds cointegration technique to assess the co-

integrating properties of the model. The findings from the bound test conducted and shown in Table 3 indicate the existence of a long-term relationship between LLNG, LNGP, LCOP, and INR. The findings indicate that the F-statistic of 8.775531 surpassed the critical values for both I(0) and I(1) at all levels of significance. Additionally, this test provides a satisfactory condition for the use of the autoregressive distributed lag (ARDL) estimation approach.

Table 2: Unit Root Test Result

Variable	Level		First difference		Integration degree
	t-statistic	p-value	t-statistic	p-value	
INR	-2.288961	0.1808	-3.515143	0.0127	I(1)
LLNG	-4.339716	0.0015	-1.376465	0.5828	I(0)
LNGP	-1.43085	0.5579	-4.426946	0.0011	I(1)
LCOP	-2.528888	0.1161	-4.322646	0.0014	I(1)

Source: Author's computation using Eviews 10

Table 3: F-bound Test Result

F-Bounds Test				
Null Hypothesis: No levels relationship				
Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	8.775531	Asymptotic: n=1000		
		10%	2.37	3.2
k	3	5%	2.79	3.67
		2.50%	3.15	4.08
		1%	3.65	4.66

Source: Author's computation using Eviews 10

Long Run and Short Run Estimates

Following the establishment of a co-integration connection among the variables, the long-run model specified in Equation (3) was estimated to get the long-run coefficients, which are shown in Table 4. The findings reveal that the impact of LLNG on inflation in Nigeria is statistically insignificant and negative. The coefficient value of -0.513653 suggests that a one per cent change in LNG exports is associated with a -0.51% change in the inflation rate. However, it is important to note that this effect is not statistically significant. This finding contradicts the results reported by Kiganda *et al.* (2017) regarding the correlation between exports and inflation in Kenya. The statistical analysis indicates that the variable representing

the value of LNGP exhibits a negative and significant relationship at a 5% level of significance. The coefficient estimate for this variable is -1.645497, suggesting that an increase in natural gas price is associated with a decrease in inflation by around 1.65%. The impact of LCOP is significant but with a negative effect on the inflation rate. This observation indicates that a rise in crude oil prices leads to about a 2.0% reduction in the inflation rate inside Nigeria. The obtained result aligns with the research conducted by Agu and Nyatanga (2021) about the impact of oil prices on inflation in Nigeria in the face of external disturbances.

The short-run outcomes resulting from the estimate of Equation (4) are shown in Table 4, following an

Table 4: Long Run and Short Run Result

Long Run Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LLNG	-0.513653	1.062620	-0.483384	0.6329
LNGP	-1.645497	0.658579	-2.498559	0.0191
LCOP	-2.010585	0.699403	-2.874718	0.0080
C	15.35958	1.676610	9.161094	0.0000
EC = INR - (-0.5137*LLNG -1.6455*LNGP -2.0106*LCOP + 15.3596)				
Short Run Estimates				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INR(-1))	0.592897	0.086539	6.851173	0.0000
D(LLNG)	-1.750226	1.008184	-1.736018	0.0944
D(LLNG(-1))	-1.101924	1.240372	-0.888381	0.3825
D(LLNG(-2))	-0.863073	1.260848	-0.684518	0.4997
D(LLNG(-3))	-0.459916	1.181680	-0.389205	0.7003
D(LLNG(-4))	2.611288	0.920359	2.837250	0.0087
D(LCOP)	1.708068	0.604264	2.826693	0.0089
D(LCOP(-1))	1.560157	0.890154	1.752682	0.0914
CointEq(-1)*	-0.655080	0.092066	-7.115340	0.0000
R-squared	0.812477	Mean dependent var	0.059247	
Adjusted R-squared	0.762471	S.D. dependent var	1.109780	
S.E. of regression	0.540873	Akaike info criterion	1.807908	
Sum squared resid	8.776294	Schwarz criterion	2.191807	
Log likelihood	-26.25421	Hannan-Quinn criter.	1.945648	
Durbin-Watson stat	1.849068			

Source: Author's computation using Eviews 10

analysis of the impact of the independent variables on the inflation rate in the long term. The analysis reveals that the previous value of inflation has a statistically significant positive relationship, as shown by a coefficient estimate of 0.592897. The coefficient values of LLNG up to the third lag exhibit a negative trend and lack statistical significance in the short-term analysis. Nevertheless, the coefficient of lag 4 of the LLNG exhibited a positive and statistically significant relationship. The coefficient for the current value of LCOP was positively and significantly associated, while the coefficient for the first lag of LCOP was positively but not significantly associated. It is important to emphasise that LNGP had no short-term impact on inflation. The error correction term (-0.655080) fulfils the econometrics criterion by exhibiting negative significance and a value below one. This indicates the rapid adjustment or speed towards long-term equilibrium. This suggests that any divergence from the long-run equilibrium is adjusted at a rate of

65.5% every six months. The modified R-square value indicates that 76.2% of the variation in the inflation rate can be accounted for by the explanatory factors. The model's fitness is confirmed by the DW value of 1.85 and an R-square of 81.2%.

Diagnostic and Stability Results

The study employed residual diagnostic tests and stability tests, as shown in Table 5, to verify the reliability and acceptability of the estimates. The findings indicate that the model residuals were normally distributed and devoid of autocorrelation, heteroscedasticity, multicollinearity, and misspecification issues. The residuals were found to be within critical bounds at a significance level of 5% based on the results of the cumulative sum (CUSUM) and cumulative sum of square (CUSUMSQ) tests, as depicted in Figures 2 and 3. The tests ensured the stability of the model during the studied periods.

Table 5: Diagnostic and Ramsey Tests Result

Breusch-Godfrey Serial Correlation LM Test	F-statistic	0.377547	Prob. F(2,24)	0.6895
	Obs*R-squared	1.189599	Prob. Chi-Square(2)	0.5517
Breusch-Pagan-Godfrey Heteroskedasticity test	F-statistic	0.862527	Prob. F(12,26)	0.5916
	Obs*R-squared	11.10478	Prob. Chi-Square(12)	0.5200
	Scaled explained SS	4.967721	Prob. Chi-Square(12)	0.9590
Histogram Normality Test	Component	Joint		
	Jarque-Bera	0.205554		
	Prob.	0.902328		
Ramsey RESET Test		Value	df	Probability
	t-statistic	0.111876	25	0.9118
	F-statistic	0.012516	(1, 25)	0.9118

Source: Author's computation using Eviews 10

Causality Test Analysis

The Granger causality test was used to investigate the causal link among the variables in the model. The results of the causality test are shown in Table 6. The outcome of the causality test suggests that there exists

a unidirectional causal relationship specifically from the price of crude oil to inflation. The empirical research conducted reveals that there is no discernible causal relationship between the exports of liquefied natural gas (LNG) and inflation.

Table 6: Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
LLNG does not Granger Cause INR	42	0.7604	0.4746
INR does not Granger Cause LLNG		2.07187	0.1403
LNGP does not Granger Cause INR	42	1.76516	0.1853
INR does not Granger Cause LNGP		0.35764	0.7017
LCOP does not Granger Cause INR	42	3.78005	0.0321
INR does not Granger Cause LCOP		0.22954	0.796
LNGP does not Granger Cause LLNG	42	0.59061	0.5591
LLNG does not Granger Cause LNGP		1.19837	0.3131
LCOP does not Granger Cause LLNG	42	0.33456	0.7178
LLNG does not Granger Cause LCOP		1.61134	0.2133

Source: Author's computation using Eviews 10

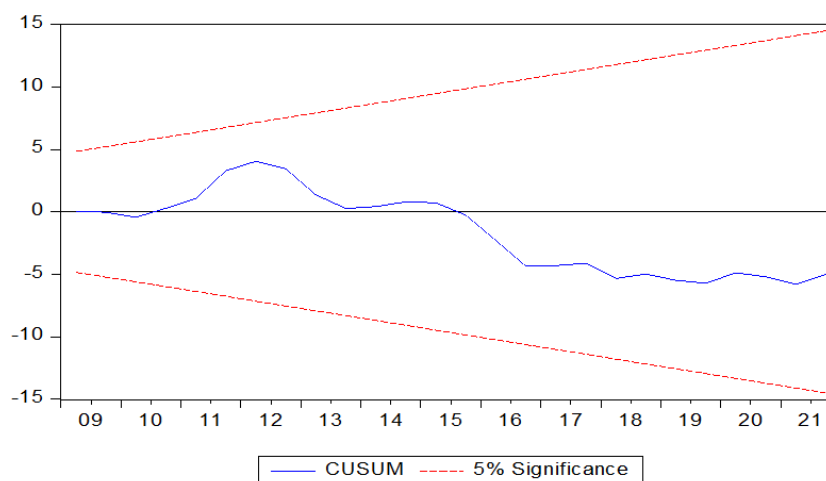


Figure 1: CUSUM Test

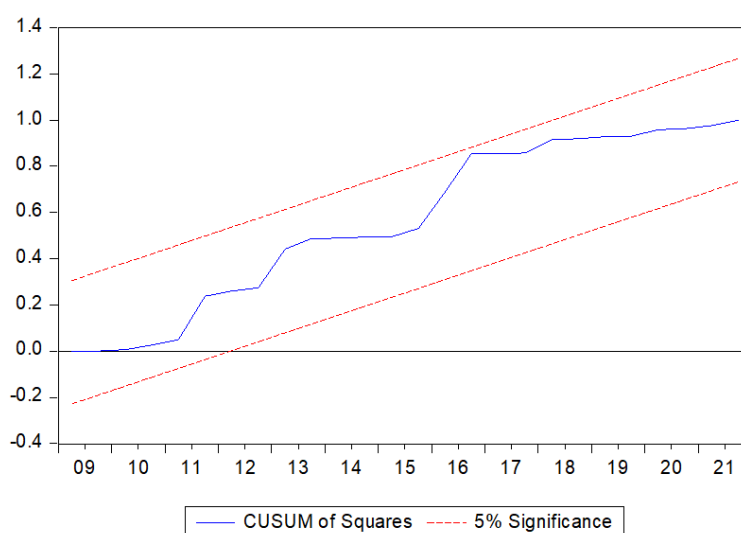


Figure 2: CUSUM of Square Test

CONCLUSION

The objective of this study was to assess the influence of LNG exports on the inflation rate within the time frame of 2000 to 2021 in Nigeria. The study used the Augmented Dickey-Fuller (ADF) unit root test, ARDL-bound co-integration test to examine the long and short-run connection between the variables in the model, diagnostic test, and the Granger causality tests as part of its methodology. The results of the unit root test indicate a combination of different orders of integration for the variable, hence indicating the appropriateness of using the ARDL-bound co-integration approach. The results of the cointegration test indicated that there was evidence of co-integration among all the variables included in the model. The findings from the long-term estimate indicate that the inflation rate in Nigeria is adversely influenced by LNG exports, natural gas prices, and crude oil prices. While the influence of natural gas prices and crude oil prices showed a noteworthy effect at a 5% significance level, the impact of LNG exports did not demonstrate statistical significance. The findings from the short-term analysis indicate that the impact of LNG exports was both negative and statistically negligible, whereas the crude oil price had a positive and

statistically significant effect. Nevertheless, in the near run, the inflation rate remained unaffected by fluctuations in the price of natural gas. The subsequent objective of this study was to ascertain the causal association between exports of LNG and inflation in Nigeria. The study's results indicate that there is no causal relationship between LNG exports and inflation in Nigeria.

Although the influence of LNG exports on inflation lacks statistical significance, it is recommended that the government continue its commitment to the LNG sector, focusing on infrastructure and technology investments to enhance competitiveness and efficiency. Expanding into new markets and diversifying the LNG portfolio will ensure a steady revenue stream while prioritising economic diversification beyond the oil and gas sector.

REFERENCE

- Adeleye, N., Ogundipe, A. A., Ogundipe, O., Ogundipe, I., & Adediran, O. (2019). Internal and external drivers of inflation in Nigeria. *Banks Bank Syst*, 14(4), 206-218.
- Agu, O. C., & Nyatanga, P. (2020). An investigation into the crude oil price pass-through to economic growth in Nigeria. *Acta Universitatis Danubius. Œconomica*, 16(1).

- Agu, O. C., & Nyatanga, P. (2021). Does the Expected Crude Oil Price Influence Inflation in Nigeria?. *African Journal of Business & Economic Research*, 16(4).
- Ahmed, R. R., Ghauri, S. P., Vveinhardt, J., & Streimikiene, D. (2018). An empirical analysis of export, import, and inflation: a case of Pakistan. *Romanian journal of economic forecasting*, 21(3), 117-130.
- Albinia, S., & Sofyan, M. (2023). The Effect of Exchange Value and Inflation on Non-Oil and Gas Export Value Period 2015 – 2021. *Sinergi International Journal of Management and Business*, 1(1), 1–16. <https://doi.org/10.61194/ijmb.v1i1.1>.
- Aliraqi, A. & Salih, Z. (2022). Inflation's Impact on Sudan Exports 1990-2020: An ARDL Approach. *World Journal of Entrepreneurship, Management and Sustainable Development*, 18(6). <https://doi.org/10.47556/J.WJEMSD.18.6.2022.2>.
- Anagaw, T. (2023). Review on: Effect of Inflation on Economic Growth in Ethiopia. *American Journal of Applied Statistics and Economics*, 2(1), 7-10. <https://doi.org/10.54536/ajase.v2i1.1658>.
- Anggoro, A. C. P. (2022). Effect of exports, imports of oil and gas products, inflation, on economic growth. *Cashflow : Current Advanced Research on Sharia Finance and Economic Worldwide*, 2(1), 148-163. <https://doi.org/10.55047/cashflow.v2i1.436>.
- Arora, V. and Cai, Y. (2014). U.S. natural gas exports and their global impacts. *SSRN Electronic Journal* <https://doi.org/10.2139/ssrn.2400775>.
- Bambang Purwoko. (2021). Analysis of the effect of inflation on exports of non-oil and gas commodities through the port of tanjung perak Surabaya. *Journal Eduwest*. 1(7): 577-584.
- Baron, R., Bernstein, P., Montgomery, W. D., & Tuladhar, S. (2015). Macroeconomic impacts of LNG exports from the United States. *Economics of Energy & Environmental Policy*, 4(1), 37-52.
- Bassey, G. E., & Ekong, U. M. (2019). Energy Consumption and Inflation Dynamics in Nigeria: An ARDL Cointegration Approach. *Energy Economics Letters*, 6(1), 66–83. <https://doi.org/10.18488/journal.82.2019.62.66.83>.
- Bernstein, P., Tuladhar, S. D., & Yuan, M. (2016). Economics of US natural gas exports: Should regulators limit US LNG exports?. *Energy Economics*, 60, 427-437.
- Granger, C. W. (1988). Some recent developments in a concept of causality. *Journal of econometrics*, 39(1- 2), 199–211. doi:10.1016/0304-4076(88)90045-0.
- Ilmas, N., Amelia, M., & Risandi, R. (2022). Analysis of the Effect of Inflation and Exchange Rate on Exports in 5-Year Asean Countries (Years 2010–2020). *Jurnal Ekonomi Trisakti*, 2(1), 121-132.
- Iyke, B. N. (2014). Electricity consumption, inflation, and economic growth in Nigeria: a dynamic causality test. Munich Personal RePEc Archive.
- Iyke, B.N. and Odhaimbo, N. M. (2014). The dynamic causal relationship between electricity consumption and economic growth in Ghana: A trivariate causality model. *Managing Global Transitions*, 12(2), 141-160.
- Jacob, T., Raphael, R., & Ajina, V. S. (2021). Impact of exchange rate and inflation on the export performance of the Indian economy: An empirical analysis. *BIMTECH Business Perspective*, 1-13.
- Javed, S., & Husain, U. (2020). An ARDL investigation on the nexus of oil factors and economic growth: A time series evidence from Sultanate of Oman. *Cogent Economics & Finance*, 8(1), 1838418.
- Kiganda, E. O., Obange, N., & Adhiambo, S. (2017). The relationship between exports and inflation in Kenya: An aggregated econometric analysis.
- Kompas, T., & Che, T. N. (2016). A structural and stochastic optimal model for projections of LNG imports and exports in Asia-Pacific. *Heliyon*, 2(6).
- Kubo, K. (2011). Natural gas export revenue, fiscal balance and inflation in Myanmar. *Asean Economic Bulletin*, 28(3), 374. <https://doi.org/10.1355/ae28-3f>.
- Liu, Y., Shi, X., & Laureceson, J. (2020). Dynamics of Australia's LNG export performance: A modified constant market shares analysis. *Energy Economics*, 89, 104808.
- Medlock, K. B., Jaffe, A. M., & O'Sullivan, M. (2014). The global gas market, LNG exports and the shifting US geopolitical presence. *Energy Strategy Reviews*, 5, 14-25.
- Menegaki, A. N. (2019). The ARDL method in the energy-growth nexus field; *best implementation strategies*. *Economics*, 7(4), 105.
- Moryadee, S., Gabriel, S. A., & Avetisyan, H. G. (2014). Investigating the potential effects of US LNG exports on global natural gas markets. *Energy Strategy Reviews*, 2(3-4), 273-288.
- Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326. <https://doi.org/10.1002/jae.616>.
- Purusa, N., & Istiqomah, N. (2018). Impact of FDI, COP, and Inflation to Export in Five ASEAN Countries. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi dan Pembangunan*, 19(1), 94-101. <https://doi.org/10.23917/jep.v19i1.5832>.
- Sahoo, M., & Sethi, N. (2018). The Dynamic Relationship between Export, Import and Inflation: Empirical Evidence from India. *The Indian Economic Journal*, 66(3–4), 294–311. <https://doi.org/10.1177/0019466220935552>.
- Tukur, N., Gowon, S., Isaiah, T. G., & Musa, G. H. (2012). A Comparative Study of Liquefied Natural Gas and Pipelines as Means of Transporting Natural Gas in Nigeria. Coventry University, UK.
- Udoudo, K. J., Kalu, I. E., & Oduola, K. (2023). Effect of Liquefied Natural Gas Exports on the Nigeria Economy: An ARDL Model Approach. *SSRG International Journal of Economics and Management Studies*, 10(5), 35-46. <https://doi.org/10.14445/23939125/IJEMS-V10I5P105>.
- Zhang, H. Y., Xi, W. W., Ji, Q., & Zhang, Q. (2018). Exploring the driving factors of global LNG trade flows using gravity modelling. *Journal of Cleaner Production*, 172, 508-515.