DOI: https://doi.org/10.37075/EA.2025.1.01

Economic Alternatives, 2025, Issue 1, pp. 5-30

The Moderating Role of Corruption in the Oil Price-Economic Growth Relationship in an Oil-Dependent Economy: Evidence from Bootstrap ARDL with a Fourier Function

Received 05.09.2023
Available: 31.03.2025

Joseph David[*], **Nurudeen Abu**[**] **and Akintola Owolabi**[***]

Abstract

This study employs the recently proposed bootstrap autoregressive distributed lag (ARDL) model, augmented with a Fourier function, and the dynamic ARDL simulation procedures, to examine whether the oil price-economic growth relationship depends on the level of corruption in an oil-dependent economy. Using Nigerian quarterly data from the 1996Q1–2021Q4 period, the results of the bounds-testing provide evidence of cointegration between the variables. In addition, the results indicate that oil price and corruption are growth-enhancing, but the effect of oil price on growth is contingent on the level of corruption. Moreover, evidence suggests that the marginal effect of oil price on economic growth varies with the level of corruption: the lower the level of corruption, the higher the growth-enhancing effect of oil price on economic growth, and vice versa. The dynamic ARDL simulation plots demonstrate a significant increase (decrease) in predicted growth in the short term due to a counterfactual rise in the price of oil (corruption), which gradually deflates (increases) after the shock in the long term. Therefore, policies geared toward diversifying the economy away from oil, reducing corruption in the oil and gas industry and the security sector, improving agricultural output, and reducing the unemployment rate are recommended to enhance growth.

Keywords: Economic growth, oil price, corruption, bootstrap ARDL, fractional flexible Fourier forms ARDL, dynamic ARDL simulation.

JEL: C15, C22, O4, O43, O13

1. Introduction

A large body of research indicates that changes in the price of oil have a

---

[*] Lagos Business School, Pan-Atlantic University, Lagos, Nigeria; and Centre for Economic Policy and Development Research (CEPDeR), Covenant University, Ota, Nigeria.

[**] Department of Economics, Baba-Ahmed University, Abuja, Nigeria.

[***] Lagos Business School, Pan-Atlantic University, Lagos, Nigeria.

significant effect on economic activity. More importantly, the impact of oil price changes differs for oil-exporting and oil-importing countries, with oil price increases considered good news for the former and bad news for oil-importing economies, and vice versa (Moshiri, 2015). In oil-dependent economies, for instance, an increase in oil prices is generally considered favorable because it brings in foreign exchange and investment opportunities that are beneficial to economic growth. In contrast, these countries view negative oil price changes as unfavorable. After all, such changes restrain public revenue and halt investment projects, leading to a deceleration in economic growth (Kriskkumar & Naseem, 2019; Moshiri, 2015).

However, evidence suggests that oil price changes might cause a non-standard effect on growth, with positive oil price changes also encouraging growth-retarding economic conditions such as exchange rate appreciation, stagflation due to high inflation, rising unemployment, rent-seeking, and poor policymaking, among others (Moshiri, 2015; Moshiri & Banihashem, 2012). Interestingly, despite years of favourable oil prices that brought in vast financial resources critical for growth, most oil-dependent nations in the Middle East, Africa, and Latin America have continued to record poor growth performance compared to the fast growth rates experienced in resource-poor East Asian countries (Moshiri, 2015; Moshiri & Banihashem, 2012; Sachs & Warner, 2001; Sala-i-Martin & Subramanian, 2003).

In the economic literature, the traditional approach used to explain the adverse effect of oil price changes on growth in oil-dependent economies is the Dutch disease theory (Corden & Neary, 1982). This theory demonstrates the shift in human and financial resources from tradable sectors (specifically, manufacturing) following the discovery of natural resources (oil) to the non-tradable sector (oil sector). Therefore, during the oil boom, an increase in oil prices and revenue leads to the appreciation of the local currency, a reduction in net exports, and the shrinking of the non-resource tradable sector (manufacturing), and consequently, the deceleration of economic growth (Kriskkumar & Naseem, 2019; Moshiri, 2015).

Recently, the quality of institutions (such as good governance, property rights, the rule of law, regulatory quality, etc.) has been offered as an important explanation for the adverse effect of oil price changes on growth in oil-dependent economies (Moshiri, 2015). According to this approach, the dependence on natural resources, such as oil, itself does not fully affect growth; instead, its interaction with poor institutional quality adversely affects growth (Boschini et al., 2007; Brunnschweiler, 2008; Mehlum et al., 2006). Thus, for oil-dependent countries with weak institutions, positive oil price changes might hamper growth but stimulate growth in countries with strong institutions. Perhaps, this is a plausible explanation for why oil-rich Norway has done well while oil-endowed Nigeria has continued to record poor growth performance (Karabegović, 2009; Larsen, 2006; Olayungbo & Adediran, 2017).

In addition to institutional quality explaining the effect of oil price changes on growth in oil-dependent economies, the level of corruption may also be fundamental in moderating this impact. It is well documented in the economic literature that corruption and a culture of rent-seeking are essential characteristics of oil-dependent economies (Sala-i-Martin & Subramanian, 2003; van der Ploeg & Arezki, 2008). Beyond this, empirical evidence suggests that oil price and corruption exhibit a strong direct association (Arezki & Brückner, 2009; Vogel, 2020). Therefore, in an oil-dependent economy with a high level of corruption, positive oil price changes will lead to sluggish growth performance due in part to the dynamic incentives that such windfalls generate for corrupt politicians to embezzle oil money, inflate the cost of social goods and services, and shift resources from growth-enhancing investments in favour of large capital-intensive projects, which may be unproductive but offer vast opportunities for bribes and kickbacks (Dietz & Eric, 2005; Gupta et al., 2000; Mauro, 1998; Tanzi & Davoodi, 1997; Vogel, 2020). On the contrary, since such oil windfalls will be channelled to productive activities transparently in oil-dependent economies with a low level of corruption, the reverse is expected to occur (Moshiri, 2015).

Notwithstanding the coexistence of slow growth performance and widespread corruption in most oil-dependent economies amid unstable oil prices, researchers have done little to evaluate the role of corruption in shaping the effect of oil prices on economic growth. Therefore, the main objective of the present study is to examine whether the effect of oil prices on growth is contingent on the level of corruption in Nigeria. The research is relevant and contributes to the extant literature in several ways. First, the study is a pioneering effort to explore the role of corruption in the oil price-economic growth nexus in an oil-dependent economy using Nigeria’s quarterly data from 1996Q1 to 2021Q4. The coexistence of consistent poor growth performance of the Nigerian economy amid a high level of corruption and unstable oil prices makes Nigeria a perfect case to study whether the impact of oil prices on growth is contingent on the level of corruption.

Second, the study employs the recently developed bootstrap autoregressive distributed lag (ARDL) model with a Fourier function to draw a correct conclusion. As indicated by McNown et al. (2018), the bootstrap test is more robust compared to the traditional ARDL approach of Pesaran et al. (2001) due in part to its ability to address issues of weak size and power properties and inconclusive inferences, which characterized the conventional approach (Abu et al., 2022; Goh et al., 2017; McNown et al., 2018). Meanwhile, since evidence suggests that structural breaks characterize most time series, failure to capture them in the analysis may lead to inaccurate conclusions (Adedoyin et al., 2020). Thus, the inclusion of a single fractional frequency flexible Fourier form in the bootstrap ARDL model ensures the incorporation of an unknown number of permanent gradual and sharp breaks in the presence of smooth transition autoregressive breaks (Gallant, 1981; Gallant & Souza, 1991; Solarin, 2019; Yilanci et al., 2020). The significant advantage of using Fourier terms, rather than dummy variables, to capture structural breaks is the elimination of the need for a researcher to assume the exact frequency of breaks, the dates of the breaks, and the exact form of the breaks (Solarin, 2019). Also interesting is the fact that the Fourier approximation helps eliminate the issue of over-parameterization, leading to a test with improved power and size properties (Enders & Lee, 2012).

Third, the study also adopts the novel dynamic ARDL simulations procedure proposed by Jordan and Philips (2018) to simulate the response of economic growth to changes (shocks) in oil prices and the level of corruption over 50 years (2021–2070). The dynamic ARDL simulation procedure generally simulates the possible effect of a counterfactual shock in one explanatory variable on the dependent variables at a single point in time using stochastic simulation techniques while holding all other regressors constant (Abu et al., 2022; Jordan & Philips, 2018; Gamal et al., 2024). Lastly, by examining the role of corruption in the relationship between oil price and economic growth using robust estimation techniques, findings from the present study are expected to rekindle the debate on the role of oil price and corruption on economic growth and expand the frontiers of knowledge among policymakers, both in Nigeria and in other oil-dependent economies.

The rest of this paper is structured as follows. Section 2 presents the review of the empirical literature. Section 3 contains the theoretical framework, model formulation, and econometric techniques. The estimation results are presented and discussed in Section 4. Finally, the conclusion and policy implications of the study are provided in Section 5.

2. Review of empirical literature

Much research has been conducted on the linkage between oil price and economic growth in developed and developing oil-dependent/oil-exporting economies. Generally, the empirical literature on the nexus presents mixed findings, with some studies demonstrating a positive link, others a negative link, while some established an insignificant relationship. Some existing studies focused on either a group of countries or regions. For example, using a sample of 10 oil-exporting Sub-Saharan African (SSA) countries during the 1986-2012 period, Akinlo and Apanisile (2015) established a positive relationship between oil prices and economic growth. Nusair (2016) also reported a similar outcome in the Gulf Cooperation Council (GCC) countries (including Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, the UAE). In the same vein, Matallah and Matallah (2016) established a positive relationship between oil rent and economic growth in 11 Middle East and North African (MENA) oil-dependent countries (Algeria, Bahrain, Iran, Iraq, Kuwait, Libya, Oman, Qatar, Saudi Arabia, the UAE, and Yemen) between 1996 and 2014.

Further, Mehrara (2008) indicated that oil price is growth-enhancing in 13 oil-exporting countries (Algeria, Colombia, Ecuador, Indonesia, Iran, Kuwait, Libya, Mexico, Nigeria, Qatar, Saudi Arabia, the UAE, and Venezuela) during the period from 1965 to 2004. Similarly, using dynamic heterogeneous panel estimation techniques, David (2024) established that oil prices have a significant positive influence on growth in 30 major oil-rich economies in Africa, Asia, Europe, North America, and South America. In contrast, Moshiri and Banijashem (2012) illustrate that oil price is not significant in influencing economic growth in six Organisation of Petroleum Exporting Countries (OPEC) member states (Algeria, Iran, Kuwait, Nigeria, Saudi Arabia, and Venezuela) during the 1970-2009 period.

Moreover, at the country-specific level, some studies have also assessed the impact of oil price on economic growth in oil-dependent/oil-exporting countries such as Algeria, Iran, Iraq, Kuwait, Libya, Nigeria, Norway, Oman, Qatar, Saudi Arabia, Syria, and the UAE (Abubakar & Akadiri, 2022; Aimer, 2016; Algahtani, 2016; Aliyu, 2009; Alkhathlan, 2013; Berument et al., 2010; Emami & Adibpour, 2012; Farzanegan and Markwardt, 2009; Jiménez-Rodríguez & Sánchez, 2004; Mahmood & Murshed, 2021; Okoro, 2014; Rotimi et al., 2022). These studies confirmed the presence of a significant positive relationship between oil prices and economic growth in the respective countries. In contrast, some authors reported a negative association in oil-exporting countries such as Nigeria and the UK (Jiménez-Rodríguez & Sánchez, 2004; Yakubu & Akanegbu, 2019), while others established a positive nexus in the short term and an inverse relationship in the long run (Olayungbo & Adediran, 2017). However, other studies demonstrate an insignificant relationship between oil price and growth in countries such as Bahrain, Brunei, Malaysia, Tunisia, and Vietnam (Berument et al., 2010; Kriskkumar & Naseem, 2019; Matthew & Adegboye, 2014).

A survey of the literature suggests that, while studies on the oil price-economic growth relationship abound, researchers did not deem it essential to explore whether the effect of oil price on economic growth is contingent on the level of corruption. Most existing studies focused only on the direct impact of oil prices on economic growth while ignoring the potential role of corruption in the nexus. Perhaps an exception is a study by Moshiri (2015), which examined the role of institutional quality (voice and accountability, political stability and absence of violence, government effectiveness, regulatory quality, the rule of law, and control of corruption) in the relationship between oil price shocks and output growth in 11 major oil-exporting countries (Algeria, Iran, Kuwait, Nigeria, Saudi Arabia, Venezuela, Canada, Norway, and the United Kingdom) during the 1970-2010 period. The empirical outcome demonstrates that the effect of oil price shocks on growth is moderated by institutional quality, with oil price shocks impeding growth in oil-exporting countries with low institutional quality. However, the present study extends the literature by explicitly investigating the role of corruption in the oil price-economic growth relationship in oil-dependent economies, with particular reference to Nigeria.

3. Theoretical framework, model, estimation technique and data issues

3.1. Theoretical framework and model specification

This study relies on Sachs-Warner's resource curse hypothesis (RCH) to establish a link between oil price, economic growth, and corruption. The RCH asserts that an abundance of and dependence on a natural resource (such as oil) harm long-term economic growth (Sachs & Warner, 1995, 1997, 2001). Various explanations have been offered in the literature regarding why natural resources hurt long-term growth. However, arguments related to the Dutch disease syndrome, variations in natural resource prices, and weak institutions (corruption) continue to dominate the discussion (Boschini et al., 2007; Bravo-Ortega & de Gregorio, 2007; Brunnschweiler, 2008; Di John, 2011; Gylafson, 2001; Humphreys et al., 2007; Leite & Weidmann, 1999; Mehlum et al., 2006; Sachs & Warner, 1995, 1997, 2001; Sala-i-Martin & Subramanian, 2003). Since the Dutch disease syndrome—characterised by an overvalued exchange rate and the consequent de-industrialization of the non-resource/tradeable sector—is triggered by fluctuations in the price of natural resources and the earnings from their export (Kriskkumar & Naseem, 2019), it is argued that Sachs-Warner's paradoxical finding can be attributed to changes in the price of natural resources (such as oil) and weak institutions (corruption) (Devine, 2012; Olayungbo & Adediran, 2017). This suggests that the effect of abundance and/or dependence on oil on long-term growth can be assessed directly through the influence of oil prices and corruption on growth.

Moreover, evidence suggests that the direction and magnitude of the impact of oil prices on growth may depend on the level of corruption. This argument is based on the observation that corruption, poor governance, and a rent-seeking culture are common features of oil-dependent countries (Sala-i-Martin & Subramanian, 2003; van der Ploeg & Arezki, 2008). Under such conditions, positive changes in oil prices may generate incentives for corrupt politicians to inflate the cost of social goods and services, embezzle oil revenues, or divert resources away from growth-enhancing investments in favor of large, non-productive, capital-intensive projects that offer opportunities for bribes (Dietz & Eric, 2005; Gupta et al., 2000; Mauro, 1997, 1998; Tanzi & Davoodi, 1997; Vogel, 2020), ultimately leading to poor economic performance.

While the preceding discussion demonstrates the critical role of corruption in the oil price-economic growth relationship, modelling the moderating role of corruption in this relationship can be challenging. However, the literature suggests that multiplicative interaction models can be utilized to determine the moderating effect of a variable on the relationship between two other variables (Brambor et al., 2006). Interestingly, many studies have adopted this approach to explore the role of corruption in the relationship between economic variables (Abu et al., 2022; d'Agostino et al., 2012; Drury et al., 2006; Freckleton et al., 2012; Fredriksson & Svensson, 2002; Morrissey & Udomkerdmongkol, 2012). Therefore, an econometric model in which economic growth depends on oil price, corruption, and the oil price-corruption interaction is specified as follows:

$$GDPG_t = \alpha_0 + \alpha_1 OILP_t + \alpha_2 CORR_t + \alpha_3 (OILP * CORR)_t + \varphi' Z_t + \mu_t \tag{1}$$

where $OILP$ is the oil price, $CORR$ represents corruption, $OILP * CORR$ denotes oil price-corruption interaction term, Z represents set of control variables (such as agricultural output, domestic security spending and unemployment rate), and μ_t is the stochastic error term with zero mean and constant variance.

Through the oil price-corruption interaction term, we can determine whether the level of corruption adversely or favourably moderates the effect of oil price on economic growth. Therefore, we compute the marginal effect of oil price on economic growth by taking the partial derivative of Equation (1) as follows:

$$\frac{\partial GDPG_t}{\partial OILP_t} = a_1 + a_3 CORR_t \tag{2}$$

Emphasis is placed on the signs of the two coefficients (a_1 and a_3). If $a_1 > 0$ and $a_3 < 0$, it suggests that oil price improves economic growth, but the reduction in corruption diminishes the favourable effect. If $a_1 < 0$ and $a_3 > 0$, it indicates that oil price impairs growth, but low corruption levels mitigate the adverse effect. If $a_1 < 0$ and $a_3 < 0$, it signifies that oil prices slow economic growth and that a reduction in corruption aggravates the adverse impact. If $a_1 > 0$ and $a_3 > 0$, it denotes that oil price is growth-enhancing and that a low level of corruption intensifies this positive effect. However, a positive marginal effect ($a_1 + a_3CORR_t$) demonstrates that a rise in oil prices and corruption levels enhances economic growth, while a negative marginal effect indicates otherwise.

3.2. Econometric procedure

The bootstrap ARDL bounds-testing approach of McNown et al. (2018) is adopted to examine the cointegrating relationship between the variables. This approach is chosen for its several advantages over the traditional ARDL bounds-testing method of Pesaran et al. (2001), particularly its ability to address the issues of weak size and power properties that characterize the traditional approach (Abu et al., 2022; Gamal et al., 2024). Additionally, the bootstrap ARDL procedure includes an extra cointegration test on the lagged level(s) of the independent variable(s) to complement the existing F- and t-tests in the traditional ARDL framework. This enhancement increases the power of the F-test, thereby providing a more robust assessment of the system's cointegration status. More importantly, this approach eliminates the issue of inconclusive inferences that may arise when using the traditional ARDL procedure (Goh et al., 2017; McNown et al., 2018).

Following Pesaran et al. (2001) and McNown et al. (2018), Equation (1) can be re-written as follows:

$$\begin{aligned}\Delta GDPG_t &= \alpha_1 + \sum_{j=1}^{p} \delta_j \Delta GDPG_{t-j} + \sum_{i=0}^{q_1} \beta_{1i} \Delta lnOILP_{t-i} + \sum_{i=0}^{q_2} \beta_{2i} \Delta CORR_{t-i} \\ &+ \sum_{i=0}^{q_3} \beta_{3i} \Delta (OILP * CORR)_{t-i} + \sum_{i=0}^{q_4} \beta_{4i} \Delta Z_{t-i} + \lambda_1 GDPG_{t-1} \\ &+ \lambda_2 lnOILP_{t-1} + \lambda_3 CORR_{t-1} + \lambda_4 (OILP * CORR)_{t-1} + \lambda_5 Z_{t-1} + \varepsilon_t \end{aligned} \qquad (3)$$

where Δ represents the difference operator. The optimal lag length (p, q) is determined by the Akaike Information Criterion (AIC) of Akaike (1979). δ_1 and $\beta_1 - \beta_4$ are the parameters of the lagged differenced regressors; $\lambda_1 - \lambda_5$ represents the coefficient of the lagged levels of the dependent and independent variables; $t = 1 \ldots T$ denotes time; ε_t is the independent and identically distributed error term.

Following the bootstrap ARDL bounds testing procedure of McNown (2018), the existence of a cointegrating relationship in Equation (3) is assessed by testing the following three null hypotheses against their respective alternatives:

- $H_0: \lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$, based on the overall F-test on all lagged level variables (F_1).
- $H_0: \lambda_1 = 0$, based on the t-test on the lagged level of the dependent variable (t).

- $H_0: \lambda_2 = \lambda_3 = \lambda_4 = \lambda_5 = 0$, based on the F-test on the lagged levels of the independent variable(s) (F_2).

The null hypothesis is rejected when the test statistic exceeds the corresponding bootstrap-generated critical value at a specific significance level. As outlined by McNown et al. (2018), cointegration between series can only be established when all three hypotheses are rejected. Two degenerate cases, which indicate false cointegration, are defined as follows: Degenerate case #1 (degenerate lagged dependent variable) occurs when the overall F-test and the F-test on the explanatory variable(s) are significant, but the t-test on the lagged dependent variable is not. Degenerate case #2 (degenerate lagged independent variable) occurs when both the overall F-test and the t-test on the lagged dependent variable are significant, but the test on the lagged independent variable(s) is not (McNown et al., 2018; Sam et al., 2019). Since either case indicates the absence of cointegration between series, all three null hypotheses must be rejected to validly conclude the presence of cointegration.

Meanwhile, evidence suggests that structural breaks are common in time series data (Adedoyin et al., 2020). Therefore, it is necessary to account for this possibility in cointegration tests to avoid inaccurate conclusions. Many empirical studies employing the bootstrap ARDL approach incorporate structural breaks in the cointegration relationship by introducing dummy variables in Equation (3) (Cai et al., 2018; Goh et al., 2017; Lin et al., 2018). However, the use of dummy variables to capture structural breaks is significantly limited because break dates must be determined a priori. Additionally, relying on dummy variables can lead to over-parameterization, weakening the test's size and power properties.

To address these limitations, studies have shown that a small number of low-frequency components in a Fourier approximation can effectively capture an unknown number of sharp and gradual breaks, including smooth transition autoregressive breaks and sharp breakpoints (Gallant, 1981; Gallant & Souza, 1991; Solarin, 2019; Yilanci et al., 2020). A key advantage of using the Fourier function to capture structural breaks is that it does not require researchers to assume the exact frequency, timing, or form of the breaks (Solarin, 2019). Moreover, Fourier approximation reduces the need to include multiple parameters in a model, enhancing the test's power and size properties (Enders & Lee, 2012).

Following Solarin (2019), the Fourier function used to capture structural breaks is given as:

$$d(t) = \sum_{k=1}^{n} \gamma_{1,k} \sin\left(\frac{2\pi kt}{T}\right) + \sum_{k=1}^{n} \gamma_{2,k} \cos\left(\frac{2\pi kt}{T}\right) \quad (4)$$

where n is the number of Fourier terms, π = 3.1416, k, t and T denotes the frequency of the Fourier, trend and sample size, respectively, and γ_1 and γ_2 captures the amplitude and displacement of the frequency component, respectively.

Evidence suggests that if n is too large, it may lead to an overfitting problem (Kathuria & Kumar, 2022; Nazlioglu et al., 2016). Pata (2019) recommended using a single frequency to mitigate this issue. Moreover, since a single frequency "allows for multiple smooth breaks and also serves as an appropriate approximation to breaks of an unknown form" (Enders & Lee, 2012), we follow Becker et al. (2006) and Ludlow & Enders (2000) and incorporate a single-frequency Fourier function as follows:

$$d(t) = \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) \quad (5)$$

Following Solarin (2019), we re-specify Equation (3) to incorporate the Fourier terms in Equation (5) as follows:

$$\begin{aligned} \Delta GDPG_t &= \alpha_1 + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \sum_{j=1}^{p} \delta_j \Delta GDPG_{t-j} \\ &+ \sum_{i=0}^{q_1} \beta_{1i} \Delta lnOILP_{t-i} + \sum_{i=0}^{q_2} \beta_{2i} \Delta CORR_{t-i} + \sum_{i=0}^{q_3} \beta_{3i} \Delta (OILP * CORR)_{t-i} \\ &+ \sum_{i=0}^{q_4} \beta_{4i} \Delta Z_{t-i} + \lambda_1 GDPG_{t-1} + \lambda_2 lnOILP_{t-1} + \lambda_3 CORR_{t-1} \\ &+ \lambda_4 (OILP * CORR)_{t-1} + \lambda_5 Z_{t-1} + \varepsilon_t \end{aligned} \quad (6)$$

Since fractional frequencies indicate permanent breaks, while integer frequencies represent temporary breaks (Christopoulos & Leon-Ledesma, 2011; Omay, 2015), we adopt the fractional frequency flexible Fourier form Bootstrap ARDL approach proposed by Yilanci et al. (2020). Accordingly, Equation (6) is estimated for all values of k in the interval k = [0.1, …,5] with increments of 0.1, selecting the frequency k^* that minimizes the AIC.

3.3. Data issues

A major constraint in a study of this nature is obtaining substantial data on corruption. The World Bank's notable corruption index is only available from 1996 to 2021, which falls short of the requirements for a time series analysis. To address this limitation, we transform the annual dataset covering the 1996–2021 period into quarterly data, spanning from 1996Q1 to 2021Q4, using the quadratic match average data interpolation technique, as suggested in the literature (Arain et al., 2019; Shahzad et al., 2017; Sharif et al., 2019). One significant advantage of this method is its ability to mitigate end-to-end deviation when converting low-frequency data into high-frequency data (Batool et al., 2019; Mishra et al., 2019; Shahbaz et al., 2018).

The variables are measured as follows: GDPG is the percentage growth rate of real GDP. OILP is proxied by the average per-barrel spot price of UK Brent crude oil. CORR is measured using the World Bank's World Governance Indicator (WGI) control of corruption index. AGR is captured as the ratio of agricultural output to GDP. INTS represents domestic security spending. UNEM is measured as the percentage unemployment rate. The data is sourced from various reputable institutions. Specifically, real GDP growth rate and agricultural output data are obtained from the World Bank's World Development Indicators (WDI) database, while oil price (UK Brent) data comes from the Organization of the Petroleum Exporting Countries (OPEC) Annual Statistical Bulletin. Additionally, data on the control of corruption index is sourced from the World Bank's WGI repository, internal security expenditure data is collected from the Central Bank of Nigeria's (CBN) Annual Statistical Bulletin, and unemployment rate data is obtained from Nigeria's National Bureau of Statistics repository.

4. Empirical results and discussion

4.1. Summary of descriptive statistics and correlations

The descriptive statistics of the variables are computed, and the results are summarised in Table 1. The findings show that, between 1996 and 2021, the average real GDP growth rate, oil price (UK Brent), World Bank's control of corruption index, agricultural output (as a share of GDP), domestic security spending, and unemployment rate were 4.823 percent, US$56.733 per barrel, -1.154, 24.644 percent, US$1.218 billion, and 19.924 percent, respectively. The corresponding standard deviations were 3.638, 30.895, 0.121, 3.999, 215.934, and 5.444, indicating considerable variability around the means. This is further confirmed by the skewness and kurtosis values, which show that the data points are not normally distributed.

The results of the correlation analysis are presented in Table 2. The findings indicate that the control of corruption index, oil price-corruption interaction, log of public expenditure on internal security, and unemployment are negatively correlated with economic growth (real GDP growth rate). In contrast, agricultural output shows a moderate and significant positive correlation with economic growth (0.56). Additionally, the results reveal a positive but weak and insignificant correlation between the log of oil price and economic growth.

4.2. Unit root test results

Before evaluating the role of corruption in the oil price-economic growth relationship, a unit root test was conducted to determine the properties of the underlying time series. To this end, we employ the traditional Augmented Dickey-Fuller (ADF) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests, along with the Zivot-Andrews (ZA) test of Zivot and Andrews (1992) and the Lee-Strazicich (LS) test (with two breaks) of Lee and Strazicich (2003).

The unit root test results, reported in Table 3, present mixed outcomes. For instance, while the KPSS test indicates that all series are stationary after first differencing, the ADF test shows that, except for the corruption index and the log of domestic security spending, all series are integrated of order one (i.e., I(1)).

Table 1. Summary Statistics

	Mean	Std. Dev.	Skewness	Kurtosis	Max.	Min.	Obs.
GDPG	4.823	3.638	0.466	4.005	15.962	-2.179	104
OILP	56.733	30.895	0.389	2.013	116.379	12.277	104
CORR	-1.154	0.121	-0.337	3.019	-0.879	-1.438	104
AGR	24.644	3.999	1.467	5.350	38.230	19.938	104
INTS	1.218	0.668	0.011	1.519	2.333	0.234	104
UNEM	19.924	5.444	2.353	8.500	39.944	13.107	104

Note: GDPG = real GDP growth rate; OILP = average spot price of UK Brent crude oil; CORR = World Bank's WGI control of corruption index; AGR = ratio of agricultural output to the GDP; INTS = domestic security spending; UNEM = unemployment rate.

Source: Authors' computation using EViews 12.

Additionally, whereas the ZA test finds that only agricultural output is stationary at level, the LS test indicates that all variables—except for the real GDP growth rate, the corruption index, and agricultural output—are stationary after first differencing. Nonetheless, since the ARDL bounds-testing procedure allows for series with different orders of integration (provided they do not exceed order one), these findings support the use of the bounds-testing procedure within the bootstrap ARDL model with a Fourier function.

4.3. Bootstrap fourier ARDL bounds-testing cointegration

Following the determination of the stationarity status of the series, we proceed to examine the cointegrating long-run relationship between the variables using the bounds-testing procedure within the framework of a bootstrap ARDL with a Fourier function. The optimal lag-length, suggested by the AIC, is (3, 2, 2, 3, 3, 2, 1), while the optimal fractional Fourier frequency (k^*) that minimizes the AIC (3.5799) is also considered. The test statistics for testing the null hypothesis across three tests (i.e. F_1, t, F_2), along with the corresponding bootstrap-generated critical values, are summarized in Table 3. The results reveal that the value of the overall F-statistic (F_1), the t-statistic on the lagged level dependent variable (t), and the F-statistic on the lagged level independent variables (F_2) all exceed the bootstrap-generated critical values at the 5 percent significance level. Therefore, we can reject the null hypothesis of no cointegration between the series.

Table 2. Results of Correlation Analysis

	ECOG	*lnOILP*	*CORR*	*OILP * CORR*	*AGR*	*lnINTS*	*UNEM*
GDPG	1.000						
lnOILP	0.109 (1.113)	1.000					
CORR	-0.475*** (-5.453)	0.415*** (4.602)	1.000				
*OILP * CORR*	-0.173* (-1.777)	-0.926*** (-24.753)	-0.181* (-1.861)	1.000			
AGR	0.562*** (6.853)	-0.539*** (-6.479)	-0.505*** (-5.908)	0.495*** (5.753)			
lnINTS	-0.205** (-2.114)	0.782*** (12.679)	0.436*** (4.893)	-0.619*** (-7.956)	-0.494*** (-5.735)	1.000	
UNEM	-0.161* (-1.644)	-0.039 (-0.400)	-0.017 (-0.169)	0.110 (1.120)	0.103 (1.048)	0.337*** (3.608)	1.000

Note: Asterisks (***), (**) and (*) denotes statistical significance at 1%, 5% and 10% levels, respectively. Values in parenthesis (.) are t-statistics. lnOILP = natural log of the average spot price of UK Brent crude oil; OILP * CORR = oil price-corruption interaction; lnINTS = natural log of domestic security spending.

Source: Authors' computation using EViews 12.

Table 3. Results of Unit Root Tests

		GDPG	*lnOILP*	*CORR*	*AGR*	*lnINTS*	*UNEM*
ADF	Level	-2.55	-2.09	-2.75*	-1.19	-3.11**	-0.791
	1st Diff.	-3.32**	-3.31**	–	-4.06***	–	-4.701***
KPSS	Level	0.39*	0.78***	0.39*	0.64**	1.19***	0.20**
	1st Diff.	0.07	0.08	0.07	0.04	0.47	0.06
ZA	Level	-5.08	-5.32	-3.67	-5.25**	-4.11	-3.13
	T_b	2001Q2	2014Q3	2004Q3	2001Q2	2000Q2	2018Q1
	1st Diff.	-9.25***	-9.25***	-7.68***	-5.376***	-9.77***	-8.62***
	T_b	2004Q1	2004Q1	2008Q2	2002Q3	2014Q3	2004Q1
LS	Level	-3.67*	-3.37	-3.59*	-5.36***	-3.34	-2.75
	T_b	2003Q1 2003Q4	2009Q1 2014Q4	2005Q1 2009Q1	2003Q1 2004Q1	1998Q3 2012Q4	2003Q1 2017Q4
	1st Diff.	-5.95***	-5.27***	-7.58***	-5.69***	-9.57***	-7.57***
	T_b	2003Q4 2012Q4	1999Q3 2009Q4	2008Q2 2015Q3	2003Q3 2004Q3	2005Q3 2013Q4	1998Q3 2017Q3

Notes: ADF represents the Augmented Dickey-Fuller (1979) test, KPSS denotes the Kwiatkowski et al. (1992) test, ZA refers to the Zivot and Andrews (1992) test with one structural break, and LS represents the Lee and Strazicich (2003) test with two structural breaks. MacKinnon's (1996) critical values (CV) for the ADF test (intercept only) are -3.50, -2.89, and -2.58 at the 1%, 5%, and 10% significance levels, respectively. The ZA test's critical values for structural change in the level shift are -5.34 (1%), -4.93 (5%), and -4.58 (10%). The KPSS asymptotic critical values are 0.74 (1%), 0.46 (5%), and 0.35 (10%). The LS test's critical values for two shifts in level (the "crash" Model A) are -4.545 (1%), -3.842 (5%), and -3.504 (10%). The ADF and ZA tests examine the null hypothesis of a unit root against the alternative hypothesis of a (trend-)stationary process, with one or two structural breaks. In contrast, the KPSS test evaluates the null hypothesis of stationarity against the alternative hypothesis of a unit root. The optimal lag length selection for the ADF and ZA tests is based on the Schwarz Information Criterion (SIC) (Schwarz, 1978). For the LS test, the traditional general-to-specific approach is used, setting the maximum lag length to 8. The lag order is determined as the point where the t-statistic exceeds the 10% asymptotic critical value (1.645). The bandwidth for the KPSS test is automatically selected using the Newey-West method with the Bartlett kernel. Asterisks (***) indicate significance at the 1% level, (**) at the 5% level, and (*) at the 10% level. T_b denotes the structural break date.

Source: Authors' computation using urca R package (for ADF, KPSS and ZA tests) and R code (for L-S).

Table 3. Bootstrap Fourier ARDL Bounds-testing Result

Lag length	$k*$	Statistics	Values	Bootstrap-generated CVs		
				1%	5%	10%
3,2,2,3,3,2,1	3.5799	F_1	4.614**	8.705	4.455	4.164
		t	-4.817**	-5.534	-4.663	-4.301
		F_2	5.259**	8.301	4.986	4.652

Note: Asterisk (**) denotes significance at the 5% level based on critical values generated from the bootstrap procedure (with 1,000 replications) as outlined by McNown et al. (2018). F_1 represents the F-statistic for the lagged level of the dependent variable, while F_2 denotes the F-statistic for the lagged level of the independent variables. The t-statistic for the lagged level of the dependent variable is represented by t. The optimal lag length is suggested by the Akaike Information Criterion (AIC). k^* refers to the optimal value of the fractional frequency of the Fourier function, which is determined by grid-searching for the value that minimizes the AIC.

Source: Authors' computation using EViews 12.

4.4. Estimation results of the ARDL model with fourier function

Since we have established a cointegrating relationship between the series using the bounds-testing procedure within the bootstrap ARDL model with the Fourier function, the results of the short- and long-run estimates of the selected ARDL model are presented in Table 4. The short-run and long-run estimates, along with the marginal effects of oil price on economic growth and post-estimation diagnostic results, are summarised in panels A, B, C, and D of Table 4, respectively.

Table 4. Results of ARDL Model with Fourier Function

Panel A: ARDL(3,2,2,3,3,2,1) Long-run coefficient estimates–Dependent variable: GDPG

Cons	ln(OILP)	CORR	OILP * CORR	AGR	ln(INTS)	UNEM
–49.538***	9.799***	–12.489***	0.045*	0.579***	–2.339***	–0.125*
(–7.743)	(5.033)	(–4.525)	(1.729)	(6.589)	(–4.152)	(–1.617)

Panel B: ARDL(3,2,2,3,3,2,1) Short-run coefficient estimates – Dependent variable: ΔGDPG

Regressors	Lag order		
	0	1	2
ΔECOG		0.544 (6.069)***	0.274 (3.322)***
Δln(OILP)	12.900 (5.821)***	–10.069 (–3.455)***	
ΔCORR	–26.399 (–6.012)***	18.248 (3.440)***	
Δ(OILP * CORR)	0.118 (3.139)***	–0.105 (–2.520)**	0.028 (1.737)*
ΔAGR	0.712 (6.793)***	–0.353 (–2.913)***	–0.226 (–2.203)**
Δln(INTS)	–2.936 (–3.809)***	2.052 (2.584)**	
ΔUNEM	–0.036 (–0.627)		
γ_1	0.170 (1.390)*		
γ_2	–0.397 (–3.029)***		

Panel C: Marginal effect of OILP on GDPG

Levels of CORR

Level	Values	Marginal Effect(s) of OILP on GDPG
Minimum	–1.438	0.0333
Mean	–1.158	0.0459
Maximum	–0.879	0.0584
Highest control of corruption score	+2.50	0.2105
Least control of corruption score	–2.50	-0.0145

Panel D: Diagnostic test statistics

ECT_{t-1}	χ^2_{SC}	χ^2_{HET}	$\chi^2_{FF}(1)$	χ^2_{J-B}	χ^2_{S-W}	$Adj. R^2$
–0.415*** (–6.974)	0.107 [0.177]	30.598 [0.166]	0.601 [0.441]	99.572 [0.000]	0.919 [0.000]	0.709

Notes: The optimal lag-length is suggested by AIC. Δ represents the first difference operator. Asterisk (***), (**) and (*) denote significance at 1%, 5%, and 10% level, respectively. In panels A and B, in parenthesis (.) are the t-ratio, and values in square parenthesis [.] In panel C are the probability values of the LM test statistics. γ_1 and γ_2 captures the amplitude and displacement of the frequency component, respectively. χ^2_{SC}, χ^2_{HET}, χ^2_{J-B}, χ^2_{S-W} and χ^2_{FF} denote the Breusch-Godfrey serial correlation, Breusch-Pagan-Godfrey heteroscedasticity, Jarque-Bera normality, Shapiro-Wilk normality, and Ramsey RESET's functional form test statistics, respectively. The marginal effects of oil price on economic growth are calculated based on Equation (2).

Source: Authors' computation using EViews 12.

The estimation results presented in Table 4 reveal that oil price has a significant and positive effect on economic growth in both the short and long run, suggesting that positive oil price improve economic growth. This finding aligns with the outcomes of previous studies (Abubakar & Akadiri, 2022; Aliyu, 2009; Akinlo & Apanisile, 2015; David, 2024; Okoro, 2014). Additionally, the results indicate a negative relationship between the control of corruption and economic growth in both the short- and long-term. This suggests that a reduction in corruption (improvement in the control of corruption index) leads to a slowdown in economic growth. This finding supports those reported in prior studies (David et al., 2024; Olayugbo & Adediran, 2017; Rotimi et al., 2022).

Furthermore, the results demonstrate that the interaction between oil price and control of corruption has a significant and positive impact on economic growth, implying that a simultaneous increase in oil prices and a reduction in corruption levels enhance economic growth in both the short and long run. Beyond the net effects, the marginal effect of a percentage increase in oil price on economic growth (panel C) was calculated using the minimum, average, and maximum values of Nigeria's control of corruption index for the 1996-2020 period, alongside the highest (+2.50) and lowest (-2.50) scores for the control of corruption index. The results show that the influence of oil price on economic growth varies with the level of corruption. The higher the level of corruption, the greater the marginal effect of oil prices on economic growth.

Moreover, the results indicate that agricultural output positively contributes to economic growth in both the short and long run. This finding is consistent with previous research (Adesoye et al., 2018; Olabanji et al., 2017; Oyakhilomen & Zibah, 2014). Additionally, the results reveal that domestic security spending negatively impacts economic growth in both the short and long term. This result is consistent with prior studies (see d'Agostino et al., 2012; Dunne & Tian, 2015; Heo, 2010; Hou & Chen, 2013; Mylonidis, 2008; Yakovlev, 2007; Yang et al., 2011). Furthermore, unemployment is significantly and negatively related to economic growth in the long term, a result consistent with previous studies (Jibir et al., 2015).

Finally, the results show that the coefficient of the error correction term lagged by one period (ECT_{t-1}) is less than one, correctly signed, and significant at the 1 percent level. This implies that approximately 41.5 percent of the disequilibrium in economic growth in the short run will be corrected within one quarter.

4.5. Diagnostics and model stability tests

We conducted several post-estimation tests to assess the adequacy of the estimated model for policymaking. The results of these tests are summarised in Panel D of Table 4. The findings show that the estimated model is free from issues of serial correlation, heteroscedasticity, and misspecification errors. However, the Jarque-Bera and Shapiro-Wilk test statistics suggest that the residuals in the estimated model do not follow a normal distribution. Fortunately, existing literature indicates that non-normality of errors may not be problematic, as this is a common characteristic of estimations involving a finite sample size (see David et al., 2024, 2025; Ahad et al., 2011). Additionally, the CUSUM and CUSUMQ plots, based on the cumulative sum of recursive residuals and

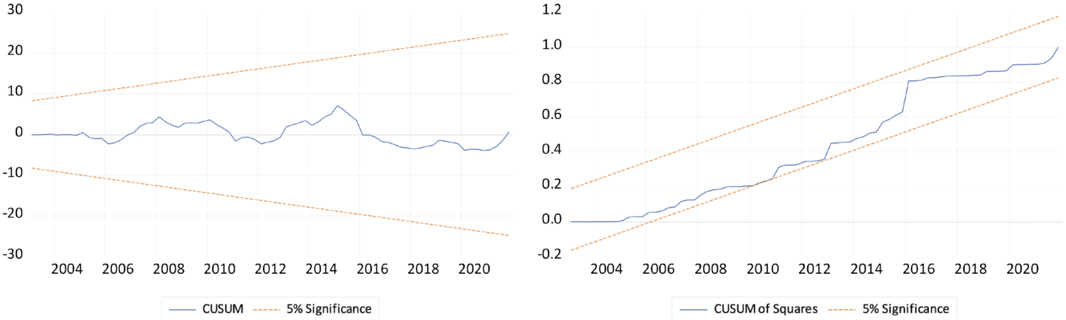

Fig 1 (right) and **Fig 2 (left)** Plots of CUSUM and CUSUMSQ

the cumulative sum of squares of recursive residuals, respectively, as presented by Brown et al. (1975) in Figures 1 and 2, show that the parameters of the estimated model are stable in the long term. Furthermore, the adjusted R-squared (R^2) suggests that the oil price, corruption, their interaction, and the control variables incorporated explain a substantial proportion of the variation in real GDP growth. Therefore, it can be concluded that the empirical findings are suitable for policymaking.

4.6. Simulations of the response of economic growth to changes in oil price and corruption

In addition to the long- and short-run estimates of the ARDL model, we also employ the dynamic ARDL simulation technique recently proposed by Jordan and Philips (2018) to project the response of economic growth to counterfactual changes (or shocks) in oil prices and corruption over a 50-year period (i.e., from 2021 to 2070). The dynamic ARDL simulation procedure typically simulates and automatically visualises the effect of a counterfactual shock in one weakly exogenous regressor at a single point in time using stochastic simulation techniques, while holding all other regressors constant (Jordan & Philips, 2018). This procedure has been applied in studies predicting the future outcomes of social, political, economic, and climate indicators (see Abu et al., 2022; Abubakar & Akadiri, 2022; Ali et al., 2021; Gamal et al.,2024; Khan et al., 2021; Olasehinde-Williams & Oshodi, 2021; Sarkodie & Owusu, 2020).

The simulation plots showing the impact of oil prices and corruption on economic growth over a 50-year period are presented in Figures 3 and 4, respectively. The plot for oil prices illustrates that a 10 percent positive shock in oil prices in the fifth year (2026) results in a significant increase in economic growth, rising from about 0.5 percent during the pre-shock period (2021–2025) to over 0.6 percent. Immediately following the hypothetical oil price shock, the growth rate drops to below 0.6 percent. However, from 2028 to 2070, the predicted growth rate stabilises at around 6 percent in the long term.

Similarly, the simulation plot for a counterfactual change in the control of corruption index (Figure 4) shows a slowdown in economic growth, decreasing from about 5 percent during the 2021–2025 period to around 2.5 percent after a hypothetical improvement in the control of corruption score (a reduction in corruption level) by 10 units in 2026. The plot further indicates that while the predicted

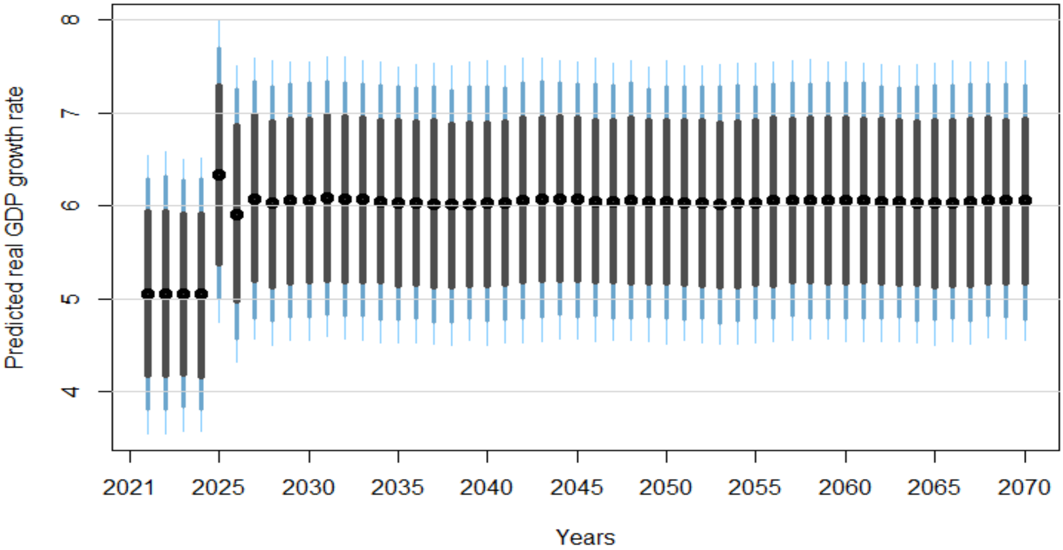

Fig 3. Plot of a counterfactual shock in predicted real GDP growth rate with a 10% increase in oil price

Note: The simulation is executed based on 10,000 replications. Black dots show the average predicted value, while shaded lines (from darkest to lightest) show the 75, 90, and 95 percentiles of the simulations' predictions, similar to a confidence interval.
Source: Authors' computation using dynardl() and dynardl.simulation.plot() functions in dynamac R package.

economic growth rate improves immediately to about 3.5 percent in the two periods following the shock, it takes approximately 22 years (until 2048) for the growth rate to stabilise around 3.8 percent—still below the 5 percent growth recorded during the pre-shock period. Therefore, the simulation results suggest that while reducing corruption may hinder growth in the short term, it is likely to have a positive long-term effect on economic growth.

4.7. Discussions and policy implications

These empirical findings are insightful and carry significant implications. First, the positive effect of oil prices on economic growth underscores the vital role the oil sector plays in the survival of oil-dependent economies, such as Nigeria. As public expenditure in these economies is heavily reliant on oil revenue, the growth-enhancing impact of oil price increases can be better observed through their direct influence on public revenue. An increase in oil prices raises public revenue, which provides the government with much-needed financial resources to invest in both human and physical capital, thereby stimulating economic growth and development. Interestingly, the graph depicting the simulated response of economic growth to counterfactual shocks in oil prices over a 50-year period, shown in Figure 3, suggests that although post-shock economic growth rates may be lower than the oil price-induced growth rate, they remain significantly higher than those observed during the pre-shock periods[2]. Conversely, a negative shock

---

[2] We appreciate the anonymous review for pointing this out.

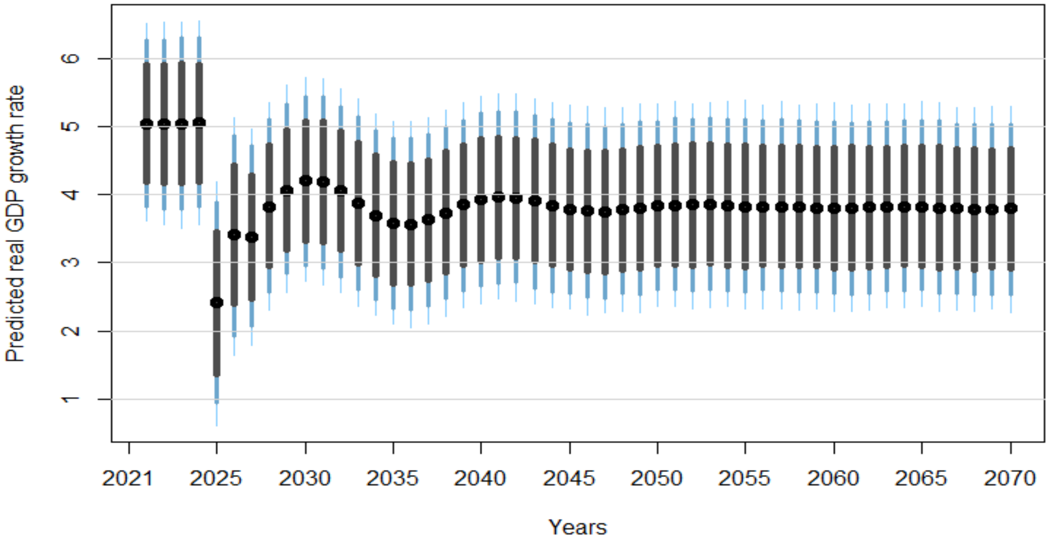

Fig 4. Plot of a counterfactual shock in predicted real GDP growth rate following a 10% increase in control of corruption score (reduction in corruption)

Note: The simulation is executed based on 10,000 replications. Black dots show the average predicted value, while shaded lines (from darkest to lightest) show the 75, 90, and 95 percentiles of the simulations' predictions, similar to a confidence interval.
Source: Authors' computation using dynardl() and dynardl.simulation.plot() functions in dynamac R package.

in oil prices would result in growth levels moving further away from the pre-shock rates.

Second, the negative relationship between corruption and economic growth implies that corruption may, paradoxically, contribute to Nigeria's economic growth. This finding supports the "grease the wheel" hypothesis (Huntington, 1968; Leff, 1964; Lui, 1985), which suggests that corruption can, in some contexts, facilitate economic activity by bypassing bureaucratic inefficiencies. While this finding contradicts the widely held belief that corruption harms economic growth, reducing corruption may lead to bureaucratic delays. For example, improvements in the detection and prosecution of corrupt practices could frustrate bureaucrats who previously used bribes to expedite business processes, such as obtaining permits or approvals, thus slowing down business activities and overall economic growth. Moreover, several studies show that in countries with high levels of corruption, reducing corruption can sometimes negatively impact growth because the benefits of such practices were sustaining growth in those economies (Ahmad et al., 2012; Swaleheen, 2011). However, the simulated response in Figure 4 suggests that while a substantial reduction in corruption initially slows down economic growth, sustained efforts to decrease corruption will eventually lead to improved growth in the long term, although not necessarily to pre-reduction levels.

Third, the positive interaction between oil prices and corruption indicates that oil prices enhance growth in a low-corruption environment but have an adverse impact in situations of high corruption. Several studies have found that natural resources, including oil, can stimulate long-term growth in countries with strong institutions (especially low corruption), but may result in slower growth in countries with weaker institutions and high corruption levels (Acemoglu et al., 2002; David,2024; Karabegović, 2009; Larsen, 2006; Olayungbo & Adediran, 2017). In Nigeria, the widespread embezzlement of oil revenues, mismanagement of oil proceeds, and various corrupt practices within the oil and gas sector have undermined the government's capacity to invest in human capital and development projects, hindering economic growth despite fluctuating oil prices.

Fourth, the positive impact of the agriculture sector on economic growth highlights its importance in driving growth within oil-dependent economies like Nigeria. Despite years of neglect and the underdevelopment of the sector, including the dominance of subsistence farming and outdated agricultural techniques, the sector continues to contribute approximately 22 percent of Nigeria's GDP and employs over 40 percent of the working population. Fifth, the inverse relationship between domestic security spending and economic growth indicates that increased government expenditure on security to address overlapping issues such as insurgency, banditry, and kidnapping, among others, tends to slow economic growth. This is not surprising, as Nigeria's security sector is known to be one of the most corruption-prone in the world. Empirical evidence suggests that increased security spending can hinder economic growth by exacerbating budget deficits, increasing inflation, and diverting funds away from productive public expenditures, thereby contributing to the "guns versus butter" trade-off (d'Agostino et al., 2012; Dunne & Tian, 2015; Heo, 2010; Hou & Chen, 2013; Mylonidis, 2008; Yakovlev, 2007; Yang et al., 2011).

Lastly, the negative relationship between unemployment and economic growth underscores the detrimental effects of high unemployment rates. Unemployment reduces income and savings, which in turn depresses aggregate demand and the production of goods and services, resulting in slower economic growth. Furthermore, high unemployment can drive individuals to engage in social vices such as prostitution, human trafficking, kidnapping, robbery, and terrorism, creating an atmosphere of insecurity and uncertainty. This environment discourages both domestic and foreign investment, leading to capital flight and a further decline in economic output.

5. Conclusion and recommendation

This study employed the bootstrap ARDL model augmented with a Fourier function and the dynamic ARDL simulation techniques to explore whether the effect of oil prices on economic growth is determined by the level of corruption. Using a quarterly time-series dataset for Nigeria from 1996 to 2021, the bootstrap ARDL bounds-testing approach, incorporating the Fourier function, reveals cointegration between economic growth and oil prices, as well as between corruption and the oil price-corruption interaction, alongside agricultural output, domestic security spending, and unemployment. The results show that both oil prices and corruption have a growth-enhancing effect, while the impact of oil prices on economic growth is significantly dependent on the level of corruption. Specifically, the marginal effect of oil prices on economic growth varies with corruption levels. When corruption is low, oil prices have a stronger growth-inducing effect on the economy, whereas higher corruption levels diminish this effect. Furthermore, the dynamic ARDL simulation plots indicate a significant short-term increase (decrease) in economic growth following a counterfactual shock (increase) in oil prices (corruption), which is followed by a gradual decline (increase) in the long term. These findings represent a notable shift from existing studies, which typically focus on the direct effects of oil prices and corruption without considering how corruption influences these relationships. Overall, the study demonstrates that the impact of oil prices on economic growth is largely determined by the prevailing level of corruption.

Based on these findings, we recommend strategies aimed at promoting economic growth, improving agricultural output, and reducing corruption, unemployment, and insecurity. Specifically, policymakers are urged to implement policies that diversify the economy and reduce reliance on oil revenues. This can be achieved through increased investment in both human and physical capital, as well as in non-oil sectors such as services and manufacturing, to foster sustained growth and development.

Second, we encourage the government to adopt practical measures to reduce corruption. Corruption can be addressed and growth can be enhanced by streamlining bureaucratic processes, removing operational red tape, and simplifying cumbersome regulations. Furthermore, raising civil servants' wages, promoting greater freedom of expression, strengthening the rule of law, improving the efficiency of the legal system, and adequately funding anti-corruption agencies can help curb corruption and stimulate economic growth.

Third, given that corruption levels affect the impact of oil prices on economic growth, the government is advised to intensify efforts to reduce corrupt practices within the oil and gas industry. Investigating, arresting, and prosecuting individuals and groups involved in corruption in the sector will help curb malpractices, enhance oil revenues, and boost economic growth. The efficiency of the industry can also be improved by ensuring that state-owned oil companies adopt a culture of accountability and transparency in their operations. Fourth, the government should focus on policies to develop and transform the agricultural sector, primarily through increased spending, access to credit facilities, better quality seedlings, and the mechanisation of agricultural production.

Fifth, while it may be tempting to propose a reduction in domestic security spending to promote growth, the various security challenges in Nigeria—such as kidnapping, cattle rustling, banditry, and conflicts between farmers and herders—necessitate increased spending on public security. To stimulate growth, the government should combat rent-seeking and corruption in the security sector by making the sector more transparent and accountable, and by subjecting the defense budget to public scrutiny. Finally, to reduce unemployment and foster growth, policymakers should focus on improving the quality of education and training, developing the agricultural sector, increasing investment in the manufacturing and service sectors, and lowering lending interest rates to stimulate aggregate demand and domestic investment.

References

Abu, N., David, J., Sakanko, M. A., Amaechi, B.-O. O. (2022). Oil price and public expenditure relationship in Nigeria: Does the level of corruption matter? Economic Studies (Ikonomicheski Izsledvania), 31(3), 59-80.

Abu, N., David, J., Gamal, A. A. M., Obi, B. (2022). Non-linear effect of government debt on public expenditure in Nigeria: Insight from bootstrap ARDL procedure. Organisations and Markets in Emerging Economies, 13(1), 163-182. https://doi.org/10.15388/omee.2022.13.75

Abubakar, I. S. & Akadiri, S. S. (2022). Revisiting oil-rent-output growth nexus in Nigeria: Evidence from dynamic autoregressive lag model and kernel-based regularised approach. Environmental Science and Pollution Research, 29, 45461-45473 https://doi.org/10.1007/s11356-022-19034-z.

Acemoglu, D., Johnson, S., & Robinson, J. A. (2002). An African success: Botswana. In D. Rodriquez, Analytic Development Narratives. Princeton: Princeton University Press.

Adedoyin, F., Ozturk, I., Abubakar, I., Kumeka, T., Folarin, O., & Bekun, F. V. (2020). Structural breaks in CO2 emissions: are they caused by climate change protests or other factors? Journal of Environmental Management, 266, 110628.

Adesoye, B. A., Adelowokan, O. A., Maku, E. O., & Salau, S. O. (2018). Enhancing agricultural value chain for economic diversification in Nigeria. African Journal of Economic Review, 6(1), 103-118.

Ahad, N. A., Yin, T. S., Othman, A. R., & Yaacob, C. R. (2011). Sensitivity of normality tests to non-normal data. Sains Malaysiana, 40(6), 637-641.

Ahmad, E., Ullah, M. A., & Arfeen, M. I. (2012). Does corruption affect economic growth? Latin American Journal of Economics, 49(2), 277-305. https://doi.org/10.7764/LAJE.49.2.277.

Aimer, N. M. (2016). The effects of fluctuations of oil price on economic growth of Libya. Energy Economics Letters, 3(2), 17-29. https://doi.org/10.18488/journal.82/2016.3.2/82.2.17.29.

Akaike, H. (1979). A bayesian extension of the minimum AIC procedure of autoregressive model fitting. Biometrica, 66(2), 237–242. https://doi.org/10.1093/biomet/66.2.237

Akinlo, T., & Apanisile, O. T. (2015). The impact of volatility of oil price on the economic growth in Sub-Saharan Africa. British Journal of Economics, Management & Trade, 5(3), 338-349. https://doi.org/10.9734/BJEMT/2015/12921.

Algahtani, G. J. (2016). The effect of oil price shocks on economic activity in Saudi Arabia: Econometric approach. International Journal of Business and Management, 11(8), 124-133.

Ali, A., Usman, M., Usman, O., & Sarkodie, S. A. (2021). Modelling the effects of agricultural innovation and biocapacity on carbon dioxide emissions in an agrarian-based economy: Evidence from the dynamic ARDL simulations. Frontiers in Energy Research, 8, 592061. https://doi.org/10.3389/fenrg.2020.592061

Aliyu, S. U. R. (2009). Oil price shocks and the macroeconomy of Nigeria: A non-linear approach. Journal of International Bususiness and Entrepreneurship Development, 5(3), 179-198.

Alkhathlan, K. (2013). Contribution of oil in economic growth of Saudi Arabia. Applied Economics Letters, 20, 343-348. https://doi.org/10.1080/13504851.2012.703310

Arain, H., Han, L., Sharif, A., & Meo, M. S. (2019). Investigating the effect of inbound tourism on FDI: The importance of quantile estimations. Tourism Economics, 26(4), 682-703. https://doi.org/10.1177/1354816619859695.

Arezki, R., & Brückner, M. (2009). Oil rents, corruption, and state stability: Evidence from panel data regressions. IMF Working Papers, 09/267.

Batool, R., Sharif, A., Islam, T., Zaman, K., Shoukry, A. M., Sharkawy, M. A., … Hishan, S. S. (2019). Green is clean: the role of ICT in resource management. Environmental

Science and Pollution Research, 26(24), 25341-25358. https://doi.org/10.1007/s11356-019-05748-0.

Becker, R., Enders, W., & Lee, J. (2006). A stationarity test in the presence of an unknown number of smooth breaks. Journal of Time Series Analysis, 27(3), 381-409. https://doi.org/10.1111/j.1467-9892.2006.00478.x

Berument, M. H., Ceylan, N. B., & Dogan, N. (2010). The impact of oil price shock on the economic growth of MENA countries. Energy Journal, 31(1-7). https://doi.org/10.5547/ISSN0195-6574-EJ-Vol31-No1-7.

Boschini, A., Pttersson, J., & Roine, J. (2007). Resource curse or not: A question of appropriability. Scandinavian Journal of Economic, 109(3), 593-617. https://doi.org/10.1111/j.1467-9442.2007.00509.x

Brambor, T., Clark, W. R., & Golder, M. (2006). Understanding interaction models: Improving empirical analyses. Political Analysis, 14(1), 63-82. https://doi.org/10.1093/pan/mpi014

Bravo-Ortega, C., & de Gregorio, J. (2007). The relative richness of the poor? Natural resources, human capital, and economic growth. In D. Lederman, & W. F. Maloney (Eds), Natural resources: Neither curse nor destiny. Washington, DC: World Bank and Stanford University Press.

Brunnschweiler, C. N. (2008). Cursing the blessings? Natural resource abundance, institutions, and economic growth. World Development, 36(3), 399-419.

Cai, Y., Sam, C. Y., & Chang, T. (2018). Nexus between clean energy consumption, economic growth and CO_2 emissions. Journal of Cleaner Production, 182(1), 1001-1011. https://doi.org/10.1016/j.jclepro.2018.02.035

Christopoulos, D. K., & Leon-Ledesma, M. A. (2011). International output convergence, breaks, and asymmetric adjustment. Studies in Nonlinear Dynamics & Econometrics, 15(3), 67-97. https://doi.org/10.2202/1558-3708.1823

Corden, W. M. & Neary, J. P., 1982. Booming sector and de-industrialisation in a small open economy. Economic Journal, 92, 825-848.

d'Agostino, G., Dunne, J. P., & Pieroni, L. (2012). Corruption, military spending and growth. Defence and Peace Economics, 23(6), 591-604. https://doi.org/10.1080/10242694.2012.663579

David, J. (2024). The role of corruption in the oil price-growth relationship: Insights from oil-rich economies. Economic Change and Restructuring, 57(246). https://doi.org/10.1007/s10644-024-09808-5

David, J., Gamal, A.A.M., Mohd Noor, M. A., & Zakariya, Z. (2024). Oil rent, corruption and economic growth relationship in Nigeria: evidence from various estimation techniques. Journal of Money Laundering Control, 27(5), 962-979. https://doi.org/10.1108/JMLC-10-2023-0160

David, J., Gamal, A.A.M., Salem, S.A.M., Viswanathan, K.K., Jalil, N.A. (2025). The role of the underground economy in the oil wealth-growth nexus: new insight from Nigeria. Organization and Markets in Emerging Economies, Forthcoming

Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. Journal of the American statistical association, 74(366a), 427-431.

Dietz, S., & Eric, N. (2005). Corruption, the resource curse and genuine saving. London: London School of Economics and Political Science.

Di John, J. (2011). Is there really a resource curse? A critical survey of theory and evidence. Global Governance, 17(2), 167-184.

Devine, N. (2012). Corruption loves company: The interactive effect of corruption and resources on economic growth (Masters dissertation, University of Missouri, Columbia, Missouri). Retrieved from https://mospace.umsystem.edu/xmlui/handle/10355/15249

Drury, A. C., Krieckhaus, J., & Lusztig, M. (2006). Corruption, democracy, and economic growth. International Political Science Review, 27(2), 121-136. https://doi.org/10.1177/0192512106061423

Dunne, J. P. & Tian, N. (2015). Military expenditure, economic growth and heterogeneity. Defence and Peace Economics, 26(1), 15-31. https://doi.org/10.1080/10242694.2013.848575

Emami, K. & Adibpour, M. (2012). Oil income shocks and economic growth in Iran. Economic modelling, 29, 1774-1779. https://doi.org/10.1016/j.econmod.2012.05.035

Enders, W. & Lee, J. (2012). A unit root test using a Fourier series to approximate smooth breaks. Oxford Bulletin of Economics and Statistics, 74(4), 574-599. https://doi.org/10.1111/j.1468-0084.2011.00662.x

Farzanegan, M. R., Markwardt, G. (2009). The effects of oil price shocks on the Iranian economy. Energy Economics, 31(1),134-151. https://doi.org/10.1016/j.eneco.2008.09.003

Freckleton, M., Wright, A., Craigwell, R. (2012). Economic growth, foreign direct investment and corruption in developed and developing countries. Journal of Economic Studies, 39(6), 639-652. https://doi.org/10.1108/01443581211274593

Gallant, A. R. (1981). On the bias in flexible functional forms and an essentially unbiased form: The Fourier flexible form. Journal of Econometrics, 15(2), 211-245. https://doi.org/10.1016/0304-4076(81)90115-9

Gallant, A. R., & Souza, G. (1991). On the asymptotic normality of Fourier flexible form estimates. Journal of Econometrics, 50(3), 329-353. https://doi.org/10.1016/0304-4076(91)90024-8

Gamal, A.A.M., David, J., Mohd Noor, M.A., Mohd Hussin, M.Y. & Viswanathan, K.K. (2024). Asymmetric effect of shadow economy on environmental pollution in Egypt: evidence from bootstrap NARDL technique. International Journal of Energy Economics and Policy, 14(3), 206–215. https://doi.org/10.32479/ijeep.15605

Gylfason, T. (2001). Natural resources, education, and economic development. European Economic Review, 45(4-6), 847-859. https://doi.org/10.1016/S0014-2921(01)00127-1

Goh, S. K., Sam, C. Y., & McNown, R. (2017). Re-examining foreign direct investment, exports, and economic growth in Asian economies using a bootstrap ARDL test for cointegration. Journal of Asian Economics, 51, 12-22. https://doi.org/10.1016/j.asieco.2017.06.001

Gupta, S., Davoodi, H., & Alonso-Terme, R. (2002). Does corruption affect income inequality and poverty? Economics of Governance, 3(1), 23-45. https://doi.org/10.1007/s101010100039

Gylfason, T. (2001). Natural resources, education, and economic development. European Economic Review, 45(4-6), 847-859. https://doi.org/10.1016/S0014-2921(01)00127-1

Heo, U. (2010). The relationship between defense spending and economic growth in the United States. Political Research Quarterly, 63(4), 760-770. https://doi.org/10.1177/1065912909334427

Hou, N. & Chen, B. (2013). Military expenditure and economic growth in developing countries: evidence from system GMM estimates. Defence and Peace Economics, 24(3), 183-193. https://doi.org/10.1080/10242694.2012.710813

Humphreys, M., Sachs, J. D., & Stiglitz, J. E. (2007). Escaping the resource curse. New York: Columbia University Press.

Huntington, S. P. (1968). Political order in changing societies. New Heaven: Yale University Press.

Jibir, A., Bappayaya, B., & Babayo, H. (2015). Reexamination of the impact of unemployment on economic growth of Nigeria: An econometric approach. Journal of Economics and Sustainable Development, 6(8), 116-123.

Jiménez-Rodríguez, R. & Sánchez, M. (2004). Oil price shocks and real GDP growth: empirical evidence for some OECD countries. ECB Working Paper, (362).

Jordan, S., & Philips, A. Q. (2018). Dynamic simulation and testing for single-equation cointegrating and stationary autoregressive distributed lag models. The R Journal, 10(2), 469-488. https://doi.org/10.32614/RJ-2018-076

Kathuria, K. & Kumar, N. (2022). Are exports and imports of India's trading partners cointegrated? Evidence from Fourier bootstrap ARDL procedure. Empirical Economics, 62(3), 1177-1191. https://doi.org/10.1007/s00181-021-02061-z

Karabegović, A. (2009). Institutions, economic growth, and the "curse" of natural resources. Vancouver, Canadan: Fraser Institute.

Khan, M. K., Teng, J.-Z., Khan, M. I. & Khan, M. F. (2021). Stock market reaction to macroeconomic variables: An assessment with dynamic autoregressive distributed lag simulations. Resource Policy, 73, 101899. https://doi.org/10.1002/ijfe.2543.

Kriskkumar, K., & Naseem, N. A. (2019). Analysis of oil price effect on economic growth of ASEAN net oil exporters. Energies, 12(17), 1-19. https://doi.org/10.3390/en12173343.

Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root? Journal of econometrics, 54(1-3), 159-178. https://doi.org/10.1016/0304-4076(92)90104-Y

Larsen, E. R. (2006). Escaping the resource curse and the Dutch disease? When and why Norway caught up with and forged ahead of its neighbors. American Journal of Economics and Sociology, 65(3), 605-640.

Lee, J., & Strazicich, M. C. (2003) Minimum Lagrange multiplier unit root test with two structural breaks. Review of Economics and Statistics, 85(4), 1082-1089. https://doi.org/10.1162/003465303772815961

Leff, N. H. (1964). Economic development through bureaucratic corruption. American Behavioral Scientist, 8(3), 8-14. https://doi.org/10.1177/000276426400800303

Leite, C., & Weidmann, J. (1999). Does mother nature corrupt? Natural resources, corruption, and economic growth. IMF Working Paper, 99/85. https://doi.org/10.5089/9781451850734.001

Lin, F.-L., Inglesi-Lotz, R., & Chang, T. (2018). Revisit coal consumption, CO_2 emissions and economic growth nexus in China and India using a newly developed bootstrap ARDL bound test. Energy Exploration & Exploitation, 36(3), 450-463. https://doi.org/10.1177/0144598717741031

Ludlow, J., & Enders, W. (2000). Estimating non-linear ARMA models using Fourier coefficients. International Journal of Forecasting, 16(3), 333-347. https://doi.org/10.1016/S0169-2070(00)00048-0

Lui, F. T. (1985). An equilibrium queuing model of bribery. Journal of Political Economy, 93(4), 760-781.

Mackinnon, J. G. (1996). Numerical distribution functions for unit root test. Journal of applied econometrics, 11(6), 601-618.

Mahmood, H., & Murshed, M. (2021). Oil price and economic growth nexus in Saudi Arabia: Asymmetry analysis. International Journal of Energy Economics and Policy, 11(1), 29-33. https://doi.org/10.32479/ijeep.10382

Matallah, S., & Matallah, A. (2016). Oil rents and economic growth in oil-abundant MENA countries: Governance is the trump card to escape the resource trap. Topics in Middle Eastern and African Economies, 18(2), 87-116.

Matthew, A. O., & Adegboye, B. F. (2014). An analysis of the effect of oil price shock and exchange rate instability on economic growth in Nigeria. Scottish Journal of Arts, Social Sciences and Scientific Studies, 18(1), 94-106.

Mauro, P. (1998). Corruption and the composition of government expenditure. Journal of Public Economics, 69, 263-279.

McNown, R., Sam, C. Y., & Goh, S. K. (2018). Bootstrapping the autoregressive distributed lag test for cointegration. Applied Economics, 50(13), 1509-1521. https://doi.org/10.1080/00036846.2017.1366643

Mehlum, H., Moene, K., & Torvik, R. (2006). Institutions and the resource curse. Economic Journal, 116(508), 1-20. https://doi.org/10.1111/j.1468-0297.2006.01045.x

Mehrara, M. (2008). The asymmetric relationship between oil revenues and economic activities: The case of oil-exporting countries. Energy Policy, 36(3), 1164-1168. https://doi.org/10.1016/j.enpol.2007.11.004

Mishra, S., Sharif, A., Khuntia, S., Meo, S. A., & Khan, S. A. R. (2019). Does oil prices impede Islamic stock indices? Fresh insights from wavelet-based quantile-on-quantile approach. Resources Policy, 62, 292-304. https://doi.org/10.1016/j.resourpol.2019.04.005.

Morrissey, O. & Udomkerdmongkol, M. (2012). Governance, private investment and foreign direct investment in developing countries. World Development, 40(3), 437-445.

Moshiri, S. (2015). Asymmetric effects of oil price shocks in oil-exporting countries: the role of institutions. OPEC Energy Review, 39(2), 222-246. https://doi.org/10.1111/opec.12050

Moshiri, S. & Banijashem, A. (2012). Asymmetric effects of oil price shocks on economic growth of oil-exporting countries. USAEE Working Paper, 12-140. https://doi.org/10.2139/ssrn.2163306

Mylonidis, Nikolaos. (2008) Revisiting the Nexus between Military Spending and Growth in the European Union. Defense and Peace Economics, 19(4), 265-272.

Nazlioglu S, Gormus, N. A., & Soytas, U. (2016) Oil prices and real estate investment trusts (REITs): gradual-shift causality and volatility transmission analysis. Energy Economics, 60, 168-175. https://doi.org/10.1016/j.eneco.2016.09.009

Nusair, S. A. (2016). The effects of oil price shocks on the economies of the Gulf Co-operation Council countries: Nonlinear analysis. Energy Policy, 91, 256-267. https://doi.org/10.1016/j.enpol.2016.01.013

Okoro, E. G. (2014). Oil price volatility and economic growth in Nigeria: A vector auto-regression (VAR) approach. Œconomica, 10(1), 70-82.

Olabanji, E., Adebisi, F., Ese, U., & Emmanuel, O. (2017). Agricultural output and economic growth in Nigeria. Journal of African Research in Business & Technology, 2017(1), 1-11. https://doi.org/10.5171/2017. 516093.

Olasehinde-Williams, G., & Oshodi, A. F. (2021). Global value chains and export growth in South Africa: Evidence from dynamic ARDL simulations. Transnational Corporations Review, 1-13. https://doi.org/10.1080/19186444.2021.1959833.

Olayungbo, D. O., & Adediran, K. A. (2017). Effects of oil revenue and institutional quality on economic growth with an ARDL approach. Energy and Policy Research, 4(1), 44-54. https://doi.org/10.1080/23815639.2017.1307146

Oyakhilomen, O., & Zibah, R. G. (2014). Agricultural production and economic growth in Nigeria: Implication for rural poverty alleviation. Quarterly Journal of International Agriculture, 53(3), 207-223.

Omay, T. (2015). Fractional Frequency Flexible Fourier Form to approximate smooth breaks in unit root testing. Economics Letters, 134, 123-126. https://doi.org/10.1016/j.econlet.2015.07.010

Pata U. K. (2019) Environmental Kuznets curve and trade openness in Turkey: bootstrap ARDL approach with a structural break. Environmental Science and Pollution Research, 26(20), 20264-20276. https://doi.org/10.1007/s11356-019-05266-z

R Core Team (2022). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org.

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

Rotimi, M. E., IseOlorunkanmi, O. J., Rotimi, G. G. and Doorsamy, M. (2021). Re-examining corruption and economic growth in oil dependent economy: Nigeria's case. Journal of Money Laundering, 25(3), 526-539. https://doi.org/10.1108/JMLC-06-21-0057

Sachs, J. D., & Warner, A. M. (1995). Natural resource abundance and economic growth. NBER Working Paper, 5398. https://doi.org/10.3386/w5398.

Sachs, J., & Warner, A. M. (1997). Sources of slow growth in african economies. Journal of African Economies, 6(3), 335-376. https://doi.org/10.1093/0xfordjournal.jae.a020932

Sachs, D. J., & Warner, A. M. (2001). Natural resources and economic development: The curse of natural resources. European Economic Review, 45(4-6), 827-838. https://doi.org/10.1016/S0014-2921(01)00125-8

Sarkodie, S. A., & Owusu, P. A. (2020). How to apply the novel dynamic ARDL simulations (dynardl) and Kernel-based regularised least squares (KRLS). MethodsX, 7, 101160. https://doi.org/10.1016/j.mex.2020.101160

Sala-i-Martin, X., & Subramanian, A. (2003). Addressing the natural resource curse: An illustration from Nigeria. NBER Working Paper, 9804. Retrieved from http://www.nber.org/papers/w9804

Sam, C. Y., McNown, R., & Goh, S. K. (2019). An augmented autoregressive distributed lag bounds test for cointegration. Economic Modelling, 80,130-141. https://doi.org/10.1016/j.econmod.2018.11.001.

Schwarz, G. E. (1978). Estimating the dimension of a model. Annals of Statistics, 6(2), 461-464. https://doi.org/10.1214/aos/1176344136

Shahbaz, M., Zakaria, M., Shahzad, S. J. H., & Mahalik, M. K. (2018). The energy consumption and economic growth nexus in top ten energy-consuming countries: fresh evidence from using the quantile-on-quantile approach. Energy Economics, 71, 282-301. https://doi.org/10.1016/j.eneco.2018.02.023.

Shahzad, S. J. H., Shahbaz, M., Ferrer, R., & Kumar, R. R. (2017). Tourism-led growth hypothesis in the top ten tourist destinations: New evidence using the quantile-on-quantile approach. Tourism Management, 60, 223-232. https://doi.org/10.1016/j.tourman.2016.12.006.

Sharif, A., Afshan, S., & Qureshi, M. A. (2019). Idolisation and ramification between globalisation and ecological footprints: Evidence from quantile-on-quantile approach. Environmental Science and Pollution Control Research, 26(11), 11191-11211. https://doi.org/10.1007/s11356-019-04351-7.

Solarin, S. A. (2019). Modelling the relationship between financing by Islamic banking system and environmental quality: Evidence from bootstrap autoregressive distributive lag with Fourier terms. Quality and Quantity, 53(6), 2867-2884. https://doi.org/10.1007/s11135-019-00904-7.

Stijns, J.-P. (2006). Natural resource abundance and human capital accumulation. World Development, 34(6), 1060-1083.

Swaleheen, M. (2011). Economic growth with endogenous corruption: an empirical study. Public Choice, 146(1-2), 23-41. https://doi.org/10.1007/s11127-009-9581-1

Tanzi, V., Davoodi, H. (1997). Corruption, public investment and growth. IMF Working Paper, 97/139.

van der Ploeg, F., & Arezki, R. (2008). Can the natural resource curse be turned into a blessing? The role of trade policies and institutions. Oxford Centre for the Analysis of Resource-Rich Economies Paper, 2008/01.

Vogel, K. B. (2020). The effect of oil windfalls on corruption: Evidence from Brazil. American Political Science Association (APSA) Working Paper. https://doi.org/10.33774/apsa-2020-wpt3g

Yakovlev, P. (2007). Arms trade, military spending, and economic growth. Defence and Peace Economics, 18(4), 317-338. https://doi.org/10.1080/10242690601099679

Yakubu, M. M., & Akanegbu, B. N. (2019). Oil price volatility and economic growth in Nigeria. Advances in Management & Applied Economics, 9(6), 1-10.

Yang, Albert J.F., William N. Trumbull, Chin Wei Yang, & Bwo-Nung Huang. (2011) On the Relationship between Military Expenditure, Threat, and Economic Growth: A Nonlinear Approach. Defense and Peace Economics, 22(4), 449-457.

Yilanci, V., Bozoklu, S., & Gorus, M.S. (2020). Are BRICS countries pollution havens? Evidence from a Bootstrap ARDL Bounds testing approach with a Fourier function. Sustainable Cities and Society, 55. https://doi.org/10.1016/j.scs.2020.102035.

Zivot, E., & Andrews, D. W. (1992). Further evidence on the great crash, the oil-price shock, and the unit-root hypothesis. Journal of Business & Economic Statistics, 10(1), 251-270. https://doi.org/10.2307/1391541