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Oil rent, corruption and economic growth relationship in Nigeria: evidence from various estimation techniques

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Abstract

Purpose – Despite the huge financial resources associated with oil, Nigeria has consistently recorded poor growth performance. Therefore, this study aims to examine how corruption and oil rent influence Nigeria's economic performance during the 1996–2021 period.

Design/methodology/approach – Various estimation techniques were used. These include the bootstrap autoregressive distributed lag (ARDL) bounds-testing, dynamic ordinary least squares (DOLS), the fully modified OLS (FMOLS) and the canonical cointegration regression (CCR) estimators and the Toda–Yamamoto causality.

Findings – The bounds testing results provide evidence of a cointegrating relationship between the variables. In addition, the results of the ARDL, DOLS, CCR and FMOLS estimators demonstrate that oil rent and corruption have a significant positive impact on growth. Further, the results indicate that human capital and financial development enhance economic growth, whereas domestic investment and unemployment rates slow down long-term growth. Additionally, the causality test results illustrate the presence of a one-way causality from oil rent to economic growth and a bi-directional causal relationship between corruption and economic growth.

Originality/value – Existing studies focused on the effects of either oil rent or corruption on growth in Nigeria. Little attention has been paid to the exploration of how the rent from oil and the pervasiveness of corruption contribute to the performance of the Nigerian economy. Based on the outcome of this study, strategies and policies geared towards reducing oil dependence and the pervasiveness of corruption, enhancing human capital and financial development and reducing unemployment are recommended.

Keywords Oil rent, Corruption, Human capital, Economic growth, Bootstrap ARDL, Nigeria

Paper type Research paper

JEL classification – C22, O13, Q32, O43

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1. Introduction

The role of natural resources in promoting growth is well documented in early development literature (see Rostow, 1961). The argument is generally made on the basis that the ensuing rents from natural resources provide governments with resources to provide public goods and invest in human and physical capital for development (Rosser, 2009). In recent decades, however, natural resources and the rent accrued from its sales have been widely associated with poor economic and social outcomes (Sachs and Warner, 1995). Rather than promoting development, it is argued that natural resource wealth in fact reduces economic growth, increases poverty, impairs health and education outcomes, impedes democracy, lowers the status of women and increases the incidence, duration and intensity of civil war (Blanton and Peksen, 2023). This position is well accentuated by the poor economic performance of countries rich in oil, minerals and other natural resources compared with the fast growth rates experienced in resource-poor East Asian countries (Sachs and Warner, 2001).

Like most countries with large deposits of natural resources, the abundance of crude oil in Nigeria has been associated with the country's economic sustainability (Olayungbo and Adediran, 2017). Over the years, the sizable crude oil deposit has contributed to the economy, in terms of increased revenue, infrastructural development and foreign investment. However, despite the huge oil wealth, Nigeria has consistently maintained an unimpressive economic performance compared to resource-poor countries (World Bank, 2023). For instance, while Nigeria received about US$853.36bn in oil rent cumulatively between 1971 and 2020, current reality suggests that revenue accrued from oil sales did not seem to add to the standard of living of most Nigerians as the country's per capita income has remained at the pre-1970s oil boom periods (World Bank, 2023). Besides, the country has also been characterised by exceptionally high rates of poverty, unemployment, income inequality, insecurity and deteriorating standard of living, among other precarious development indicators [National Bureau of Statistics (NBS), 2020a, 2020b, 2022; World Bank, 2023].

Besides the developmental challenges confronting Nigeria, the country has also continued to contend with massive corruption, evidenced by various reports of prominent international organisations such as Transparency International (TI), Political Risk Service Group and the World Bank among others. Despite the efforts of successive administration in tackling corruption, Nigeria has consistently ranked high in the league of corrupt nations in the world. For instance, in TI's 2022 country comparison corruption perception ranking, Nigeria ranks low at 150 out of 180 countries, only ahead of war-torn countries such as Iraq, Somalia, Yemen, Chad, Sudan, Libya and Syria.

Recently, evidence has shown that in natural resource-rich countries such as Nigeria, the dependence of the economy on the ensuing wealth tends to fuel the pervasiveness of corruption (Arezki and Brückner, 2009; Vogel, 2020). Thus, by directly influencing the level of corruption, it is suggestive that the rent from natural resources such as oil and the pervasiveness of corruption would together impair economic growth and development. This argument is premised on the fact that oil wealth fuels pervasive corruption in oil-rich countries, and such pervasiveness provides an important opportunity for corrupt politicians and officials to misappropriate, under-remit, mismanage and waste oil rents (Leite and Weidmann, 1999). Consequently, this leads to poor economic outcomes.

Despite the unimpressive growth performance, coupled with the widespread corruption in the country, researchers have paid little attention to assessing the effect of oil rent and corruption on economic growth until recently (see Raifu, 2021; Rotimi *et al.*, 2021; Waziri and Azare, 2020). While the studies deserve some commendations, the presence of some methodological weaknesses, such as the use of a small sample size, absence of important diagnostic tests and exclusion of relevant variables, tend to affect the reliability of the conclusion of studies. The presence study is important and contributes to the existing literature for a number of reasons. First, this study uses different estimation techniques, including the recently developed bootstrap autoregressive distributed lag (ARDL), the canonical cointegration regression (CCR), dynamic ordinary least squares (DOLS) and the fully modified OLS (FMOLS) to explore the effect of oil rent and corruption in Nigeria between 1996 and 2021. One of the advantages of using different estimation techniques is that we are able to determine the consistency and robustness of the results. Second, to overcome the shortcomings of past studies regarding small sample size, this study uses a robust interpolation technique suggested in the literature to transform the finite annual datasets into quarterly data. Third, the study conducts important diagnostics tests, including the serial-correlation, heteroscedasticity and model stability tests, which some of the existing studies failed to conduct to check the reliability of the results generated. Finally, the outcome of the present study is expected to rekindle debate on the subject matter and expand the frontiers of knowledge among economists, researchers, policy analysts and policymakers in Nigeria and beyond.

The rest of this paper is structured as follows. Section 2 provides literature review on the oil rent, corruption and growth relationship. The methodology is discussed in Section 3. In Section 4 the estimation results are presented and discussed. The study is concluded and policy implication is provided in Section 5.

2. Review of empirical literature

Over time, several efforts have been made to explore the direct effect of oil rent and corruption on economic growth, albeit in isolation, from different perspectives. For instance, some focused on a group of countries (see Asiedu *et al.*, 2021; Eregha and Mesagan, 2020; Fuinhas *et al.*, 2015; Hordofa *et al.*, 2022; Matallah and Matallah, 2016; Mesagan *et al.*, 2019a, 2019b; Ofori and Grechyna, 2021). Besides Fuinhas *et al.* (2015), all these studies conclude that oil rent promotes growth. The relationship has also been explored at country-specific level in oil-dependent countries such as Ghana, Iran, Malaysia, Nigeria and Sudan, and similar conclusion has been made (Adabor *et al.*, 2022; Dada and Abanikanda, 2019; Emami and Adibpour, 2012; Mesagan *et al.*, 2019a, 2019b; Mohamed, 2020; Okoye *et al.*, 2022; Opoku and Buabeng, 2021; Raifu, 2023). On the contrary, others confirmed a negative relationship between oil rent and growth (Adamu *et al.*, 2021; Inuwa *et al.*, 2022; Mesagan *et al.*, 2019a, 2019b; Oludimu and Alola, 2022), while Badeeb *et al.* (2021) concluded that the relationship is insignificant.

Research has also been conducted to examine the corruption–growth relationship. From a cross-country perspective, some studies discovered that corruption impairs growth (see Afonso and de Sá Fortes Leitão Rodrigues, 2022; Ahmad *et al.*, 2012; Akıncı *et al.*, 2022; Bentzen, 2012; Gründler and Potrafke, 2019; Hakimi and Hamdi, 2017; Mauro, 1995; Shahbaz *et al.*, 2018; Shittu *et al.*, 2018; Spyromitros and Panagiotidis, 2022; Swaleheen, 2007), whereas others reveal that corruption and economic growth are positively related (see Kesar and Jena, 2022). In some group of countries, Drury *et al.* (2006) confirmed an insignificant relationship. From a country-level perspective, a number of studies demonstrate a negative relationship between corruption and growth in Italy, the USA and Nigeria (see Del Monte and Papagni, 2001; Glaeser and Saks, 2006; Ndem *et al.*, 2022; Rotimi *et al.*, 2013).

While studies on the effects of oil rent and corruption on growth abounds, very few studies focused on how they contribute to influencing growth, both within and without Nigeria. Most of the studies are either considering the joint effect of natural resources (including oil) and institutions on growth (see Akanni, 2007; Brunnschweiler and Bulte, 2008; Ji *et al.*, 2014; Hassan *et al.*, 2019; Raifu, 2021; Saâdaoui and Jbir, 2021; Zallé, 2019) or the impact of natural resources and corruption on growth (see Devine, 2012; Oyinlola *et al.*, 2015; Papyrakis and Gerlach, 2004). Others focused on the effect of oil wealth and corruption on growth (Eregha and Mesagan, 2019). In Nigeria, a handful of studies examined the relationship between oil rent, corruption and economic growth (see Abubakar and Akadiri, 2022; Olayungbo and Adediran, 2017; Rotimi *et al.*, 2021; Waziri and Azare, 2020). However, due to the methodological gap of some of the studies, the discourse on the relationship has remained inconclusive. Therefore, this study contributes to the literature by assessing the effect of oil rent and corruption on economic growth in Nigeria between 1996Q1 and 2021Q4 using a battery of robust estimation approaches.

3. Methodology

3.1 Model specification

To examine the effect of oil rent and corruption on economic growth in Nigeria, we follow Olayungbo and Adediran (2017) and specify an econometric model as follows:

$$lnY_t = a_0 + b_1 lnOILR_t + b_2 CORR_t + \varphi' Z_t + \varepsilon_t \tag{1}$$

where ln is natural log (to reduce skewness), $t = 1, 2 \ldots, T$ denotes time. lnY is economic growth (measured as real per capita gross domestic product [GDP]), $lnOILR$ denotes oil rent and $CORR$ represents corruption. Z is a set of control variables (human capital development, financial development, exchange rate, domestic investment and unemployment). ε_t is stochastic error term, α_0 is intercept and b_i and φ are slope coefficients.

3.2 Data issues

A major constraint to a study of this nature is getting substantial data on corruption. The notable corruption index of the World Bank is only available from 1996 to 2021, which falls short of the requirement for a time series analysis. Therefore, we transform the annual data set covering the 1996–2021 period into quarterly data, spanning from 1996Q1 to 2021Q4, using the quadratic match average data interpolation technique suggested in the literature (Arain *et al.*, 2019; Sharif *et al.*, 2019). One of the significant advantages of the method lies in its ability to address end-to-end deviation during the conversion of low-frequency data into high-frequency data (Batool *et al.*, 2019; Mishra *et al.*, 2019).

The variables are measured as follows. Y is measured based on GDP per capita in constant 2015 US$. $OILR$ is the differences between the cost of production of oil and what is received in monetary or financial terms (in US$). $CORR$ is captured by using the World Bank's Worldwide Governance Indicator (WGI) control of the corruption index. The index takes a value of -2.5 to 2.5, and higher values indicate that corruption is low and vice versa. To reflect the level of corruption and make interpretation straightforward, the control of the corruption index is rescaled by subtracting the values of the index from 2.5 (the maximum possible value). Human capital development is measured using the Penn World Table's human capital index. The exchange rate is measured based on the unit price of naira relative to the US dollar based on monthly averages. Financial development is measured using International Monetary Fund's (IMF's) financial development index. Domestic investment is measured as a ratio of gross fixed capital formation to the GDP in a particular year. The annual percentage unemployment rate is used to measure unemployment. The data on the variables are collected from various sources, including the World Bank's World Development Indicators and WGI, the National Bureau of Statistics, the IMF and the Central Bank of Nigeria.

3.3 Econometric technique

To explore the impact of oil rent and corruption on economic growth in Nigeria, we will use the bootstrap ARDL bounds-testing approach proposed by McNown *et al.* (2018). The technique is an extension of the ARDL bounds-testing technique of Pesaran *et al.* (2001). The method addressed the weak size and power properties that characterised the traditional bounds-testing approach (Abu *et al.*, 2022a, 2022b; David *et al.*, 2023). Building on the bounds-testing framework of Pesaran *et al.* (2001), the approach included an additional cointegration test on the lagged level(s) of the independent variable(s) to complement the existing *F*- and *t*-tests of Pesaran *et al.* (2001), thus increasing the power of the *F*-test. By extension, this provides a better and more robust insight regarding the cointegration status of the system. Moreover, the bootstrap-generated critical values eliminate inconclusive inferences that characterised the traditional ARDL procedure (McNown *et al.*, 2018).

Generally, a bivariate ARDL can be written as follows:

$$y_t = c + \sum_{i=1}^{p} \sigma_i' y_{t-i} + \sum_{j=0}^{q} \vartheta_i' x_{t-i} + \upsilon_t \tag{2}$$

where i and j are the index of lags, $i = 1, 2, \ldots, p; j = 0, 1, 2, \ldots, q$. $t = 1, 2 \ldots, T$ denotes time. y_t is the dependent variable, and x_t is the independent variable. σ_i and ϑ_i, are the coefficient of the lags of y_t and x_t, respectively. c is the constant term and υ_t is the stochastic error term. The optimal lag lengths (p and q) are selected based on AIC suggestion.

Equation (2) can be re-parameterised and expressed in an error correction representation as follows:

$$\Delta y_t = c + \rho' y_{t-1} + \gamma' x_{t-1} + \sum_{i=1}^{p-1} \lambda_i' \, \Delta y_{t-i} + \sum_{j=1}^{q-1} \delta_i' \, \Delta x_{t-i} + \upsilon_t \tag{3}$$

Where Δ represents the difference operator; λ_i and δ_i are functions of the original parameters in equation (3). $\rho = -\left(1 - \sum_{i=0}^{p} \sigma_i\right)$ and $\gamma = \sum_{j=0}^{p} \vartheta_j$.

Following McNown *et al.* (2018), the cointegration between y_t and x_t is established by testing the following three hypotheses: H_0: $\rho = \gamma = 0$, based on the overall F-test on all lagged-level variables (F_1); H_0: $\rho = 0$, based on the t-test on the lagged level of the dependent variable (t); and H_0: $\gamma = 0$, based on the F-test on the lagged levels of the independent variable(s) (F_2). All three null hypotheses are expected to be rejected for a valid conclusion on cointegration to be reached.

If cointegrating (long-run) is established, then the long-run estimate is obtained by normalising the coefficients of the lagged explanatory variables (γ) by the coefficient of lagged dependent variables (ρ), i.e. $-(\gamma/\rho)$. The corresponding dynamic short-run error correction model is specific as follows:

$$\Delta y_t = c + \sum_{i=1}^{p} \zeta_i' \Delta y_{t-i} + \sum_{i=1}^{q} \xi_i' \Delta x_{t-i} + \phi \mu_{t-1} + \varepsilon_t \tag{4}$$

where ϕ is the coefficient of the error term lagged by one period (μ_{t-1}). It represents the speed of adjustment back to equilibrium in the long-run following a deviation from the equilibrium in the short-run.

In addition to the bootstrap ARDL bounds testing approach, three other cointegration techniques are used. These include the CCR of Park (1992), DOLS of Saikkonen (1992) and Stock and Watson (1993) and the FMOLS of Hansen and Phillips (1990). One of the major advantages of these single cointegrating vector estimation techniques is their ability to solve issues like endogeneity bias and serial-correlation, in addition to the provision of more efficient results when using finite samples (Narayan and Narayan, 2004). In addition to cointegration tests, we also explore the causal relationship between the variables using the Toda–Yamamoto Granger no-causality tests (Toda and Yamamoto, 1995). The approach addressed the major issues in the traditional Granger test while dealing with the issue of asymptotic critical values in the absence of cointegration and reducing the risks associated with wrong determination of the order of integration (Toda and Yamamoto, 1995).

4. Results and discussion

4.1 Descriptive statistics and correlations analysis

The computed descriptive statistics of the variables are presented in Table 1. The results reveal that the average of log of real per capita GDP, log of oil rent, World Bank's rescaled control of corruption index, human capital index, log of exchange rate, financial development index, domestic investment (% of GDP) and unemployment rate between 1996 and 2021 are 2.63 (US$2,109.568), 23.71 (US$27.5 billion), 3.674, 1.701, 4.884 (N165.853), 0.204, 24.389% and 19.753%, respectively. The corresponding standard deviation are 0.225 (443.267), 0.889 (19.900), 0.143, 0.204, 0.779 (97.913), 0.025, 8.446 and 4.856, respectively, and it suggests that the data points are relatively stable. However, the skewness and kurtosis values of the variables demonstrate that the data points are not normally distributed.

The results of the correlation analysis are presented in Table 2. The results demonstrate a statistically significant, positive and strong correlation between human capital and economic growth ($r = 0.94$), log of exchange rate and economic growth ($r = 0.77$) and financial development index and economic growth ($r = 0.72$). In addition, the results illustrate that the correlation between oil rent and economic growth is positive and moderate ($r = 0.63$), and the correlation between domestic investment (% of GDP) and economic growth ($r = -0.86$) is significant, negative and strong. Furthermore, the correlation between the oil rent and corruption index is weak, negative and significant ($r = -0.29$). On the other hand, the correlation between the unemployment rate and economic growth is negative but insignificant.

	Mean	SD	Skewness	Kurtosis	Max.	Min.	Obs.
lnY	7.630	0.225	−0.515	1.712	7.899	7.264	104
lnOILR	23.709	0.887	−0.472	2.415	24.989	21.339	104
RCORR	3.674	0.143	0.585	2.786	4.008	3.389	104
HC	1.701	0.204	−0.105	1.759	2.034	1.351	104
lnEX	4.884	0.779	−1.268	4.579	6.024	2.382	104
FD	0.204	0.025	0.414	3.069	0.2739	0.152	104
DI	24.389	8.466	0.411	1.943	40.700	13.973	104
UE	19.753	4.856	2.035	6.998	36.334	13.107	104

Notes: *lnY* = real GDP per capital; *lnY* = natural log of per capita GDP; *OILR* = oil rent (US$bn); *lnOILR* = natural log of oil rent; RCORR = rescaled World Bank's WGDI control of corruption; HC = human capital index; FD = financial development index; *lnEX* = natural log of exchange rate; gross fixed capital formation (domestic investment); UE = unemployment rate
Source: Authors' computation

Table 1.
Summary statistics

4.2 Results of unit root test

Before estimating the growth model, a unit root test is conducted to determine the stationarity property of the series. For this purpose, the conventional augmented Dickey–Fuller (ADF) and the Philips–Perron (PP) tests are conducted. The results of the unit root tests are summarised in Table 3. The results suggest that *RCORR* is stationary in level and thus integrated of order zero [I(0) process]. On the other hand, the test results demonstrate that *lnY*, *lnOILR*, *HC*, *lnEX*, *FD*, *DI* and *UE* are stationary after taking their first difference, indicating that the variables are integrated of order one [i.e. I(1) process]. Therefore, this suggests that the series is a mixture of I(0) and (1).

4.3 Results of bootstrap autoregressive distributed lag bounds-testing to cointegration

To determine the presence of a cointegrating relationship between the series, the bootstrap bounds-testing approach proposed by McNown *et al.* (2018) is adopted. The results of the test statistics of the three tests (i.e. F_1, t, F_2) and the corresponding bootstrap-generated critical values are summarised in Table 4. The results illustrate that the values of the F-statistic (F_1), t-statistic on the lagged level dependent variable (t) and F-statistic on lagged level independent variables (F_2) all exceed the bootstrap-generated critical values at a 5% level. Therefore, the null hypothesis of no cointegration among the series is rejected.

	lnY	*lnOILR*	*RCORR*	*HC*	*lnEC*	*FD*	*DI*	*UE*
lnY	1.00							
lnOILR	0.63***	1.00						
RCORR	−0.52***	−0.29***	1.00					
HC	0.94***	0.45***	−0.53***	1.00				
lnEC	0.77***	0.41***	−0.24**	0.86***	1.00			
FD	0.72***	0.52***	−0.72***	0.71***	0.55***	1.00		
DI	−0.86***	−0.77***	0.33***	−0.68***	−0.61***	−0.59***	1.00	
UE	0.13	−0.32***	0.02	0.38**	0.45***	0.04	0.21**	1.00

Note: Asterisks (***) and (**) denotes statistical significance at 1% and 5% levels, respectively
Source: Authors' computation

Table 2.
Correlation analysis

Variable(s)	ADF Level	ADF 1st diff.	I(d)	PP Level	PP 1st diff.	I(d)
lnY	−1.625	−3.717***	I(1)	−1.469	−3.901***	I(1)
lnOILR	−1.279	−2.999**	I(1)	−1.302	−2.869**	I(1)
RCORR	−2.680*	–	I(0)	−1.579	−5.088***	I(1)
HC	−1.641	−3.268**	I(1)	−1.373	−3.262**	I(1)
lnEX	−0.219	−5.086**	I(1)	−1.832	−6.593***	I(1)
FD	−1.500	−2.902**	I(1)	−2.397	−4.656***	I(1)
DI	−1.971	−3.198**	I(1)	−1.041	−3.670***	I(1)
UE	0.019	−3.081**	I(1)	−1.574	−5.421**	I(1)

Notes: I(d) denotes variables' order of integration. Both ADF and PP tests are conducted with intercept (random walk with drift). MacKinnon's (1996) critical values for intercept are given as: −3.50, −2.89 and −2.58, at 1, 5 and 10% levels, respectively. The models are estimated by setting the maximum lag to 12, while the optimal lag-length is selected based on Schwarz's (1978) information criteria. Asterisks (***), (**) and (*) indicate significance at 1, 5 and 10% level, respectively
Source: Estimation output

Table 3.
Results of unit root tests

4.4 Estimation results of the autoregressive distributed lag model

Following the confirmation of cointegration among the series, a long-run model and restricted error correction ARDL (short-run) model with an optimal lag-length of (2,0,1,4,0,4,0,1), as suggested by AIC, are estimated. The results of both models alongside the post-estimation diagnostics are reported in Panel A, Panel B and Panel C of Table 5, respectively.

The results of the long- and short-run estimates of the selected models illustrate that oil rent has a significant positive effect on economic growth in the long-run at 5% level of significance. A percent increase in oil rent leads to improvement in economic growth by 0.036% in the long term. This finding is consistent with the ones reported in previous studies in Nigeria (see Abubakar and Akadiri, 2022; Inuwa *et al.*, 2022; Okoye *et al.*, 2022; Olayungbo and Adediran, 2017; Raifu, 2023; Rotimi *et al.*, 2021; Waziri and Azare, 2020).

			Bootstrap-generated CVs		
Lag length	Statistics	Values	1%	5%	10%
2,0,1,4,0,4,0,1	F_1	6.279**	7.519	6.140	5.371
	t	−4.622**	−4.973	−3.922	−3.43
	F_2	4.796**	6.069	4.571	3.959

Notes: Asterisk (**) denotes significance at a 5% level based on critical values generated from the bootstrap procedure (with 1,000 replications) of McNown *et al.* (2018). F_1 represents the F-statistic for the lagged level variables F_2 denotes the F-statistic for the lagged level of the independent variables, and t is the t-statistic for the lagged level of the dependent variable. The optimal lag-length is suggested by AIC
Source: Authors' computation using EViews 13

Table 4. Bootstrap Fourier ARDL bounds-testing result

Panel A: ARDL(2,0,1,4,0,4,0,1) long-run coefficient estimates – Dependent variable: lnY

Cons	lnOILR	RCORR	HC	lnEX	FD	DI	UE
3.821***	0.036**	0.497***	0.865***	−0.155***	1.789*	−0.015***	0.0052
(4.093)	(2.199)	(2.888)	(5.216)	(−3.844)	(1.871)	(−5.519)	(1.343)

Panel B: ARDL(2,0,1,4,0,4,0,1) short−run coefficient estimates – Dependent variable: ΔlnY

	Lag order			
Regressors	0	1	2	3
ΔlnY		0.245 (2.816)***		
$\Delta RCORR$	0.075 (3.764)***			
ΔHC	−4.906 (−2.158)***	3.645 (1.302)	2.090 (0.758)	3.751 (1.641)*
ΔFD	0.541 (3.064)***	−0.386 (−1.844)*	−0.274 (−1.309)	−0.394 (−2.202)**
ΔUE	−0.0007 (−1.886)***			

Panel C: Diagnostic statistics tests

ECT_{t-1}	$\chi^2_{SC}(3)$	$\chi^2_{FF}(1)$	χ^2_{HET}	χ^2_{NORM}	$Adj.R^2$
−0.078*** (−7.247)	0.187 [0.911]	0.051 [0.822]	22.606 [0.255]	594.15 [0.000]	0.736

Notes: **Δ** represent first difference operator. Asterisk (***), (**) and (*) denote significance at 1, 5 and 1% level, respectively. Values in parenthesis (.) in Panel A and B are the *t*-ratio, and values in square parenthesis [.] in panel C are the probability values of the LM test statistics. χ^2_{SC}, χ^2_{HET}, χ^2_{N} and χ^2_{FF} denote BG LM tests for serial correlation, BPG LM test heteroscedasticity, JB normality test and Ramsey RESET *f*-statistic, respectively. The model is estimated by setting the maximum lag to 4, while the optimal lag-length is suggested by AIC
Source: Estimation output

Table 5. Estimation results of the ARDL model

The results demonstrate the importance of oil rent in the growth of Nigeria's economy, through its role in providing the necessary resources for job creation, technological enhancement and the provision of foreign currency required for foreign trade.

In addition, the results demonstrate that corruption is positively related to growth in the long-run and short-run at 1% significance level. A unit increase of the (rescaled) control of corruption index (that is, increase in corruption) leads to increase in economic growth by 64.38% in the long-run. Also, an increase in the corruption index by a unit leads to an improvement in economic growth by 7.788% in the short-run. This finding is consistent with the outcomes of prior studies in Nigeria (see Olayungbo and Adediran, 2017; Sunkanmi and Isola, 2014). The positive relationship between corruption and economic growth indicates that the increase in the level of corruption will promote economic growth in Nigeria. Moreover, this finding supports the "grease the wheel" hypothesis, which posited that corruption enhances economic growth by serving as "efficiency grease" to the wheels of otherwise inefficient institutions/bureaucracies (see Huntington, 1968; Leff, 1964).

Regarding other variables, the results show a significant positive relationship between human capital and economic growth in the long-run, and an inverse relationship between human capital development and economic growth in the short-run. A unit increase in the human capital index raises economic growth by more than 100% (137.501%) in the long-run. However, in the short-run, a unit increase in human capital index slows down economic growth by −99.26%. The significance positive effect of human capital development on economic growth in the long-run supports previous empirical studies (see Zallé, 2019; Raifu, 2021, 2023) and reflects the important role of human capital development in enhancing economic growth and development. However, the negative relationship between human capital development and economic growth in the short-run, while contradicting the anecdotal and empirical position, reflects the low and unimpressive posture of Nigeria towards human capital development and its consequence on social and economic development in the country.

In addition, the results indicate that exchange rate (depreciation) has a significant negative impact on economic growth in the long-run. A unit increase (depreciation) in exchange rate leads to the deceleration in economic growth by 0.155% in the long-run. The outcome substantiates the findings of recent studies on the relationship between exchange rate and economic growth in Nigeria (see Olamide *et al.*, 2022; Mesagan *et al.*, 2022). The negative relationship between exchange rate depreciation and economic growth clearly depicts the adverse implication of the depreciation of the local currency (Naira) in the economy due to the undiversified nature of the country's export basket and the heavy reliance of the country on the import of goods and services, ranging from raw materials and machineries to basic household commodities and refined petroleum products. Moreover, the results reveal that financial development has a statistically significant positive effect on economic growth in the short- and long-run. A percent increase in financial development raises economic growth by 1.789. Also, a unit increase in financial development index enhances economic growth in the short-run by 71.77%. The significant positive relationship between financial development and economic supports prior research in Nigeria (see Audu and Okumoko, 2013; Inuwa *et al.*, 2022; Ogwumike and Salisu, 2012), reflecting the important role of the development of the financial sector in mobilising financial resources necessary for spurring economic activities and thus economic growth.

Furthermore, domestic investment has a negative effect on economic growth in the long-run, and the relationship is statistically significant at 1% level of significance. A percent increase in domestic investment (gross fixed capital formation as a percentage of the GDP) leads to a decrease in economic growth by −1.489%. The outcome in at variance with previous studies (Leite and Weidmann, 1999; Mauro, 1996; Olayungbo and Adediran, 2017). However, a negative relationship between domestic investment is not unexpected when the stock of investments is not channelled to the right sector or the existing institutional and legal frameworks are not favourable to such investment. Additionally, the results demonstrate that unemployment has a significant negative effect on economic growth at 1% level of significance. An increase in unemployment rate by a percent causes economic growth to fall by 0.069% in the short-term. This outcome is in line with Okun's law and recent empirical findings in Nigeria (see Jibir *et al.*, 2015).

Finally, the coefficient of the error correction term lagged by one period (ECT_{t-1}), which represents the speed of adjustment towards long-run equilibrium, is correctly signed, less than unity and significant at 1% level. The size of the coefficient implies that about 7.8% of disequilibrium in the short term will be corrected within one quarter.

4.5 Results of diagnostic and model stability tests

To ascertain the adequacy of the results generated based on the ARDL model, tests for serial-correlation, heteroscedasticity, normality and model specification bias or error were carried out, and results were summarised in Panel C of Table 5. The results of Breusch–Godfrey (BG) serial-correlation test, Breusch–Pagan–Godfrey (BPG) heteroscedasticity tests and Ramsey's (1969) RESET results suggest that the estimated model is free from the problems of serial-correlation, heteroscedasticity and specification bias. Although the probability value corresponding to the Jarque–Bera test statistic suggests that the error terms in the estimated model are not normally distributed, evidence suggests that the non-normality of the error terms is not an issue in estimations involving finite samples (see Ahad *et al.*, 2011). In addition, Brown *et al.*'s (1975) cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) plots presented in Figure 1 illustrate that F1
the parameters of the estimated model are stable over time.

4.6 Estimation results of canonical cointegration regression, dynamic ordinary least squares and fully modified ordinary least squares estimators

To determine the robustness and consistency of the results generated from the ARDL model, three alternative estimation techniques (DOLS, FOLS and CCR) are used to examine the effects of oil rent and corruption on economic growth in Nigeria. The results of the DOLS, CCR and FMOLS estimators, summarised in Table 6, are similar to the ones obtained in the T6
ARDL model (except for the financial development variable). Specifically, the DOLS (Panel A), CCR (Panel B) and FMOLS (Panel C) results illustrate that an increase in oil rent and

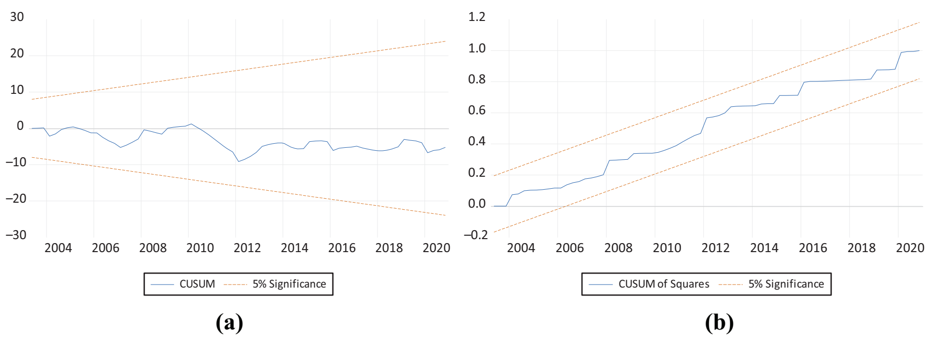

Figure 1.
CUSUM and CUSUMSQ plots

Notes: (a) CUSUM plot; (b) CUSUMSQ plot
Source: Authors' computation using EViews 13

Table 6. Estimation results of DOLS, CCR and FMOLS models

Cons	lnOILR	RCORR	HC	lnEX	FD	DI	UE
Panel A: Results of the DOLS model – Dependent variable: lnY							
5.598*** (14.849)	0.024*** (3.079)	0.079 (1.389)	1.165*** (8.867)	−0.119*** (−4.936)	−0.559 (−1.506)	−0.011*** (−7.986)	0.0004 (0.171)
Adj. R^2	0.992						
Panel B: Results of the CCR model – Dependent variable: lnY							
6.107*** (17.112)	0.025*** (2.807)	0.017 (0.312)	0.894*** (10.928)	−0.069*** (−4.276)	−0.212 (−0.668)	−0.011*** (−8.097)	5.05E-05 (0.027)
Adj. R^2	0.983						
Panel C: Results of the FMOLS model – Dependent variable: lnY							
5.885*** (15.037)	0.019** (2.057)	0.234*** (3.823)	1.038*** (13.429)	−0.138*** (−9.049)	−0.505 (−1.373)	−0.013*** (−8.251)	−0.015*** (−7.313)
Adj. R^2	0.859						

Notes: Asterisk (***), (**) and (*) denote significance at 1, 5 and 10% level, respectively. Values in parenthesis (.) are the *t*-ratio. For the DOLS model, the long-run variance estimators are computed using AIC determined pre-whitening lag, Bartlett Kernel and Newey–West automatic bandwidth, while the lead and lag-length are both fixed to 1. The long-run covariance matrix in CCR and FMOLS models are computed using the AIC to determine the whitening lag-length, the Bartlett Kernel and Newey–West automatic bandwidth
Source: Estimation output

corruption human capital development is associated with the improvement in economic growth, while depreciation of the exchange rate slow down economic growth in Nigeria, in the long-run. Overall, the ARDL, DOLS, CCR and FMOLS estimation results are similar in many regards, especially and thus increase our confidence that the estimates obtained are consistent and robust.

4.7 Causality tests

In addition to the ARDL, FMOLS, DOLS and CCR estimation, the Toda–Yamamoto no-causality tests are used to determine the direction of causality between the variables. The results of the Toda–Yamamoto causality test are summarised in Table 7. The results reveal that the null hypothesis of Granger's no-causality from oil rent to economic growth can be rejected at 1% level of significance. The presence of a causal relationship between oil rent and economic growth supports the findings of previous studies (see Mesagan *et al.*, 2019a, 2019b; Mohamed, 2020; Oludimu and Alola, 2022; Adabor *et al.*, 2022). Moreover, the results reveal the presence of a bidirectional causal relationship between corruption (and human capital development and financial development) and economic growth. The results also present sufficient evidence to reject the null hypothesis of Granger no-causality from exchange rate (and domestic investment and unemployment rate) to economic growth at 5% (10 % and 1%) level of significance. In addition, the results demonstrate a significant two-way causal relationship between oil rent and corruption and a unidirectional causal relationship from oil rent to human capital development and from corruption to human capital development. T7

5. Conclusion and policy implications

This study investigates the effect of oil rent and corruption on economic growth in Nigeria between 1996 and 2021 using several estimation techniques, including the bootstrap ARDL, DOLS, CCR and FMOLS estimators. The results of the ARDL bounds testing procedure provide evidence of a cointegrating relationship between oil rent, corruption, economic growth and the control variables considered. Moreover, the results of the ARDL, DOLS, CCR and FMOLS estimators reveal that oil rent and corruption have significant positive effect on economic growth, both in the short- and long-run. Moreover, the results reveal that human capital development and financial development promote economic growth, whereas increase in

	lnY	*lnOILR*	*RCORR*	*HC*	*lnEX*	*FD*	*DI*	*UE*
lnY	–	12.17	14.08*	13.11*	5.88	74.13***	124.46***	8.97
lnOILR	24.86***	–	17.70**	25.91***	40.59***	87.87***	8.47	6.67
RCORR	20.43***	26.16***	–	20.45***	20.19***	77.32***	69.12***	5.27
HC	38.09***	6.46	13.03	–	29.43***	29.084***	19.34**	10.31
lnEX	16.75**	14.18*	17.99**	11.29	–	17.10***	8.19	11.37
FD	16.83**	9.47	12.15	5.65	14.35*	–	70.36***	11.18
DI	9.75	46.89***	17.46**	19.47**	8.29	10.08	–	6.25
UE	37.39***	17.73**	28.09***	12.019	34.56***	49.96***	51.43***	–

Notes: H_0: x_t does not Granger cause y_t. The augmented lag ($k + d_{\max}$) – the order of the augmented lag VAR suggested by Toda and Yamamoto (1995) – is 9. The optimal lag is based on the AIC lag order selection procedure. Asterisks (***), (**) and (*) denotes statistical significance at 1, 5 and 10% levels, respectively
Source: Estimation output

Table 7. Estimation result for causality test (Toda and Yamamoto no-causality)

domestic investment and unemployment rate dampens economic growth in the long-run. Additionally, the results of the Toda–Yamamoto causality provide evidence of a unidirectional causality from oil rent to economic growth but not the other way round; and a two-way causal relationship between corruption and economic growth. Based on these findings, the study recommends policies and strategies to reduce the dependence on oil and the prevalence of corruption, improve human capital development and financial development, encourage investment in value-added sectors of the economy and drive down the unemployment rate in the country.

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