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The moderating effect of corruption on the oil price-economic growth nexus: Insight from a panel of oil-rich economies

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Abstract
This study re-examines the direct effects of oil price and corruption on economic growth, and determines whether the effect of oil price on growth is contingent on the level of corruption. Focusing on 25 oil-rich countries between 1996 and 2021, and using dynamic heterogeneous panel estimation techniques, the study reveals that oil price and corruption stimulate economic growth in oil-rich countries. In addition, evidence from the results demonstrate that the marginal effect of oil price on economic growth in oil-rich countries varies with the level of corruption. In other words, the study shows that changes in oil price stifle growth at high level of corruption but encourage growth at low levels of corruption. Apparently, the result reveal that the simultaneous increase in oil price and the level of corruption will impair economic growth, but the increase in oil price coupled with the reduction in corruption would be of greater benefit to the economy. Using a disaggregated sample of countries based on the level of corruption, the results suggest that the adverse effect of the simultaneous increase in oil price and corruption is larger in oil-rich countries with relatively low level of corruption compared to countries with a higher level of corruption. The implication of the study is that corruption is an important channel through which changes in oil price and dependence on oil exert its influence on growth in oil-rich countries. Thus, without reducing the level of corruption, the abundance of oil would not produce the desirable long-term economic benefits.

Keywords: Economic growth, oil price, corruption.

JEL Classification: O4, O43, O13, C23

1 Introduction

A large body of research indicates that changes in oil price have a significant effect on economic activity. Evidence has, however, shown that the effect of the changes differs for oil-exporting and oil-importing countries, with positive changes in oil price considered good news in the former and bad news in oil-importing economies, and vice versa (Moshiri 2015). In oil-dependent economies, for instance, an increase in oil price is generally considered favourable because it brings in foreign exchange and investment opportunities beneficial to economic growth. In contrast, these countries consider negative oil price changes unfavourable. After all, they restrain public revenue and halt investment projects, leading to a deceleration in economic growth (Kriskkumar and Naseem 2019; Moshiri 2015).

However, evidence suggests that oil prices 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 policy-making, amongst others (Moshiri 2015; Moshiri and Banihashem 2012). Interestingly, despite years of favourable oil prices, which brought in a vast financial resource that is critical for growth, most oil-rich nations in the Middle East, Africa and Latin America have continued to record poor growth performance in comparison with the fast growth rates experienced in resource-poor East Asian countries (Moshiri 2015; Moshiri and Banihashem 2012; Sachs and Warner 2001; Sala-i-Martin and 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 and Neary 1982).

The view 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). Thus, during the oil boom, an increase in oil prices and revenue lead to the appreciation of the local currency, a reduction in net-export and the shrinking of the non-resource tradable sector (manufacturing), and consequently the deceleration of economic growth (Kriskkumar and Naseem 2019; Moshiri 2015).

Recently, the quality of institutions (such as good governance, property rights, the rule of law, regulatory quality, et cetera) 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, themselves don't fully affect growth; instead, their interaction with poor institutional quality affects growth adversely (Boschini et al. 2007; Brunnschweiler 2008; Mehlum et al. 2006). So, for oil-rich 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 why oil-rich Norway has done well while oil-endowed Nigeria has continued to record poor growth performance (Karabegović 2009; Larsen 2006; Olayungbo and Adediran 2017).

Within the context of quality institutions, the level of corruption has been thought to hold an important key to explaining the poor economic growth performance of natural resources-rich countries. In other words, given the direct effect of corruption on growth, as well as the nature of relationship between oil and corruption, it is suggested that the effect of oil price on long-term growth may be particularly dependent on the prevailing level of corruption. 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 and Subramanian 2003; van der Ploeg and Arezki 2008). Beyond this, empirical evidence suggests that oil price and corruption exhibit a strong direct association (Arezki and Brückner 2009; Vogel 2020). Thus, it is indicative that in an oil-rich economy with a high level of corruption, positive oil price changes will lead to sluggish growth performance. This is partly on account of the interesting dynamic incentives that such windfalls generate for corrupt politicians to embezzle oil money, inflate the cost of social goods and services, and shift resource from growth-enhancing investments in favour of large capital-intensive projects, which may be non-productive but offer a vast opportunity for bribes and kickbacks (Dietz and Eric 2005; Gupta et al. 2000; Mauro 1998; Tanzi and Davoodi 1997; Vogel 2020). Whereas in oil-rich countries with relatively low level of corruption, such oil windfalls would benefit long-term economic growth since the accruing funds would most likely be channelled to productive activities (Moshiri 2015).

Notwithstanding the coexistence of slow growth performance and widespread corruption in most oil-rich economies amid unstable oil prices, researchers have done little to evaluate whether the effect of oil prices are contingent on the level of corruption in these countries. Therefore, the main objective of the present study is to moderating impact of corruption on the effect of oil price on growth in oil-rich countries. 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 oil-rich economies. Using a sample of 25 oil-rich countries across Africa, Asia, Europe and Latin America, the study takes advantage of the difference in the level of development, oil-dependence and corruption level in the countries, thus providing an important contribution to the resource curse literature. To ensure the outcome of the study are robust and consistent, the study adopts a step-wise approach based on the different level of corruption in the countries. Different measures of corruption are also employed to ensure the reliability of the outcome for policy making. Second, the study employs dynamic heterogeneous panel estimation techniques to explore the cross-country and country-specific dynamic of economic growth to oil price based on the level of corruption. By accommodate both the dynamic short-run and long-run relationship between oil price, growth and corruption, and a possible heterogeneous dynamic adjustment process, the techniques provide a better understanding of the interaction between the variables. Moreover, the study also adopts the Dumitrescu-Hurlin (2012) heterogeneous panel causality tests to provide an important information on the causal relationship between the variables. Lastly, by examining the role of corruption in the oil price-growth nexus in oil-rich countries, findings from the study are expected to rekindle the debate on the role of oil price and corruption on growth and expand the frontiers of knowledge among policymakers, researchers, and economists on the channels through which the adverse effect of oil price changes are transmitted into an oil-rich country.

The rest of this paper is divided as follows. Section two presents the review of empirical literature. Section three contains methodology and data. The estimation results are presented in the fourth section, while the discussion and policy implications are taken up in section five. The conclusion and policy recommendation are provided in the last section.

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 associated with the nexus presents mixed findings, with some studies demonstrating a positive and negative link while others 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. In contrast, Moshiri and Banijashem (2012) illustrate that oil price is not significant in influencing economic growth in six (6) Organisation of Petroleum Exporting Countries (OPEC) member states (Algeria, Iran, Kuwait, Nigeria, Saudi Arabia, and Venezuela) in 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 and Akadiri 2022; Aimer 2016; Algahtani 2016; Aliyu 2009; Alley et al. 2014; Alkhathlan 2013; Bala and Alhassan 2018; Berument et al. 2010; Emami and Adibpour 2012; Farzanegan and Markwardt 2009; Jiménez-Rodríguez and Sánchez 2004; Mahmood and Murshed 2021; Okoro 2014; Rotimi et al. 2022; Yusuf 2015). 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 and Sánchez 2004; Yakubu and Akanegbu 2019), while others established a positive nexus in the short-term and an inverse relationship in the long-run (Olayungbo and 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 and Naseem 2019; Matthew and Adegboye 2014).

A survey of the literature suggests that, while studies on the oil price-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 only focused 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 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 whether the effect of oil price on growth is conditioned by the levels of corruption in 25 oil-rich economies which cut across the continents of Africa, Asia, Europe and Latin America.

3 Data and Methodology

3.1 The Model

The study relies on Sachs-Warner's resource curse hypothesis (RCH) to forge a link between oil price, economic growth, and corruption. The RCH asserts that abundance and dependence on a natural resource (such as crude oil) hurts long-term economic growth (Sachs and Warner, 1995). Various explanations for why natural resources hurt long-term growth have been offered in the literature associated with the RCH. Remarkably, regarding relating to the Dutch disease syndrome, variations in natural resource price and weak institutions (corruption) continue to dominate the literature (Di John 2011; Moshiri 2015; Olayungbo and Adediran 2017). Since the Dutch disease syndrome is triggered by the fluctuations in the price of natural resources and the earnings from its export (Kriskkumar and 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 price) and weak institutions (corruption) (Devine 2012; Olayungbo and Adediran 2017). Therefore, this suggests that the effect of the abundance and/or dependence on oil on long-term growth can be assessed directly through the influence of oil prices and corruption on growth.

Besides, evidence suggests that the direction and magnitude of the impact of oil prices on growth may be contingent on the level of corruption. This is premised on the argument that corruption, abysmal governance, and a rent-seeking culture are usual features of oil-dependent countries (Sala-i-Martin and Subramanian 2003). Thus, any positive changes in oil prices, for instance, will generate interesting dynamic incentives for corrupt politicians to either inflate the cost of social goods and services, embezzle oil money, or divert resources away from growth-enhancing investments in favour of large non-productive capital-intensive projects which offers huge opportunity for bribes (Dietz and Eric 2005; Gupta et al. 2000; Vogel 2020), but ultimately leads to poor economic performance (Badeeb et al. 2021).

Therefore, to re-assess the impact of oil prices and corruption on economic growth in oil-dependent countries, and explore the role of corruption in influencing the impact of oil price on economic growth, the following the dynamic linear cross-country growth model is specified:

$$y_{g_{i,t}} = \phi y_{g_{i,t-1}} + \omega_1 op_{i,t} + \omega_2 co_{i,t} + \omega_3 (op_{i,t} \times co_{i,t}) + \varphi' z_{i,t} + \mu_i + \eta_t + \varepsilon_{i,t} \qquad (1)$$

where $i = 1,2, \ldots, N$ is the number of groups (countries), and $t = 1,2 \ldots, T$ denotes time. y_g is economic growth (proxy by nominal gross domestic product), and op denotes oil price (proxy by Brent crude oil price). co represents corruption (proxy by Transparency International's corruption perception index, CPI), and for robustness checks World Banks's control of corruption index is also used)[1]. Z is a set of control variables (such as unemployment rate, foreign direct investment, public expenditure, population growth rate, and inflation rate). μ_i and η_t represents unobserved country-specific effect and time-specific effect, respectively. $\varepsilon_{i,t}$ stochastic error term. ϕ, ω_1, ω_2, 3, and φ are slope coefficients to be estimated. To reduce skewness, GDP and public spending are transformed into natural logarithm.

Through the oil price-corruption interaction term, we can determine how moderates the effect of oil price on economic growth. Therefore, we compute the marginal effect of oil price on economic growth through the partial derivative of Equation (1) as follows:

$$\frac{\partial y_{g_{i,t}}}{\partial op_{ti,}} = \omega_1 + \omega_3 co_{i,t} \qquad (2)$$

Emphasis is on the signs of the two coefficients (ω_1 and ω_3). If $\omega_1 > 0$ and $\omega_3 < 0$, it suggests that oil price improves economic growth, but increase in the level of corruption diminishes the favourable effect. If $\omega_1 < 0$ and $\omega_3 > 0$, it connotes that oil price impairs growth, but corruption mitigate the adverse effect. If $\omega_1 < 0$ and $\omega_3 < 0$, it signifies that oil prices slow economic growth and rising corruption levels aggravates the adverse impact. If $\omega_1 > 0$ and $\omega_3 > 0$, it denotes oil price is growth-enhancing, and growing level of corruption intensifies that positive effect. However, a positive marginal effect ($\omega_1 + \omega_3 co_{i,t}$) demonstrate that a rise in oil prices and the level of corruption enhance economic growth, while a negative marginal effect connotes otherwise.

3.2 Estimation Techniques

To estimate the parameters of the dynamic model specified in Equation (1), we employ the dynamic mean group (MG) and pooled mean group (PMG) estimators[2]. The MG estimator (developed by Pesaran and Smith 1995) is a flexible dynamic panel estimation technique in that it accounts for heterogeneous slope coefficients, allowing the intercept, short- and long-run slope coefficients, and the error variance to vary across groups (countries). Unfortunately, the estimates of the long-run average coefficients are inefficient in the presence of slope homogeneity (Pesaran et al. 1999). Also, MG estimators is unsuitable for short time-spans, since outliers can substantially influence the coefficient averages (Fuinhas et al. 2015). In contrast, the PMG estimator (proposed by Pesaran et al. 1999) assumes homogeneous long-run coefficients, but allows the intercept, short-run slope coefficients, and error variance to vary across groups. Pesaran et al. (1999) demonstrated that the

[1] The indices which reflect the perceived extent of corruption in the public sector, and takes the values between 0 and 100, and -2.5 and 2.5, respectively, with higher values suggesting low level of corruption and vice versa. To actually reflect the level of corruption and make interpretation straightforward, the indices are rescaled by subtracting the country-level values of the index from the highest possible value (100 and 2.5). Therefore, the index will range from 0 (absence of corruption) to 100 (pervasive corruption), and 0 (not corrupt) to 5 (high level of corruption), respectively.

[2] The MG and PMG estimators are appropriate for the study given that the length of time-series (T) exceeds the number of countries (N).

PMG estimates are more consistent and efficient than the MG when the long-run slope coefficients are homogeneous.

The choice of the MG/PMG estimators are guided by two main reasons. First the estimators can be applied regardless of the order of integration of the variables in the model. Secondly, and most importantly, the estimators provide both the long-run estimates and possible heterogeneous dynamic short-run estimates (Ehigiamusoe et al. 2018). By proving insight into the behaviour of variables in the short- and long-run, these estimators provide viables options for policymaking.

Following Pesaran et al. (1999), a bivariate unrestricted error correction representation of autoregressive distributed lagged (ARDL) (p, q) model can be written as follows:

$$y_{it} = \sum_{j=1}^{p} \lambda_{ij} y_{i,t-j} + \sum_{j=0}^{q} \vartheta'_{ij} x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3}$$

where x_{it} is a $k \times 1$ vector of independent variables. ϑ_i are the $k \times 1$ coefficient vector. λ_{ij} are scalars. $\varepsilon_{,t}$ denote the error term.

Equation (3) can be re-parameterized and expressed in an error correction representation as follows:

$$\Delta y_{it} = \phi_i \left(y_{i,t-1} - \theta'_i x_{it} \right) + \sum_{j=1}^{p-1} \lambda^*_{ij} \Delta y_{i,t-1} + \sum_{j=0}^{q-1} \vartheta'^*_{ij} \Delta x_{i,t-j} + \mu_i + \varepsilon_{it} \tag{3}$$

where Δ represents the first difference operator. ϕ_i is the coefficient of the error correction term, and measures the speed of adjustment to long-run equilibrium, and θ'_i represents the vector of long-run parameters. The optimal lag length (p, q) is determined by the Akaike Information Criterion (AIC). The determine the most appropriate or adequate estimator between the MG and PMG, the DFE estimator is initially used as the benchmark model since it does assume homogenous slope coefficients. Thus, the Hausman test is computed to decide the most suitable model between the MG and PMG estimators.

3.3 Data

The study uses annual data covering the 1996-2021 period for a panel of 25 oil-producing countries in Africa, Asia, Europe, North America, and South America.[3] The data for nominal GDP, unemployment rate, foreign direct investment (relative to the GDP) government expenditure, and population growth rate are sourced from the World Bank's World Development Indicators (WDI), while the data on inflation rate are collected from the IMF's World Economic Outlook (WEO), and oil prices data are sourced from BP Statistical Review of World Energy. Moreover, the data on corruption are collected from the Transparency International (TI) and World Bank's World Governance Indicators (WGI).

[3] The selected countries include Algeria, Angola, Azerbaijan, Bahrain, Brunei Darussalam, Congo, Rep., Ecuador, Equatorial Guinea, Gabon, Indonesia, Iran, Iraq, Kazakhstan, Kuwait, Libya, Malaysia, Mexico, Nigeria, Oman, Qatar, Russia, Saudi Arabia, Sudan, United Arab Emirates, and Venezuela.

4 Empirical Results

4.1 Descriptive Statistics and Correlation Analysis

The summary of descriptive statistics and correlation analysis of the variables are summarised in the upper and lower panel of Table 1, respectively. The results indicate that average GDP (in billion US dollars), oil price (per barrel), unemployment rate, foreign direct investment (relative to the GDP), government expenditure (in billion US dollars), population growth rate, and the inflation rate of the selected 25 countries between 1996 and 2021 are about US$224 billion, US$56.74 (per barrel), 8.08 percent, 3.79 percent, US$32 billion, 2.39 percent, and 157.44 percent, respectively. In addition, the mean values of TI's corruption perception index (CPI) and the World Bank's control of corruption index are 32.75 and -0.55, suggesting the pervasiveness of corruption in most of the countries. A cursory look at the summary statistics suggests a wide dispersion in the data points around the mean values, evidenced by the standard deviation and the great disparity between the minimum and maximum values. Besides, the correlation analysis demonstrates that oil price, control of corruption index, corruption perception index, public spending, and inflation have a weak positive correlation with economic growth, but the correlation between the variables (except for public spending) is weak. Analogously, unemployment rate, foreign direct investment, and population growth rate have a significant positive correlation with economic growth.

Table 1 Descriptive statistics and correlation matrix

	yg_{it}	op_{it}	co_{it}^T	co_{it}^W	ue_{it}	fdi_{it}	ge_{it}	po_{it}	p_{it}
Mean	224,000	56.74	32.75	-0.55	8.08	3.79	32,000	2.39	157.44
SD	352,000	30.39	14.96	0.75	6.188	9.605	57,100	2.295	2704.23
Min.	233	12.72	6	-1.63	0.1	-18.918	220	-5.28	-9.86
Max.	2,290,000	111.67	77	1.56	29.77	161.82	430,000	19.36	65374.1
op_{it}	0.372[a]	1.000							
co_{it}^T	0.024	-0.035	1.000[a]						
co_{it}^W	0.077[b]	-0.005	0.843[a]	1.000					
ue_{it}	-0.311[a]	-0.069[c]	-0.482[a]	-0.544[a]	1.000				
fdi_{it}	-0.367[a]	-0.103[a]	-0.12[a]	-0.095[a]	0.019	1.000			
ge_{it}	0.949[a]	0.349[a]	0.063[c]	0.114[a]	-0.311[a]	-0.306[a]	1.000		
po_{it}	-0.186[a]	0.069[c]	0.204[a]	0.266[a]	-0.165[a]	0.051	-0.194[a]	1.000	
p_{it}	0.077[b]	0.016	-0.052	-0.072[c]	-0.025	-0.019	0.091[b]	-0.109[a]	1.000

Note: Asterisks (a), (b) and (c) denotes statistical significance at 1%, 5% and 10% levels, respectively. y_g = nominal GDP; op = Brent crude oil price; co^T = TI's corruption perception index; co^W = World Bank's control of corruption index; ue = unemployment rate; fdi = foreign direct investment (relative to the GDP); ge = aggregate government spending; po = population growth rate; p = inflation rate

Source: Author's computation using EViews 12

4.2 Cross-section Dependence Tests and Panel Unit Root Tests Results

Prior to the estimation of the growth model, cross-sectional dependence (CSD) tests and panel unit root tests are conducted to ascertain the presence of cross-sectional dependence among the countries and determine the stationarity properties of the data, respectively.

The results of the four CSD tests conducted (Breusch-Pagan LM, Pesaran scaled LM, Pesaran CSD, and Baltagi-Feng-Kao Bias-corrected scaled LM) summarised in Table 2 provide robust evidence to reject the null hypothesis of "no cross-sectional dependence" for all variables. The presence of CSD indicates interdependence amongst the twenty-five (25) countries. This may not be surprising given that all the countries are major producers and exporter of crude oil, and changes in the prices of the commodity often have similar impact on the macroeconomic variables and fiscal policy in the countries. Therefore, it is imperative to employ tests and estimation techniques which take account of CSD.

Table 2 Results of Cross-sectional Dependence Tests

	Breusch-Pagan LM	Pesaran LM	Bias-corrected scaled LM	Pesaran CSD
yg_{it}	6742.51^{a}	263.01^{a}	262.51^{a}	81.90^{a}
op_{it}	7800.0^{a}	306.19^{a}	305.69^{a}	88.32^{a}
co_{it}^{T}	2795.76^{a}	101.89^{a}	101.39^{a}	-0.49
co_{it}^{W}	2323.46^{a}	82.61^{a}	82.11^{a}	-1.49^{c}
ue_{it}	2331.42^{a}	82.93^{a}	82.43^{a}	6.29^{a}
fdi_{it}	789.96^{a}	20.00^{a}	19.50^{a}	5.60^{a}
ge_{it}	6041.85^{a}	234.41^{a}	233.91^{a}	76.97^{a}
po_{it}	1593.78^{a}	52.82^{a}	52.32^{a}	19.46^{a}
p_{it}	700.32^{a}	16.34^{a}	15.84^{a}	9.21^{a}

Note: H_0: no cross-section dependence (correlation). df = 300. Asterisks (a) denote significance at the 1% level.
Source: Author's computation using EViews 12 and Stata 14

In addition to the CSD test, unit root tests are also conducted using both the fist-generation panel unit root tests (such as the Levin-Lin-Chu, LLC; Im-Pesaran-Shin, IPS; and the ADF-Fisher tests) and the second-generation unit root test which assumes cross-sectional dependence among groups (cross-sectionally augmented IPS, CIPS, of Pesaran, 2007). The results of tests are reported in Table 3. The results of the tests present mixed outcome. However, the four tests demonstrate that TI's corruption index, FDI, and public expenditure are stationary at level, while World Bank's corruption index and unemployment rate only stationary after taking their first difference. For the remaining series, while some test demonstrates their stationarity at level, others indication their stationarity after differencing. However, none of the series is integrated of order more than one – I(1). Since the series are mixture of I(0) and I(1) series, there is sufficient justification to assess the long-run equilibrium relationship between the variables.

Table 3 Panel Unit Root Tests

	First generation tests						Second generation test	
	LLC		IPS		ADF-Fisher		CIPS	
yg_{it}	-4.049^{a}	–	0.759	-14.348^{a}	39.467	275.309^{a}	-2.511^{a}	–
op_{it}	-2.302^{b}	–	-0.912	-16.347^{a}	42.575	315.661^{a}	2.610^{a}	–
co_{it}^{T}	-9.112^{a}	–	-5.852^{a}	–	130.371^{a}	–	-2.385^{a}	–
co_{it}^{W}	0.742	-16.761^{a}	1.109	-17.394^{a}	47.791	341.362^{a}	-1.244	-4.604^{a}
ue_{it}	2.675	-12.900^{a}	4.051	-12.867^{a}	44.549	275.153^{a}	-1.194	-3.561^{a}
fdi_{it}	-5.614^{a}	–	-7.252^{a}	–	151.231^{a}	–	-3.213^{a}	–
ge_{it}	-4.762^{a}	–	-1.314^{c}	–	88.239^{a}	–	-2.248^{b}	–
po_{it}	-0.747	-5.174^{a}	0.129	-9.504^{a}	71.539^{b}	–	-1.764	-2.723^{a}
p_{it}	7.066^{a}	–	-13.115^{a}	–	278.933^{a}	–	-2.429^{a}	–

Notes: Δ is first differenced notation; LLC denotes Levin-Lin-Chu test, IPS is Im-Pesaran-Shin test, and CIPS is Pesaran's (2007) cross-sectional augmented IPS (CIPS) test. Asterisks (***), (**) and (*) denotes statistical significance at 1%, 5% and 10% levels, respectively.
Source: Author's computation using E-Views 12 (LLC, IPS and ADF-Fisher tests) and Stata 14 (CIPS – `xtcips` package)

4.3 Cointegration Tests

The results of the unit root tests indicating the possibilities that the variables being I(0), borderline I(0)/I(1), or I(1) compromises the reliability of the existing panel cointegration tests. Nonetheless, the first-generation cointegration test of Kao (1999) was computed to determine the cointegrating relationship between the variables. The results of the cointegration test reported in Table 4. The results of the cointegration test without the oil price-corruption interaction is summarised in the upper panel, and the test result with the interaction term is reported in the lower panel. The results provide sufficient evidence to rejected the null hypothesis of no cointegration. Therefore, it can be concluded that a long-run relationship exists among the variables.

Table 4 Kao residual cointegration test

Null hypothesis: no cointegration	*t*-statistic	Probability value
	Without oil price-corruption interaction	
ADF	-8.7601***	0.000***
Residual Variance	0.0142	
HAC Variance	0.0124	
Null hypothesis: no cointegration	*With oil price-corruption interaction*	
ADF	-8.7944***	0.000***
Residual Variance	0.0141	
HAC Variance	0.0133	

Note: Asterisks (***) denotes statistical significance at 1% level.
Source: Author's computation using EViews 12

4.4 Estimation Results

The results of the relationship between oil price, corruption and economic growth in oil producing countries are summarised in Table 5. Six models were estimated, namely the model without the oil price-corruption interaction (Model I) and the model with the oil price-corruption interaction (model II), using the whole sample (Columns 1-2) and the sub-samples of countries with relatively low level of corruption (Columns 3-4) and high level of corruption (Columns 5-6)[4]. The step-wise analysis enables us determine the specific role of corruption in the oil price-growth nexus across countries with different levels of corruption. In all the six models, the Hausman test statistics suggest that the PMG is the most appropriate estimator[5]. Therefore, emphasis is on the results of the PMG estimator. The long-run and short-run estimates of the models are summarised in panel A and B, respectively.

In Column 1, oil price, corruption and a number of control variables were included in the model for the full sample, and the results indicate that corruption[6] has a positive and significant long-run effect on economic growth, while oil price has both short- and long-run positive impact on economic growth. These findings are consistent with the outcome of some existing studies which discovered that increase in oil price stimulates economic growth in oil-rich countries (see Akinlo and Apanisile 2015; Fuinhas et al. 2015; Matallah and Matallah 2016; Mehrara 2008; Nusair 2016), and the pervasiveness of corruption enhances growth in such economies (see Olayugbo and Adediran 2017; Rotimi et al. 2022). In Column 2, the inclusion of the oil price-corruption interaction term[7] shows a

[4] The determination of whether a country is least corrupt or highly corrupt is based on its average corruption perception index (CPI) score over time. Countries with CPI score between 0 and 49 and grouped as most corrupt countries while countries with CPI score between 50 and 100 are classified as least corrupt countries.

[5] To save space, the estimation results of the DFE and MG models ae not presented since the Hausman test statistic demonstrate that the PMG models are the most appropriate models. They are, however, available upon request.

[6] The TI's corruption index is used for the analysis. The index is rescaled to make interpretation straightforward. To ensure that the rescaling does not lead to a misleading outcome we also used the original index for all the analysis. Interestingly, except for difference in the signs of the coefficient, **the same** outcome (both in terms of size and significance of the coefficient) was obtained.

[7] To avoid the problem of multicollinearity, the interaction term is regressed on oil price and corruption. The ensuing residual from the regression is then used to replace the interaction term during estimation.

significant increase in the intensity of the short- and long-run positive impact of oil price on economic growth, and a slight reduction in the magnitude of the positive impact of corruption on growth, while the interaction term enters with a significant and negative coefficient at 1 percent level. This implies that the economy of the 25 oil-dependent countries will grow by 0.0025% point following a unit increase in oil price when the level of corruption is zero, and a 0.0066% point increase in economic growth a result of a unit increase in the level of corruption assuming the price of oil is zero. However, the coefficient of the interaction term suggest that economic growth would decrease by 0.0001% point following a simultaneous increase in both oil price and the level of corruption.

In Column 3 and 4, the sample of 5 selected least corrupt countries (Brunei Darussalam, Malaysia, Oman, Qatar, and the UAE) is used. The results indicate that corruption supports long-term economic growth in oil-dependent countries with relatively low level of corruption, and oil price has a significant and positive short- and long-run positive impact on economic growth. When the oil price-corruption interaction term is introduced (Model II, Column 4), the long-run result shows that oil price and the interaction term enter with a negative and significant coefficient at 1 percent level, while corruption enter the model with a significant and positive coefficient. The short-run result, however, demonstrate that increase in oil price improve growth, while corruption impairs economic growth in oil-rich countries with relatively low level of corruption. Thus, it is indicated that a simultaneous increase in oil price and the level of corruption in oil-rich countries with relatively low level of corruption will lead to a decline in growth by 0.001% point. Ironically, all five countries adopts either absolute or elected monarchy system.

Furthermore, the results in Column 5 and 6 (sample of oil-rich countries with pervasive corruption) reveals that increase in both oil price and the level of corruption stimulates economic growth in the short- and long-run. The introduction of the interaction term in Column 6 did not necessarily change the direction of the impact of oil price and corruption on growth, except for the slight increase (reduction) in the magnitude of the impact of oil price in the long-run (short-run) and the decay of the intensity of the effect of corruption on growth. However, the interaction terms also enter with a negative and significant coefficient at 1 percent level, suggesting that increase in both oil price and corruption will results to the decrease in growth by 0.0001% point.

Since the sign of the estimated coefficient (oil price and interaction term) are different in all the models with the interaction term (except for the model for least corrupt countries), it is imperative to compute the marginal effect within the samples using the estimated coefficients in Columns 2, 4, and 6, based on Equation (2). Therefore, the marginal effects computed at the minimum, mean, and maximum levels of corruption for the whole sample, relatively less corrupt countries, and very corrupt countries are -0.0004%, -0.0059%, and -0.0093%; -0.0206%, -0.0427%, and -0.0559%; and -0.00042%, -0.0056%, and -0.0088, respectively. This imply that a unit increase in oil price would lead to a 0.0004% decrease in growth at the minimum level of corruption in very corrupt countries, and 0.021% reduction in countries with relatively low corruption level. At the mean and maximum levels of corruption, a unit increase in oil price would reduce growth by 0.0056% and 0.0088%, and 0.0427% and 0.0059% in least corrupt oil-rich countries and highly corruption oil-rich countries, respectively. Therefore, it is suggestive that a simultaneous increase in oil price and the level of corruption will have an adverse effect on long-term economic growth in oil-rich countries, but an increase in oil price and a significant reduction in the level of corruption would be of greater benefit to the economy.

Regarding the control variables included in the models, the results demonstrate that unemployment and FDI impairs economic growth, while public expenditure, population growth and inflation rate stimulate growth, both in the short- and long-run. The outcomes are all consistent with existing studies (Azam 2022). Theoretically, FDI may hurt growth by crowding-out of domestic investment, causing dependence, increasing external vulnerability, and lowering balance of payment due to repatriation of profits (Abbes et al. 2015; Ayenew 2022). However, the negative impact of FDI on growth in the oil-rich countries may not be unconnected to the skewed direction of FDI inflow to the oil sector and the low absorptive capacity of the countries in terms of low human capital, weak quality of governance (especially in terms of high level of corruption and weak rule of law), macroeconomic policy instability, and depth of domestic financial market (Nejati and Bahmani 2020). In addition, in all the estimated models, the convergence coefficient (coefficient of the correction term lagged by a period) is less than one, negative, and significant at 1 percent level of significance, implying the presence of cointegrating relationship between the variables. The size of the coefficient also suggests that it will take between 3.3 years and 4.8 years for any disequilibrium in economic growth in the short-run to be corrected.

4.5 Robustness and Consistency Checks

To determine the robustness and consistency of the results obtained, we use the World Bank's control of corruption index[8] as alternative measure of corruption. The estimation results of the PMG model[9] reported in Table 6 reveal that the coefficients of interest variables (oil price, corruption and oil price-corruption interaction) are similar in terms of signs and significance. (Although the sizes of the coefficient are somewhat different.) In all the models, oil price enters with a positive and significant coefficient (except for Model II, Column 6), and the coefficient of corruption is positive and significant (except for the low corruption oil-rich countries sample). Similarly, the oil price-corruption interaction term is negative and significant across the three models (Columns 2, 4, and 6). In all the estimations, the convergence coefficient is negative, less than one, and statistically significant, demonstrating the presence of cointegrating relationship between the variables. In addition, the signs and significance of the control variables is also consistent with the results using the TI's corruption index. The coefficient of unemployment rate and FDI is negative and significant, while public expenditure, population growth, and inflation rate enters with a positive and significant coefficient in all the models.

Meanwhile, since the estimated coefficient of oil price and the interact term have different signs, it indicates that the effect of oil price on growth varies with the level f corruption. Thus, we compute the marginal effect using the estimated coefficients of oil price and the interaction term in Columns 2, 4, and 6. The marginal effect of oil price on growth evaluated at the minimum, mean, and maximum levels of corruption for the full-sample, least corrupt countries, and highly corrupt countries are -0.0156%, -0.0508%, and -0.0722%, respectively, for the full sample. For oil-rich countries with relatively low corruption level, the marginal effect of oil price on growth at the minimum, mean, and maximum levels of corruption are -0.0384%, -0.1286%, and -0.1831%, respectively, and -0.0649%, -0.1896%, and -0.2650%, respectively, for highly corruption oil-rich countries. This confirms the earlier results that increase in oil price is of greater benefit to economic growth in oil-rich countries when the level of corruption is low.

4.6 Causality Tests

To determine the direction of causal relationship between the variables, the Dumitrescu-Hurlin (2012) heterogeneous panel causality tests is implemented. The results of the causality test summarised in Table 7 presents evidence of a unidirectional heterogenous causality between oil price and economic growth, running from oil price to growth, but not the other way round. In addition, the results reveal

[8] We used the rescaled World Bank's control of corruption index (to actually reflect corruption) so that interpretation can be straightforward.

[9] Similar to the main results in Table 5, only the results of the PMG model are presented since the Hausman test statistics suggest that the PMG is the most appropriate estimator.

a two-way causal relationship between economic growth and corruption, and a bi-directional causal relationship running from economic growth to unemployment rate (and FDI, and population rate).

Table 5 Estimation results of oil price, corruption and economic growth relationship

Regressors	Dependent variable: $\Delta y_{g_{it}}$			Model I: ARDL(1,1,1,1,1,1,1,1) Model II: ARDL(1,1,1,1,1,1,1,1,1)		
	Full Sample		Least Corrupt Countries		Most Corrupt Countries	
	I	II	I	II	I	II
Panel A: Long-run Estimates						
op	0.0014 (0.0003)^{a}	0.0025 (0.0003)^{a}	0.0049 (0.001)^{a}	-0.0092 (0.001)^{a}	0.0013(0.0003)^{a}	0.0023 (0.0004)^{a}
co^T	0.0069 (0.001)^{a}	0.0066 (0.001)^{a}	0.0075 (0.002)^{a}	0.0169 (0.002)^{a}	0.0071 (0.001)^{a}	0.0062 (0.001)^{a}
$op \times co^T$		-0.0001 (1.74×10^{-5})^{a}		-0.001 (4.22×10^{-5})^{a}		-0.0001 (2.40×10^{-5})^{a}
ue	-0.0181 (0.003)^{a}	-0.0258 (0.004)^{a}	-0.0132 (0.036)	-0.0713 (0.041)^{c}	-0.0187 (0.003)^{a}	-0.0267 (0.004)^{a}
fdi	-0.0144 (0.003)^{a}	-0.0153 (0.003)^{a}	0.0079 (0.009)	0.0146 (0.008)^{c}	-0.0140 (0.003)^{a}	-0.0142 (0.003)^{a}
ge	0.7989 (0.013^{a}	0.7805 (0.012)^{a}	0.7505 (0.053)^{a}	0.8996 (0.020)^{a}	0.8015 (0.013)^{a}	0.7869 (0.013)^{a}
po	0.0598 (0.009)^{a}	0.0458 (0.006)^{a}	-0.0014 (0.005)	0.0048 (0.006)	0.0644 (0.012)^{a}	0.0532 (0.009)^{a}
p	2.69×10^{-6} (1.05×10^{-6})^{a}	2.31×10^{-6} (9.79×$^{-7}$)^{a}	0.0049 (0.007)	0.0103 (0.005)^{a}	2.99×10^{-6} (1.14×10^{-6})^{a}	2.80×10^{-6} (1.11×$^{-6}$)^{a}
ect	-0.2141 (0.053)^{a}	-0.2295 (0.060)^{a}	-0.3125 (0.226)^{c}	-0.2959 (0.195)^{c}	-0.2445 (0.064)^{a}	-0.2530 (0.071)^{a}
Panel B: Short-run Estimates						
op	0.0043 (0.001)^{a}	0.0045 (0.001)^{a}	0.0035 (0.001)^{a}	0.0081 (0.004)^{b}	0.0042 (0.001)^{a}	0.0041 (0.002)^{a}
co^T	-0.0007 (0.002)	-0.0016 (0.003)	-0.0006 (0.003)	-0.0065 (0.005)^{c}	-0.0009 (0.003)	-0.0013 (0.003)
$op \times co^T$		-3.58×10^{-6} (5.97×10^{-5})		0.0001 (0.0002)		-1.64×10^{-5} (6.78×10^{-5})
ue	-0.1149 (0.056)^{b}	-0.1332 (0.062)^{b}	-0.0563 (0.033)^{c}	-0.0067 (0.051)	-0.1407 (0.069)^{b}	-0.1659 (0.077)^{b}
fdi	-0.0022 (0.003)	-0.0020 (0.004)	0.0002 (0.004)	-0.0036 (0.003)	-0.0036 (0.004)	-0.0040 (0.004)
ge	0.3058 (0.057)^{a}	0.3032 (0.066)^{a}	0.2733 (0.129)^{b}	0.2763 (0.133)^{b}	0.2798 (0.067)^{a}	0.2669 (0.076)^{a}
po	-0.0266 (0.076)	-0.0167 (0.091)	-0.0141 (0.021)	-0.0245 (0.084)	-0.0358 (0.097)	-0.0341 (0.118)
p	0.0029 (0.001)^{a}	0.0019 (0.001)^{c}	0.0048 (0.005)	0.0041 (0.005)	0.0011 (0.001)	0.0003 (0.001)
d_2020	0.0567 (0.073)	0.0697 (0.076)	0.0015 (0.025)	0.0264 (0.039)	0.0725 (0.091)	0.0800 (0.095)
c	1.3439 (0.329)^{a}	1.5334 (0.400)^{a}	2.1161 (1.512)^{c}	1.1619 (0.741)^{c}	1.5197 (0.392)^{a}	1.6796 (0.464)^{a}
Hausman test	1.96 [0.96]	2.76 [0.89]	1.93 [0.96]	4.63 [0.61]	3.76 [0.81]	2.54 [0.19]
No. of countries	25	25	5	5	20	20
Observations	650	650	130	130	520	520
Log likelihood	995.106	1054.859	227.843	254.687	782.108	815.533

Notes: The optimal lag-length is suggested by AIC. Model I is estimation without the oil price-corruption interaction term, and Model II is the estimation with the interaction term. Values in (.) are standard error and [.] is probability value. Asterisks (^{a}), (^{b}) and (^{c}) denotes statistical significance at 1%, 5% and 10% levels, respectively.
Source: Author's Computation using Stata 14 and EViews 12

Table 6 PMG estimation results of the effect of corruption on oil price-growth nexus using alternate measure of corruption

Regressors	Dependent variable: $\Delta y_{g_{it}}$		Model I: ARDL(1,1,1,1,1,1,1,1) Model II: ARDL(1,1,1,1,1,1,1,1,1)			
	Full Sample		Least Corrupt Countries		Most Corrupt Countries	
	I	II	I	II	I	II
Panel A: Long-run Estimates						
op	0.002 (0.0003)[a]	0.003 (0.0003)[a]	0.0056 (0.001)[a]	0.0084 (0.002)[a]	0.0010 (0.000)[a]	-5.42×10^{-5} (0.001)
co^W	0.129 (0.037)[a]	0.138 (0.038)[a]	0.0123 (0.052)	0.0329 (0.044)	0.0709 (0.029)[b]	0.0721 (0.030)[b]
$op \times co^W$		-0.001 (0.001)[c]		-0.0020 (0.001)[c]		-0.0028 (0.001)[a]
ue	-0.016 (0.003)[a]	-0.017 (0.003)[a]	-0.009 (0.017)	-0.0099 (0.015)	-0.0269 (0.003)[a]	-0.0259 (0.004)[a]
fdi	-0.007 (0.003)[b]	-0.009 (0.003)[a]	-0.0153 (0.004)[a]	-0.0112 (0.003)[a]	-0.0119 (0.003)[a]	-0.0111 (0.003)[a]
ge	0.836 (0.012)[a]	0.836 (0.011)[a]	0.7189 (0.049)[a]	0.7164 (0.038)[a]	0.8260 (0.013)[a]	0.8264 (0.013)[a]
po	0.032 (0.007)[a]	0.033 (0.008)[a]	0.0059 (0.006)	-0.0038 (0.005)	0.0589 (0.013)[a]	0.0545 (0.013)[a]
p	1.11×10^{-6} (1.04×10^{-6})	1.46×10^{-6} (1.00×10^{-6})[c]	0.0406 (0.009)[a]	0.0389 (0.007)	2.97×10^{-6} (1.35×10^{-6})[b]	2.47×10^{-6} (1.37×10^{-6})[c]
ect	-0.233 (0.054)[a]	-0.243 (0.058)[a]	-0.3527 (0.126)[a]	-0.3702 (0.135)[a]	-0.2611 (0.067)[a]	-0.2542 (0.068)[a]
Panel B: Short-run Estimates						
op	0.004 (0.001)[a]	0.003 (0.002)[b]	0.0031 (0.001)[a]	0.0015 (0.003)	0.0042 (0.001)[a]	0.0026 (0.002)[c]
co^W	0.048 (0.054)	0.001 (0.053)	0.1049 (0.040)[b]	0.0815 (0.075)	0.0364 (0.062)	-0.0261 (0.065)
$op \times co^w$		0.002 (0.002)		-0.0018 (0.003)		0.0016 (0.002)
ue	-0.104 (0.052)[b]	-0.104 (0.051)[b]	-0.0257 (0.038)	-0.0454 (0.039)	-0.1223 (0.064)[b]	-0.1149 (0.064)[c]
fdi	-0.001 (0.004)	0.001 (0.004)	0.0083 (0.004)[b]	0.0098 (0.003)[a]	-0.0030 (0.005)	-0.0017 (0.005)
ge	0.288 (0.059)[a]	0.272 (0.057)[a]	0.2207 (0.147)[c]	0.2338 (0.113)[b]	0.2549 (0.066)[a]	0.2520 (0.067)[a]
po	0.017 (0.029)	0.043 (0.032)	-0.0370 (0.049)	-0.0414 (0.085)	0.0136 (0.053)	0.0248 (0.041)
p	0.002 (0.001)[c]	0.001 (0.001)[c]	0.0013 (0.003)	-0.0031 (0.002)[c]	0.0005 (0.001)	-0.0002 (0.001)
d_2020	0.036 (0.068)	0.028 (0.067)	0.0456 (0.038)	0.0704 (0.049)[b]	0.0462 (0.084)	0.0326 (0.084)
c	1.463 (0.342)[a]	1.526 (0.364)[a]	2.7469 (0.893)[a]	2.8289 (0.936)[a]	1.7264 (0.442)[a]	1.6974 (0.450)[a]
No. of countries	25	25	5	5	20	20
Observations	650	650	130	130	520	520
Log likelihood	995.104	1030.940	230.674	251.749	775.938	797.197

Notes: The optimal lag-length is suggested by AIC. Model I is estimation without the oil price-corruption interaction term, and Model II is the estimation with the interaction term. Values in (.) are standard error and [.] is probability value. Asterisks ([a]), ([b]) and ([c]) denotes statistical significance at 1%, 5% and 10% levels, respectively.
Source: Authors' Computation using Stata 14, and EViews

Table 7 Results of Dumitrescu-Hurlin Panel Causality Tests

	y_g	op	co^T	co^W	ue	fdi	ge	po	p
y_g	–	2.018	5.637[a]	4.825[a]	4.561[a]	3.917[a]	5.895[a]	5.068[a]	4.459[a]
op	1.499[c]	–	4.728[a]	2.894	3.634[a]	2.320	2.340	4.627[a]	2.000
co^T	5.708[a]	4.086[a]	–	3.938[a]	3.186[c]	3.399[b]	4.347[a]	3.562[a]	2.670
co^W	2.950	2.867	6.516[a]	–	3.759[a]	2.960[c]	2.596	3.689[a]	2.609
ue	3.671[a]	3.088[c]	2.898[c]	3.328[b]	–	3.363[a]	4.209[a]	3.919[a]	3.355[b]
fdi	4.003[a]	2.242	2.697	3.406[b]	2.552	–	3.793[c]	3.066[c]	4.081[a]
ge	1.974	2.506	5.446[a]	5.364[a]	5.647[a]	4.543[c]	–	4.023[a]	5.226[a]
po	3.116[c]	2.831	3.264[b]	2.963[c]	5.281[a]	2.949[c]	3.806[a]	–	7.418[a]
p	2.368	1.986	2.699	2.309	3.085[c]	4.065[a]	2.832	10.154[a]	–

Note: H_0: x_{it} does not homogeneously cause y_{it}. Asterisks ([a]), ([b]) and ([c]) denotes statistical significance at 1%, 5% and 10% levels, respectively.
Source: Author's Computation using EViews 12

5 Discussion and Policy Implications

The empirical findings of this study are quite revealing and have some important implications. Under empirical specifications without the interaction term, we show that increase in oil price and corruption has a significant positive impact on the growth of the economy of oil-rich countries. With the revenue from the sales of oil being the main source of public revenue in most of the oil-rich countries, increase in the price of oil may boost growth through its direct impact on public revenue. Also, the positive impact of corruption on growth, even in countries with relatively low level of corruption, demonstrate a possible symbiotic relationship between corruption and growth in oil-rich countries. While the partitioning of the samples based on the level of corruption did not change the positive effect of oil price and corruption on growth, the magnitude of their long-run impact is much more for countries with relatively low level of corruption. Ultimately, the outcome demonstrates that the economies of oil-rich countries with relatively low level of corruption benefit more from increase in oil price. Going from one oil-rich country to another, this position is well established with the economies of UAE, Qatar and Malaysia, with relatively low level of corruption achieving higher economic prosperity while their highly corrupt counterparts still struggling with basic developmental needs.

Moreover, and most importantly, the negative sign of the interaction term signals the adverse consequence of the simultaneous increase in oil price and the level of corruption. The outcome partly supports the findings of Moshiri (2015), which demonstrate that oil prices shocks are moderated by the quality of institutions in oil-rich countries. From the results, the introduction of the interaction term saw the magnitude of the positive effect of increase in oil price on growth rising and the diminution in the size of the effect of corruption on economic growth in countries with relatively high level of corruption. However, in countries with relatively low level of corruption, the inclusion of the interaction between oil price and corruption led to the impact of oil price on growth turning negative and increase in the level of corruption on growth rising. In other words, the results demonstrate that while the increase in either oil price or the level of corruption may be beneficial to long-term economy growth in oil-rich countries, the simultaneous increase in both oil price and corruption have a grave consequence on growth, with the effect becoming more cancerous as countries move from higher levels of corruption to lower levels. In Nigeria, for instance, despite the increase in the prices of oil during the periods prior the 2014 negative shocks the pervasiveness of corruption saw the economy performing abysmally. Apparently, this outcome confirms the validity of the natural resource curse phenomenon in selected oil-rich countries, which is particularly transmitted through the corruption channel.

The policy implication of this finding is that, regardless of the individual effect of oil price increase and corruption, the reduction of the level of corruption is fundamental for oil price increase (and the oil resources) to facilitate economic growth in oil-rich countries, and consequently turning the curse of the oil resources to a blessing. In other words, for an increase in oil price (and thus the abundance of oil in oil-rich countries) to facilitate sustainable economic growth and development, the level of corruption needs to be drastically reduced. Apart from its direct deleterious effect on economic growth, the pervasiveness of corruption also impairs economic growth through the abundance and windfall from oil sales. In natural resources-rich countries, it is shown that the reliance on the resources often facilitates a culture of rent-seeking, weakens the economic institutions, and promotes corruption (van der Ploeg and Arezki 2008). However, following positive shocks (such as large exogenous windfalls created by oil price shocks), these anomalies, especially the corruption, tend to be exacerbated, and thus the impact on long-term growth. This is basically because such positive shocks typically generate large flows of cash into the government's coffers than they can effectively manage, and the ensuring windfall often incentivise corrupt politicians and officials to misappropriate, under-remit, mismanage and waste oil rents. The pervasiveness of these corrupt practices clearly reduces the financial capacity of the government to financial developmental projects and investment in growth-enhancing investments. Ultimately, this affects economic prosperity negatively. To achieve long-term economic growth and benefit from oil wealth, oil-rich must employ and adopt strategies aimed to reducing the level of corruption in the countries. While the reduction in the level of corruption is important for oil-rich countries regardless of the current level of corruption in the countries, it perhaps most important for oil-rich countries with relatively level of corruption to sustain the reduction in the levels of corruption to enable the wealth accrue from oil benefits the economy.

6 Conclusion

The study seeks to establish the role of corruption in the oil price-growth nexus in oil-rich countries. Focusing on 25 oil-rich countries in Africa, Europe, Asia, and Americas between 1996 and 2021, and using several dynamic heterogeneous panel estimation techniques, evidence from the study demonstrate that both oil price and corruption stimulate economic growth. In addition, and most importantly, the results indicate that the interaction between oil price and corruption has a significant corrosive impact of economic growth in oil-rich countries. In other words, the study reveals that the simultaneous increase in oil price and corruption have an adverse effect on the growth oil oil-rich economies. In essence, the effect oil price on economic growth in oil-rich countries varies with the level of corruption, with the marginal effect of oil price having a beneficial impact on growth at low levels of corruption, but impairing growth at higher levels of corruption. Using a disaggregated sample of countries with relatively low level of corruption and countries with high level of corruption, the results demonstrates that the adverse impact of the simultaneous increase in oil price and corruption is larger in oil-rich countries with relatively low level of corruption compared to countries with their counterparts with a higher level of corruption. The economic implication of this study is that corruption is an important channel through which changes in oil price and the dependence on oil exert its influence on economic growth in oil-rich countries. Hence, an increase in oil price would not produce the desirable long-term economic benefits except it is accompanied by a reduction in the level of corruption.

Therefore, oil-rich countries are encouraged to adopt appropriate strategies to reduce the level of corruption to enable their economies benefit from the abundance of the natural resources. The level of corruption can be reduced and growth enhanced by removing operational red tape and simplifying cumbersome regulations in the bureaucratic system. Also, the malaise can be curbed by raising the income level and wages of civil servants, promoting greater freedom of expression, entrenching the rule of law and efficiency in the legal system, and the adequate funding of anti-graft agencies.

Notwithstanding the seeming positive effect of oil price on growth, policymakers in oil-rich countries are urged to implement policies to diversify their economy and public revenue away from oil. This can be achieved through increased investment in human and physical capital, and critical non-oil sectors such as the service, manufacturing, agricultural, et cetera, to spur sustained growth and development.

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