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The Dynamic Impact of Oil Price on Economic Growth in African Countries

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Abstract

This study examines the influence of oil prices on economic growth across 51 African countries from 2005 to 2023. It uses pooled Ordinary Least Squares (OLS), Random Effects (RE), Fixed Effects (FE), and the Generalized Method of Moments (GMM) estimations to address issues of endogeneity and dynamic relationships. The analysis includes key macroeconomic variables such as the labor force, capital, exchange rates, inflation, and the current account balance. Results from dynamic panel GMM models show sustained economic growth, indicated by a strong, positive lagged GDP coefficient. Oil prices have a statistically significant positive effect on growth in the RE, FE, and GMM models, highlighting the influence of oil market fluctuations on African economies. Variables like labor force and capital investment support growth, while inflation and exchange rate volatility negatively affect it, reflecting macroeconomic risks. Additionally, the impact of oil prices on economic growth is asymmetric between oil-importing and oil-exporting countries, indicating the vulnerability of African economies to oil price fluctuations. These findings emphasize the crucial role of oil price movements in shaping the economic landscape of African nations and underscore the need for comprehensive macroeconomic policies to manage inflation and exchange rate pressures.

Keywords: Oil Price, Economic Growth, Africa, GMM

Introduction

Energy is a critical driver of economic growth and poverty alleviation, as it is essential for producing goods and services that fuel industrial development, transportation, and economic activity at various scales. Energy demand is vital to sustaining growth, and oil remains the dominant energy source globally. However, oil price volatility plays a significant role in shaping the economic stability and growth of nations worldwide. In 2022, global energy consumption reached 4,422.1 million tons, with oil accounting for 34% of this total. Although renewable energy sources, such as solar and wind, are growing rapidly, with consumption increasing significantly between 2020 and 2023, oil continues to dominate the energy supply, accounting for 30% of the total in 2022.

Despite its global significance, the research problem is insufficiently examined within the African context: How do oil price fluctuations asymmetrically influence economic growth in oil-exporting versus oil-importing African countries, and what accounts for the varied responses documented in the empirical literature? This subject transcends economic inquiry, representing a major theme in current social science discussions regarding the "resource curse," energy dependency, global inequality, and the political economy of commodity shocks. Classical economic theory posits symmetric effects of oil price fluctuations; however, research contests this perspective, uncovering nonlinear, asymmetric, and institutionally mediated effects that differ markedly among locations and economic frameworks (Hamilton & Herreras, 2001; Rafiq et al., 2016). Africa's distinctive status as the world's third-largest oil-producing continent, coupled with energy insecurity, inadequate refining capacity, and enduring poverty, renders it a pivotal subject for analysing these discussions.

The significance of this study is rooted in its direct engagement with unsolved theoretical and empirical issues. Initially, it tackles the geographic and methodological deficiencies in the literature, which have predominantly concentrated on industrialised economies or singular African case studies, overlooking a thorough, cross-country examination that considers endogeneity and dynamic impacts. Secondly, it enhances the current dialogue on asymmetric shocks and nonlinear modelling in macroeconomics, addressing demands for more sophisticated frameworks that transcend linear assumptions. The findings possess immediate policy significance for African governments and regional entities contending with energy transitions, fiscal instability, and sustainable development amid fluctuating global oil markets.

Recent empirical studies highlight the urgency and complexity of this research. Akinsola and Odhiambo (2020) demonstrated that declines in oil prices, rather than increases, stimulate growth in Sub-Saharan Africa, underscoring the region's distinct structural vulnerabilities. Bala et al. (2021) and Kriskkumar et al. (2022) identified asymmetric effects in Malaysia, indicating that fluctuation in prices can promote growth, highlighting its dual function as a producer and trader. Gbatu et al. (2017) demonstrated that oil shocks negatively impact GDP in ECOWAS importers, whereas the effects are negligible for exporters. In contrast, Olayungbo and Umechukwu (2022) identified varying responses among African exporters, noting that Algeria and Egypt exhibit greater vulnerability compared to Gabon and Nigeria. Recent studies, including those by Sabayo et al. (2023) in Tanzania and Fakhreddine et al. (2024) in Lebanon, provide evidence that oil-price volatility, rather than price levels alone, exacerbates inflation and output in economies reliant on

imports. The inconsistent and context-specific findings highlight a fragmented empirical landscape, emphasising the necessity for a unified and methodologically rigorous analysis across a diverse African sample.

This study extends and critiques existing literature by examining 51 African nations from 2005 to 2023 through dynamic panel models and system GMM. It addresses endogeneity, captures both short- and long-term effects, and distinguishes between oil-exporting and oil-importing countries. Integrating essential macroeconomic variables such as labour, capital, inflation, exchange rates, and the current account provides a comprehensive framework for understanding the interaction between oil price dynamics and domestic economic structures in shaping growth trajectories. This study examines nonlinearities and asymmetric responses, offering empirical evidence that either corroborates or challenges existing theories related to the resource curse, Dutch disease, and energy dependency in developing regions.

In doing so, this research addresses a significant empirical gap and enhances the understanding of the integration and destabilisation of peripheral economies within global commodity markets in the field of social science. The findings will enhance energy and fiscal policies, contribute to discussions on economic diversification and institutional quality, and provide evidence-based insights for sustainable development in oil-dependent and energy-insecure regions in Africa and beyond.

Literature Review

The relationship between oil prices and macroeconomic performance, as observed since 1970, was examined using a wide array of indicators, including inflation, trade balance, exchange rates, fixed investment, consumption, employment, stock markets, and fiscal accounts. The empirical results, however, remain mixed: some studies identified a strong and significant link between oil price changes and macroeconomic variables (Hamilton & Herreras, 2001; Eltony & Al-Awadi, 2001; Abeysinghe, 2001; Rafiq et al., 2016; Van Eyden et al., 2019; Bala et al., 2021), while others reported either no significant effect (Bala et al., 2021; Olayungbo & Umechukwu, 2022; Kriskkumar et al., 2022) or asymmetric impacts depending on whether prices rose or fell (Mork, 1989; Akinsola & Odhiambo, 2020; Bala et al., 2021). Methodologically, early works relied primarily on time series analysis (Darby, 1982; Uri, 1996; Hamilton, 1983), whereas later studies incorporated panel data approaches to capture cross-country dynamics (Cavalcanti et al., 2014; Gbatu et al., 2017).

Initial research emphasized oil prices as a key driver of global recessions and inflationary pressures. Darby (1982) applied two-stage least squares and principal component methods, concluding that oil price spikes in 1973–1974 significantly fueled stagflation by shifting the aggregate supply curve. Hamilton's (1983) seminal VAR analysis for the U.S. (1948–1980) confirmed that oil price shocks had a strong influence on GNP growth and inflation, a finding supported by Burbidge and Harrison (1984). However, their extended dataset suggested that the relationship weakened in the 1980s, prompting Mork (1989) to propose an asymmetric model, which shows that oil price increases reduce output, whereas price decreases exert a minimal effect.

Subsequent studies expanded variable sets and refined techniques. Dotsey and Reid (1995) employed VAR models that included unemployment, interest rates, and inflation to demonstrate that oil shocks disproportionately affect industrial sectors. Federer (1996) found no asymmetric effects in U.S. output, whereas Hamilton (1996) revealed that oil price hikes, rather than general volatility, drove downturns. Collectively, these early works established oil price shocks as key macroeconomic drivers but highlighted weakening significance over time, motivating methodological innovation.

In the 2000s, research expanded geographically and examined the role of oil in both oil-exporting and oil-importing economies. Eltony and Al-Awadi (2001) examined Kuwait using VAR/VECM, showing that government expenditure transmitted oil shocks. Abeysinghe (2001) introduced a structural VARX model across 12 Asian and OECD economies, illustrating positive effects in oil-exporting nations but negative trade-driven effects in importers. Studies in developing regions have confirmed vulnerability. Bacon and Adib (2005) found that a 10% increase in oil prices cut growth by 4% in low-income African nations, while Guo and Kliesen (2005) linked price volatility to U.S. investment and unemployment.

Blanchard et al. (2008) compared six advanced economies, revealing that oil shocks in the 1970s had more severe inflationary and employment effects than in the 2000s, reflecting improved monetary policy and structural changes. Similarly, Rafiq et al. (2009) demonstrated that oil price volatility exacerbated unemployment and fiscal deficits in post-crisis Thailand, while Farzanegan and Markwardt (2009) showed that Iranian growth and government spending were highly sensitive to oil price fluctuations, highlighting the country's dependence on oil revenues. Studies in Trinidad and Tobago (Lorde et al., 2009) and Turkey (Jbir & Zouari-Ghorbel, 2009) offered mixed evidence, suggesting that effects vary by fiscal structure and openness.

The 2010s saw growing recognition of asymmetric and country-specific dynamics. Tang, Wu, and Zhang (2010) found no direct CPI effects in China due to price controls, while Du et al. (2010) argued that oil price drops, rather than increases, harm Chinese growth by signaling global slowdowns. Ghosh and Kanjilal (2013) confirmed asymmetric impacts in India, with negative oil shocks more inflationary than positive ones. Regional studies also proliferated. Berument et al. (2010) highlighted heterogeneity in MENA economies, and Gbatu et al. (2017) demonstrated that oil price shocks significantly harm GDP in net oil-importing ECOWAS states but are insignificant for exporters. Van Eyden et al. (2019) employed advanced panel estimators to confirm that oil price volatility has a significant negative impact on long-term growth in OECD nations.

Recent research emphasizes the importance of nonlinear modeling and the role of institutional structures. Akinsola and Odhiambo (2020) employed panel ARDL models to demonstrate that decreases in oil prices benefit growth in Sub-Saharan Africa. In contrast, increases have a muted effect due to subsidies and low oil intensity. Bala et al. (2021) and Kriskkumar et al. (2022) applied TAR, MTAR, and NARDL approaches to Malaysia, finding asymmetric effects where both price rises and drops can boost growth, reflecting its dual role as an oil producer and trader. Olayungbo and Umechukwu (2022) reported contrasting responses among African exporters, with Algeria and Egypt more vulnerable than Gabon and Nigeria.

Recent empirical work follows this trend, using nonlinear and panel-based methodologies to a variety of economies while confirming that the oil price-macroeconomy relationship is still mixed and country-specific. In Tanzania, Sabayo, Massito, and Moshi (2023) employed an ARDL model to demonstrate that oil-price volatility, rather than level fluctuations, has a significant negative impact on both inflation and output, emphasizing the fragility of African oil-importing economies. Similarly, in Lebanon, Fakhreddine et al. (2024) used an NARDL framework to reveal long-run asymmetry: oil price drops improve GDP, while increases have little impact, reflecting the country's reliance on imported energy. In Nigeria, Sa'ad, Ibrahim, and Bilyaminu (2023) found that oil-price shocks asymmetrically affect inflation via exchange-rate dynamics, with positive shocks lowering inflation in the short run but increasing it in the long run.

Further empirical evidence continues to develop these themes, incorporating nonlinear, structural, and panel-based models across diverse economies while confirming that oil-macroeconomy linkages are context-specific. In Tanzania, Sabayo, Massito, and Moshi (2023) showed via an ARDL model that oil-price volatility not the price level significantly worsens inflation and output, highlighting vulnerability among import-dependent African economies. In Lebanon, Fakhreddine et al. (2024) demonstrated long-run asymmetry using NARDL, showing that price declines improved output while increases had muted effects. In Nigeria, Sa'ad, Ibrahim, and Bilyaminu (2023) identified asymmetric inflationary responses transmitted through exchange-rate depreciation. Similarly, evidence from Algeria (Benaissa, 2024) shows that both positive and negative shocks affect government revenue and non-oil GDP, moderated by fiscal policy, while Alqahtani (2024) identified adverse effects on Saudi financial stability through inflationary channels. In Morocco, El Yadmani, El Amrani, and Essabir (2025) found that volatility reduces GDP and worsens trade balances, whereas Akinwale and Lee (2025) showed that oil shocks in OECD exporters reduce growth and interest rates while temporarily raising inflation.

The literature consistently shows that oil prices influence macroeconomic performance. However, the direction, magnitude, and persistence of effects are highly context-specific, shaped by trade balances, subsidy policies, and structural factors. While early studies focused on U.S. and OECD economies using time-series VARs, recent research leverages panel and nonlinear models to capture asymmetries, volatility, and cross-country heterogeneity. However, gaps remain: Few studies examine African economies comprehensively, as research has focused mainly on ECOWAS or Sub-Saharan blocks. Limited work integrates exchange rate regimes and balance of payment into oil price analyses**.** Studies often overlook long-term dynamics of oil dependence in low-income countries, despite rising demand forecasts.

Despite extensive global research on oil price fluctuations and macroeconomic performance, significant gaps remain regarding their impact on African economies. Existing studies provide mixed evidence: some report strong effects of oil price changes on growth and inflation, while others find negligible or asymmetric impacts. Much of the literature focuses on developed countries or limited developing regions, often overlooking the heterogeneity among African nations in terms of oil dependence, fiscal structures, and institutional quality. Methodologically, many studies rely on time-series or standard panel methods that may not adequately capture endogeneity, dynamic effects, or cross-country

differences. Furthermore, few studies comprehensively examine both oil-importing and oil-exporting African countries over extended periods and explicitly link oil price volatility to key macroeconomic variables such as labor, capital formation, inflation, and exchange rates. This study addresses these gaps by analyzing 51 African countries from 2005 to 2023 using dynamic panel models and system GMM, providing robust evidence on the short- and long-term impacts of oil price fluctuations on economic growth and macroeconomic stability across diverse African contexts.

Methodology

Data Source and Measurement

This research includes 51 African nations: 18 export oil and 33 import it. Exporting countries include Algeria, Cameroon, Angola, Tunisia, Ghana, D. R. Congo, Congo, Egypt, Morocco, Niger, Mozambique, Nigeria, Libya, Gabon, Ivory Coast, Equatorial Guinea, South Africa, and Sudan. The study covers the following oil-importing countries: Djibouti, Botswana, Burkina Faso, Benin, Burundi, Comoros, Cape Verde, Ethiopia, Eswatini, Kenya, Lesotho, Gambia, Madagascar, Malawi, Guinea, Mauritius, Guinea Bissau, Tanzania, Rwanda, Uganda, Guinea, Namibia, Mauritania Mali, Senegal, Seychelles, Sierra Leon., Togo Sao Tome, Zambia and Zimbabwe. Data on the variables are retrieved from the World Bank, World Development Indicators, and the Energy Information Administration (EIA), covering 2015 to 2023.

Variable Description

This section provides a detailed description of the model's variables. To address the study's objective, it is important to define the measurement scales for the variables. Therefore, Gross Domestic Product (GDP) serves as an independent variable in the model to analyze how economic growth affects carbon emissions, using the logarithm of real per capita GDP in 2010 US dollars. Data collected from 2015 to 2023 from the World Bank Database indicate that GDP is likely to have a positive influence on carbon emissions in 49 selected African countries. Africa, being an emerging continent with growth across all sectors, is expected to increase its energy consumption, thereby positively influencing carbon emissions. The anticipated outcome is to effectuate a favorable influence on carbon emissions. The anticipated outcomes align with the findings of Wang et al. (2013), Jalil (2014), Hanif (2018), and Mohsin et al. (2021).

Inflation (INF): The model used an inflation variable to examine the influence of macroeconomic variables on economic growth. The logarithm of the consumer price index was utilized to compute the inflation rate. The World Bank of Statistics publishes annual statistics derived from data sets covering the years 2015 to 2023. A decline in inflation is expected to affect oil prices and economic growth adversely. Consequently, a decline in inflation is anticipated to enhance purchasing power, reduce oil import costs for importing nations, and ultimately raise output levels. The results are anticipated to align with the research conducted by Cologni & Manera (2008), Rafiq, Salim, & Bloch (2009), and Ghosh & Kanjilal (2013).

Oil price (OP): This variable was included in the model to examine its effect on economic growth. The annual crude oil price, denominated in US dollars per barrel, is utilised to determine the oil price. The annual oil price will be determined using data from BP's Statistical Review of World Energy 2023. The outcomes are projected to favour oil-exporting

nations, as increased oil revenue is expected to boost economic growth in these regions. A negative impact on oil-importing nations is anticipated, as oil imports will divert capital to oil-exporting nations; this uncertainty is likely to diminish investment and adversely influence economic performance. The findings are anticipated to correspond with the research conducted by Hamilton & Herreras (2001), Ettony & Al-Awadi (2001), Abeysinghe (2001), Rafiq et al. (2016), Eyden et al. (2019), and Bala et al. (2021), which revealed that rising oil prices significantly affect economic growth and macroeconomic factors.

Exchange rate (EX): The stability of economic growth depends on the stability of the exchange rate, whether it is fixed or floating. The unadjusted weighted average value of a country's currency relative to other major currencies, expressed in US dollars, is called the exchange rate. The variable is included because of its direct influence on oil prices and economic growth, which are under investigation in African nations. This study employs the LCU per US$ period-average as the exchange rate measure. The data were gathered from the World Development Indicators (World Bank, 2023) and cover the period from 2015 to 2023. The findings are expected to have an adverse impact on oil prices and economic growth in certain African nations. A rise in currency values increases the cost of importing oil, significantly impacting the economic growth of many African countries that rely heavily on oil imports. The results correlate with the findings of Farzanegan and Markwardt (2009), Uneze and Ekor (2012), and Ghosh and Kanjilal (2013).

Labour force (L): The labour force is considered one of the main factors in economic growth. Solow posits that an increase in population correlates with a rise in labour supply. He argues that labour can only enhance growth in the short term. Empirical research has identified both positive and negative impacts on economic growth (Abdelsalam, 2020). The expected result is to have a positive effect, as increased labour force utilisation will improve production and positively affect economic growth. This study measures labour as the total labour force and population growth, utilising data from the World Bank database covering the period from 2015 to 2020. The results are anticipated to align with the findings of Ahmed, Kumar, and Shahbaz (2016) and Abdelsalam (2020).

Physical Capital (K): As in the neoclassical model, capital availability enhances growth performance. Solow posits that economic growth will increase due to capital expansion. Gross Fixed Capital Formation serves as a proxy for capital. The results are expected to have a positive impact on economic growth, as investments in railway, road, school, and building construction will ultimately improve economic performance. The results are anticipated to align with the findings (Ahmed, Kumar, & Shahbaz, 2016; Tiba, 2019; Abdelsalam, 2020). The balance panel data were sourced from the World Bank Database in 2023, covering the period from 2015 to 2023.

Current account (CA): This is a component of the balance of payments that summarises all foreign transactions. The balance of payments (BOP) records a nation's financial interactions with the international community. The Balance of Payments log in local currency units per US dollar was analyzed to assess the impact, using data from World Bank Statistics spanning 2015 to 2023. The findings are expected to positively influence economic growth in the countries specified in the study. The revenue from oil and other natural resources exported by African countries is expected to improve the balance of payments and

stimulate economic growth. The research findings are expected to align with those of Uneze and Ekor (2012) and Bayraktar et al. (2016).

Model Specification

This study employs the Abdelsalam (2020) Model, which is best expressed as follows:

$$Y = AK^{\alpha}L^{(1-\alpha)} \quad (1)$$

$$Yit = AK_{it}\,\alpha L_{it} \quad (2)$$

Y represents the output (GDP), A denotes technological progress, K represents physical capital, L is the used labor force, and X represents control variables (exchange rate, consumer price index and current account) . EX, CPI, and CA represent the exchange rate, consumer price index, and current account, respectively and OPC is price change which is the additional variable in the model. The equation can be transformed into a log form. Equation (9) can be rewritten as follows in static form:

$$lnGDP_{it} = \beta_0 + \beta_1 \ln OPC_{it} + \beta_2 \ln K_{it} + \beta_3 \ln L_{it} + \beta_4 \ln EX_{it} + \beta_5 \ln CPI_{it} + \beta_6 \ln CA_{it} + \varepsilon_{it} \quad (3)$$

Whereas in dynamic form the equation can be written as: -

$$lnGDP_{it} = \beta_0 + \beta_1 \ln GDP_{it-1} + \beta_2 \ln OPC_{it} + \beta_3 \ln K_{it} + \beta_4 \ln L_{it} + \beta_5 \ln EX_{it} + \beta_6 \ln CPI_{it} + \beta_7 \ln CA_{it} + \varepsilon_{it} \quad (4)$$

The early model was augmented by focusing on oil-importing and exporting nations, and we analysed the nonlinearity present in the models. This study utilises the previously discussed theoretical framework, incorporating the works of Abdelsalam (2020) and Doer (2025) to analyse the nonlinear and asymmetric impacts of oil prices on economic growth in oil-exporting and oil-importing nations. The model analyses these two groups separately to identify the distinct effects of oil price fluctuations. Since oil is a crucial economic factor, it has opposite effects on producers and consumers in response to changes in oil prices.

The analysis model includes a dummy variable (d) to distinguish between oil exporters (d = 0) and oil importers (d = 1). Including the square of oil prices (oil²) addresses diminishing returns. Additional interaction terms between oil price variables and the dummy variable, specifically, loil_d = loilprice × d (represented as OPd) and oil2_d = oil2 × d (represented as (OP2d), are incorporated to estimate the specific marginal effects for oil-importing countries. This analysis assesses the differential impacts of oil price fluctuations on various groups. The Allison method is employed to measure changes in oil prices, producing comparable results for both negative and positive price fluctuations in the estimation of interaction terms.

$$lnGDP_{it} = \beta lnGDP_{i,t-1} + \beta_1 ln(OP_{it}) + \beta_2 ln(OP_{it})^2 + \beta_3 \ln K_{it} + \beta_4 \ln L_{it} + \beta_5 \ln EX_{it} + \beta_6 \ln CPI_{it} + \beta_7 \ln CA_{it} + \beta_8 \ln OPd_{it} + \beta_9 ln(OP_{it})^2 d + \beta_{10} d_{it} + \varepsilon_{it} \quad (5)$$

Estimation Method

In this study, we employ multiple panel-data estimation methods to ensure robustness and address issues such as unobserved heterogeneity, endogeneity, and dynamics. We begin with Pooled Ordinary Least Squares, which treats all observations as independent and overlooks potential entity-specific or time-specific effects. To account for unobserved individual differences, we then apply both Random Effects (assuming the entity effects are uncorrelated with the regressors) and Fixed Effects (which control for all time-invariant unobservables by focusing on within-entity variation). Recognizing that some explanatory variables may be

endogenous or that past outcomes could influence current outcomes (lagged dependent variables), we also implement System GMM in its one-step and two-step versions. The one-step System GMM estimator uses initial weighting matrices under weaker error-structure assumptions, yielding consistent estimates. The two-step version improves efficiency by employing a more general weighting matrix that accommodates heteroskedasticity (and possibly autocorrelation). However, caution is necessary regarding potentially biased standard errors and the proliferation of instruments. However, in the first GMM run, the estimation is preliminary and assumes homoskedasticity. At this stage, the residuals do not fully account for endogeneity correction, which means that conducting the AR(2) test could produce misleading results, and that is why we did not include it in the results table.

Results and Discussion

We used static and dynamic panel models. Static analysis included Pooled OLS, Random Effects, and Fixed Effects models. The Breusch-Pagan LM test was significant at the 5% level, so we chose the random-effect model. The Hausman test p-value of 0.245 also supported this choice. We then analyzed the model using one-step and two-step GMM for 49 African countries.

Next, the study developed a dynamic model based on the endogenous growth model, with economic growth as the dependent variable in the model estimation. The system GMM estimation was the primary technique used. The GMM system estimated the variables in both one- and two-step procedures. System GMM estimation is the most effective method for estimating a dynamic panel model with an economic growth effect and endogeneity of some explanatory variables.

The study reports three tests: the Sargan test for overidentifying restrictions, the first (AR1) and second (AR2) tests for serial correlation. The AR2 test was accepted (p=0.948), but the AR1 test rejected the null hypothesis of no serial correlation. The Sargan test for one-step GMM yielded a p-value of 0.000, contradicting the null hypothesis and suggesting potential invalid instruments. Conversely, the two-step GMM Sargan test supported the null hypothesis, indicating uncorrelated instruments with the error term. Since the two-step GMM results are more efficient, the study will rely on them for discussion.

The table below summarizes the static findings. The results show that in all three tests, Pooled OLS, Fixed, and Random effects labor force (LL) and capital (K) are positively correlated at the 1% significance level. This indicates that increasing labor and capital drives economic growth in 49 African countries. The analysis also reveals that oil prices (OPC) and inflation (CPI) have a statistically significant impact on economic growth at the 5% level. Specifically, inflation has a negative effect, while oil has a positive effect in both fixed- and random-effects models. However, the Pool OLS estimation results are not significant. Additionally, the exchange rate is significantly negatively related in the Pool OLS model at the 5% level, but not in the fixed and random estimations. Finally, the static model indicates that the balance of payments (BOP) has an insignificant positive effect on economic growth across 49 African countries.

GMM results, revealing that exchange rates and inflation significantly harm economic growth in 49 African countries. Higher exchange rates and inflation undermine stability:

inflation cuts purchasing power, while currency depreciation raises import costs and reduces exports. These challenges hinder sustained growth by affecting stability and investor confidence. Additionally, a 1% rise in last year's GDP leads to a 0.474% increase in current GDP, indicating past performance boosts current growth.

Research shows a positive link between oil prices, labor participation, and growth. A 1% rise in oil prices boosts growth by 0.08%, underscoring oil's role in African economies. This aligns with studies (Berument & Ceylan, 2004; Majidli & Gulliyev, 2020) indicating that oil price changes greatly affect oil-dependent African nations. Increased labor participation also positively impacts growth; a 0.146% rise in participation leads to a 0.146% growth increase, highlighting the importance of investing in human capital. The findings suggest that growing the labor force and improving market conditions can enhance productivity, exports, and growth, consistent with Akinlo and Apanisile (2015).

The study finds that gross capital formation has a negative, statistically insignificant link with economic growth in Africa. Despite increases from 416.56 in 2020 to 476.12 in 2022, it has not significantly boosted economic performance. This aligns with the literature (Akinsola & Odhiambo, 2020), indicating that capital formation's impact depends on investment quality and efficiency. Factors such as poor infrastructure, inefficient use, or a lack of investment in high-return sectors may explain the weak link. A targeted approach focusing on manufacturing, technology, and education is needed for sustainable growth.

The balance of payments has a positive but insignificant effect on growth. Although many African countries have negative trade balances, these imbalances significantly affect economic growth. Dependence on imports and oil exports makes these economies vulnerable to external shocks like price fluctuations and demand changes (Longe et al, 2018; Gnimassoun, Joëts, and Razafindrabe, 2017). Improving domestic production, labor skills, and stabilizing oil prices could enhance the trade balance and long-term growth.

The CPI shows that inflation negatively impacts growth; a 1% drop in inflation raises GDP by 0.061%. Reducing inflation boosts economic performance, vital for African nations with high inflation. Lower inflation improves purchasing power, consumption, and investment, supporting growth. This aligns with prior research on stable inflation and macroeconomic stability (Darby, 1982; Hooker, 2002; Ghosh & Kanjikal, 2013). Addressing inflation and exchange rate instability, along with oil, labor, and capital investments, can accelerate African economic growth..

Table 1
Static and Dynamic Estimation

Variables	Pool OLS	Random Effect	Fixed Effect	S-GMM one Step	S-GMM Two Step
l.GDP				0.459 ***	0.474 ***
				(0.069)	(0.038)
LEX	-0.056***	0.002	-0.001	-0.119***	-0.0111***
	(0.016)	(0.003)	(0.777)	(0.003)	(0.003)
LCPI	-0.034	-0.027**	-0.027**	-0.075	-0.061***
	(0.744)	(0.010)	(0.010)	(0.011) ***	(0.017)
LCA	-0.060	0.001	0.001	-0.007	0.0001
	(0.036)	(0.003)	(0.003)	(0.216)	(0.011)
LL	0.592***	0.717***	0.735***	0.158***	0.146***
	(0.036)	(0.053)	(0.067)	(0.025)	(0.031)
LOPC	0.063	0.053***	0.052***	0.093***	0.079***
	(0.166)	(0.013)	(0.013)	(0.011)	(0.008)
LK	0.286***	0.123***	0.119***	-0.042***	-0.028
	(0.029)	(0.012)	(0.012)	(0.016)	(0.018)
Cons	9.622	9.663	9.498	2.188	3.572
Adjusted R-squared	0.694	0.655	0.653		
Breusch & Pagan LM test		1316.54***			
Hausman Test		7.91			
Sargan test				84.042***	21.923
AR(2)					0.020

Note: *, ** and *** depict 10%, 5% and 1% level of significance respectively.

Table 2 The nonlinear impacts of rising oil prices on exporting and importing countries were estimated using System Generalised Method of Moments (GMM) estimation, utilising difference GMM to evaluate the robustness of the findings. This estimation method is based on available data from 44 nations from 2005 to 2023, comprising 18 oil-exporting and 26 oil-importing countries. The GMM method is suitable for our data because the number of countries exceeds the number of years (N > T). The analyses are categorised into exporting and importing countries, as fluctuations in oil prices are believed to have varying impacts on oil-exporting and oil-importing nations. These categories are classified using a dummy variable, with the exporting nation denoted as 0 and the importing nation as 1. A preliminary test was conducted to validate the use of system GMM. The estimation includes assessing serial correlation among the variables and the validity of the employed instruments. The Arellano-Bond test was utilised to estimate serial correlation, yielding a p-value of 0.586, indicating that second-order autocorrelation is not statistically significant. The Sargan test of over-identification yields a *p*-value of 0.186, surpassing the 0.05 threshold. The results suggest rejecting the null hypothesis of instrument validity, indicating that the instruments

used in the regression are valid. Consequently, the AR2 and Sargan tests validate the robustness of system GMM estimation, thereby improving the accuracy and consistency of the estimated results.

Table 2 provides quantified estimates based on 324 observations from African oil-importing and exporting nations. The findings indicate that, in both system GMM and difference GMM estimations, inflation rates and oil price fluctuations have positive and significant effects on economic growth in both oil-exporting and oil-importing nations. The findings demonstrate that changes in oil prices have nonlinear effects on economic growth across 44 African nations, encompassing both oil-exporting and oil-importing nations. Oil-exporting nations benefit substantially from rising oil prices; however, they face diminishing returns and volatility-related risks. In contrast, oil-importing nations face adverse effects from increasing oil prices; however, these impacts may be less pronounced as prices rise, owing to mitigation strategies or economic adjustment mechanisms. The findings regarding control variables indicate that the exchange rate (EX), balance of payments (BOP), and physical capital (K) negatively affect economic growth in both exporting and importing countries. In contrast, labour demonstrates a significant impact on economic growth, as evidenced by various GMM estimations. The findings indicate that the labour force in African countries is not facilitating economic advancement, as increasing unemployment rates adversely affect growth. a reduction in the exchange rate benefits oil-importing nations by enhancing their purchasing power.

A nonlinear relationship is observed between oil prices and economic growth across African nations, regardless of whether they are oil importers or exporters. In oil-exporting nations, rising oil prices markedly enhance economic growth, evidenced by a coefficient of 4.356 and a *p*-value below 0.01. This indicates that higher oil prices boost resource revenues through increased export income, expanded fiscal capacity, and strengthened foreign reserves, thereby facilitating public investment and consumption. The findings are consistent with data indicating that oil supply in African oil-exporting countries rose from 7,716,831 Terajoules in 2015 to 8,816,164 Terajoules in 2022 (IEA, 2023). Nevertheless, the magnitude of this positive effect appears constrained. The inclusion of the squared term (oil2) yields a negative, statistically significant coefficient of -0.546 (p-value < 0.01). This indicates a nonlinear relationship in which the advantages of increasing oil prices decrease at higher levels. This pattern reflects the theories of the "resource curse" and Dutch disease, indicating that excessive oil revenues can lead to inflation, currency overvaluation, and resource misallocation. These factors present challenges to governance, political stability, and government effectiveness, ultimately obstructing economic growth (Isser et al., 2024; Corruption Percentage Index, 2023). The findings align with the findings of Berument et al. (2010) and Kriskkumar et al. (2022).

The interaction between oil prices and the oil-importing country dummy (loil_d) is negative and statistically significant, exhibiting a coefficient of -3.439 and a *p*-value below 0.01. This underscores the negative effects of increasing oil prices on economic growth in oil-importing countries, which rely significantly on imported fuels for electricity, transportation, and industrial production. Rising oil prices lead to higher input costs, deteriorating trade balances, and inflation in these economies, ultimately reducing output. The squared interaction term (oil2_d) is positive and statistically significant, with a coefficient of 0.424 and

a p-value below 0.01, suggesting a nonlinear adjustment process. Initial increases in oil prices have a significant negative effect; however, this impact diminishes at higher price levels. In African oil-importing nations, governments frequently mitigate rising oil prices through subsidies and investments in alternative energy sources, with negligible effects on economic growth. The coefficient for the oil importer dummy (d) is positive and statistically significant, with a value of 6.299 and a p-value of 0.000, suggesting that oil-importing countries typically exhibit higher baseline growth rates than oil-exporting countries. This aligns with the resource dependency literature, which posits that oil-exporting economies face structural and governance challenges that impede long-term development. In contrast, more diverse, less resource-dependent economies are better able to sustain growth amid global fluctuations. The results indicate a nonlinear relationship between oil prices and economic growth in both African oil-exporting and importing countries. The results are consistent with the results of Gbatu et al. (2017) and Akinsola & Odhiambo (2020).

Table 2
The Nonlinear Impact of Oil Price on Economic Growth in Africa Oil Exporting and Importing Countries.

Variables	System GMM	Difference GMM
$LGDP_{it-1}$	0.260*** (0.088)	0.531** (0.245)
LEX	-0.078*** (0.030)	0.296*** (0.048)
LK	-0.065* (0.039)	0.101** (0.040)
LCPI	0.751*** (0.035)	0.416*** (0.056)
LCA	-0.265*** (0.046)	-0.288*** (0.059)
LLAB	-0.071 (0.103)	-0.422*** (0.149)
LOP	4.356*** (0.370)	2.669*** (0.448)
LOP^2	-0.546*** (0.047)	-0.322*** (0.059)
LOPd	-3.439*** (0.611)	-1.514*** (0.520)
LOP^2d	0.424*** (0.080)	0.174** (0.068)
D	6.299*** (1.167)	2.427** (1.140)
Constant	2.698	5.790*
Sargan test	0.186	0.388
Number of Observations	352	352
Number of Instruments	30	26
AR2	0.586	0.388

Note: *, **, and *** depict 10%, 5% and 1% levels of significance, respectively.
The numbers in parentheses are the Standard errors.

Conclusion and Policy Implications

Researchers examined how oil prices influence economic growth in 51 African countries from 2005 to 2023, using methods including pooled OLS, Random-Effects, Fixed-Effects, and dynamic GMM. Results indicate that oil prices promote growth, especially when accounting for biases and time variations. Labor force participation and capital accumulation drive growth, while inflation and exchange rate fluctuations hinder it. Past GDP growth affects current outcomes, reflecting the structural features of African economies.

The findings reveal high sensitivity to oil prices, offering opportunities and risks: oil-exporting countries benefit from higher prices, while importers face rising costs. Effective management requires macro policies that control inflation, stabilize currencies, and support sustainable investment. Policy implications include diversifying economies, stabilizing revenue with funds, and investing in renewable energy, infrastructure, and human capital. Regional cooperation and economic integration can reduce vulnerability to global oil price changes.

The study emphasizes the vital role of labor and human capital in boosting economic growth across African nations. Increased labor force participation significantly boosts GDP, highlighting the importance of policies that invest in education, vocational training, and skill development, especially for youth and women. In addition to labor improvements, capital formation should prioritize quality over quantity. Focused investments in high-return sectors such as manufacturing, technology, and education, combined with effective public project management and incentives for private sector investment, can ensure that capital effectively supports sustainable growth. Macroeconomic stability is equally essential. Inflation and exchange rate volatility were found to impede economic performance by lowering purchasing power and increasing import costs. African policymakers should aim for low, stable inflation through prudent monetary policy, strengthen central bank independence, and implement measures to reduce currency volatility.

Furthermore, the positive impact of oil prices on growth highlights the importance of managing natural resources efficiently, including stabilizing revenues and promoting downstream value addition to maximize economic benefits while reducing exposure to global price fluctuations. Lastly, the study stresses the importance of boosting domestic production and diversifying trade. Over-reliance on imports and oil exports leaves economies vulnerable to external shocks, making import substitution, export diversification, and the development of skilled labor crucial for long-term growth. Economic stability, supported by good governance, fiscal discipline, and long-term planning, enhances the positive effects of past growth on current performance. By focusing on human capital development, strategic investment, macroeconomic stability, and resource and trade management, African countries can achieve resilient, inclusive, and sustainable economic growth.

Despite providing valuable insights into the relationship between oil prices and African economic growth, this study has several drawbacks. First, the analysis is based on secondary data from 51 African countries spanning 2005 to 2023, which may contain

measurement mistakes, missing data, or variations in national reporting standards. Second, while panel estimation techniques such as OLS, RE, FE, and GMM help address endogeneity and dynamic effects, model specification difficulties and omitted-variable bias cannot be eliminated. Third, the study analyzes African countries as relatively homogeneous groups of oil producers and importers, which may obscure structural, institutional, and policy variations that influence growth responses to oil price shocks. Fourth, external factors such as geopolitical conflicts and technological advances in energy. Markets, or international trade dynamics, were not explicitly incorporated, which may limit the generalizability of the findings. Finally, the study's macro-level focus limits its ability to capture sectoral or microeconomic dynamics that could provide deeper insights into how changes in oil prices affect productivity, employment, and investment behavior across different African economies.

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