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Implication of Oil Price Fluctuations on GDP Growth in Ghana

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ABSTRACT

This study investigates the connection between Ghana's GDP growth and the varying oil price. The paper used annual secondary data from the WDI and U.S. Energy Commission databases, spanning 1980-2020, because of availability of data for the chosen variables. Data analysis was done using VEC model. Results of the VECM show that Oil price has a positive effect on GDP growth in the short-run but a negative effect in the long-run. The results further indicates that if there is a shock in oil price in the short-run 197.70% of the short-run disequilibrium will be re-adjusted to equilibrium in the long run, 7.74% of inflation, 75.60% of GFCF, 10.20% of trade, 148.35% of consumption and 83.83% of exchange rate will be re-adjusted to the long-run equilibrium. Further, the granger test shows that oil price granger cause GDP growth and has unidirectional relationship. It was therefore concluded that an increase in oil price leads to a decline in the economy, hence a negative relationship between oil price fluctuation and GDP growth. Based on the findings, we recommend that the Government of Ghana should implement tight monetary policies to manage the inflationary pressures, hedging, or diversify into non-petroleum sources of energy such as solar to reduce high dependence on oil.

1. INTRODUCTION

Oil, as a mineral resource, possesses significant scarcity concerning a nation's available resources. It is widely acknowledged within the scientific community that oil represents a finite and non-renewable resource on Earth. The situation where the demand for oil surpasses its supply at prevailing market prices inevitably triggers price escalations, thus fostering incentives for increasing supply and aligning with demand equilibrium. The intrinsic value and scarcity of oil prompt both developed and developing nations to actively pursue access to these indispensable resources. The scarcity of oil can arise from various determinants, including technical limitations, geopolitical maneuvers, and constraints in extraction capacities. The global availability of oil is inherently constrained by existing deposits and the feasibility of accessing and extracting oil reserves (National Geographic, 1888).

Nations engaged in oil exports enjoy distinct advantages compared to importing counterparts. Consequently, a reduction in oil supply precipitates escalated oil prices, thereby enhancing profit margins for oil-exporting nations. Such escalations have ripple effects across numerous macroeconomic indicators within a nation. Elevated oil prices often correlate with increased prices for related oil-derived products, including natural gas and oil (Kpogli, 2015).

Oil is universally recognized as a pivotal catalyst for economic growth and advancement. Hence, fluctuations in oil prices wield significant influence as they impact the macroeconomic metrics of all nations (Kpogli, 2015). In recent years, oil prices have demonstrated pronounced volatility. For instance, Kpogli (2015) illustrates that in 2003, the price of Brent crude oil exceeded $30 per barrel, rising to $60 per barrel by August 2005, subsequently reaching $147.30 per barrel in July 2008. Thereafter, oil prices oscillated, experiencing fluctuations until December 2008, when they plummeted to $30 per barrel. This decline was attributed to diminished oil demand in the United States amid the onset of the global economic recession.

The International Energy Agency (IEA) has frequently emphasized the impact of oil quantities on GDP progression. In response to this concern, the IEA revised its 2010 projection of $104 per barrel upwards in 2011, anticipating a nominal oil

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price of $114 per barrel by 2015. This underscores the pivotal role of oil prices in shaping economic expansion. Various scholarly inquiries, such as those conducted by Rasche & Tatom (1981), Darby (1982), Hamilton (1983), and Burbidge & Harrison (1984), have delved into the interplay between oil prices and economic variables, revealing a statistically negative correlation between oil prices and economic growth (Aziz & Dahalan, 2015). Likewise, investigations by Jiménez Rodríguez & Sánchez (2005), Ghalayini (2011), Cunado & de Garcia (2005), and Gokmenoglu et al. (2015) have focused on developed economies. Subsequent analyses by Eksi et al. (2011), Cavalcanti & Jalles (2013), Ju et al. (2014), and Negi (2015) have examined non-US economies, consistently identifying statistically significant associations between oil prices and economic performance. This raises inquiries regarding the generalizability of these findings to developing, oil-importing nations such as Ghana, a query of both academic interest and substantial policy and economic ramifications. This investigation endeavors to address this inquiry, potentially furnishing valuable insights for policymakers and economists. Earlier research by Laryea & Sumaila (2001), Akpan (2009), and Kinyanjui (2018) conducted in other developing countries suggested that oil price fluctuations predominantly impact inflation rates, without fully elucidating their implications for GDP growth.

In Ghana, oil prices have demonstrated notable fluctuations over successive years. However, the ramifications of these fluctuations on overall GDP growth in Ghana have received scant scholarly attention. Moreover, while inquiries such as those conducted by Kpogli (2015), Antwi (2021), and Ruzima & Veerachamy (2015) have scrutinized the repercussions of oil price oscillations on inflationary dynamics and allied factors, they have not specifically probed into the impact of these fluctuations on GDP growth nor have they established the relationship between GDP growth and oil price variations in an oil-importing jurisdiction like Ghana. Addressing this lacuna, the present investigation endeavours to elucidate the ramifications of oil quantity shifts on GDP progression and to discern the correlation between GDP growth and oil prices, while also delineating the directional trends of oil price alterations, within the Ghanaian context.

2. LITERATURE REVIEW

This research segment is dedicated to scrutinizing the literature pertaining to the link concerning oil quantities and economic performance, constituting the primary aim of the study. Furthermore, a comprehensive review of pertinent works was undertaken to offer comparative perspectives. Within this section, the theoretical underpinnings and empirical evidence elucidating the nexus between crude oil prices and GDP growth are expounded upon.

2.1 Empirical Literature

A comprehensive examination of prior research underscores an ongoing discourse surrounding the influence of oil quantities on economic progression. It has been suggested that heightened oil prices yield augmented profits, translating into increased incomes, particularly within oil-exporting nations (Akpan, 2009; Foudeh, 2017; Jahangir & Dural, 2018; Dabachi et al., 2020). However, divergent perspectives exist, with certain studies proposing that in oil-exporting economies, ascending oil prices may not invariably culminate in elevated income levels but instead foster expansions in investment and consumption incomes.

Following Hamilton's seminal inquiry in 1983, which delineated a negative correlation between oil prices and actual output, the nexus between oil prices and economic growth has garnered considerable scholarly attention. Furthermore, as elucidated by Elneel & AlMulhim (2022), researchers such as Gisser & Goodwin (1986), Kahn & Hampton (1990), Bernanke et al. (1997), Ayadi et al. (2000), Brown & Yücel (2002), and Wu & Ni (2011) have all provided credence to the proposition that oil value shocks exert adverse pressures on the economic progression trajectories of oil-exporting nations. This phenomenon is ascribed to the diminution of financial reserves requisite for facilitating economic and societal advancements, thereby attenuating these nations' capacity to tackle developmental imperatives.

The fluctuations in oil prices exert a substantial influence on global welfare (Mgbame et al., 2015). However, alternative inquiries (Vespignani et al., 2019; Gershon et al., 2019) posit that economic interventions can improve the repercussions of oil price surprises on actual economic output. In 2020, Akinsola & Odhiambo reviewed literature on the effect of oil price fluctuations on economic growth and concluded that the effect varies for different countries and periods and concluded that generally, there is a negative relationship between oil price and economic growth.

In 2003, Chang and Wong scrutinized the influence of crude oil values on Singapore's GDP progression, revealing a negative relationship albeit lacking statistical significance. Furthermore, their analyses failed to unveil any discernible correlation between crude oil prices and other variables under scrutiny.

Blanchard and Gali (2007) analyzed the ramifications of oil value oscillations on inflation and GDP growth in contemporary economies vis-à-vis those of the 1970s. Their findings, aligned with those of Rodriguez & Sanchez (2005), underscored unstable relationships, particularly prominent in modern economies. They attributed this phenomenon to factors such as a flexible labor market, diminished energy intensity, and stable monetary policies (Kinyanjui, 2018).

Similarly, Alkhateeb and Sultan (2019) scrutinized the dynamics of India's economic development vis-à-vis oil prices utilizing data spanning from 1989 to 2017. Employing Pearson's Bound Test and vector error correction methodologies, their study unveiled evidence of long-run co-integration among economic growth, oil prices, capital formation, and inflation. They concluded that oil prices, capital formation, and inflation Granger caused economic growth, implying a detrimental impact of oil values on economic progression. Furthermore, Ruperto (2020) assessed the impact of oil price on the Malaysian economy by applying the VECM and the multivariate GARCH models to analyse the data. The author sued quarterly data from quarter 3 (Q3) of 1987 to Q3 of 2019. Results from the VECM showed a positive relationship between oil price and Malaysian GDP and that of the GARCH model suggested a significant volatility persistence in and inter-sector volatility spillovers between oil price, stock and foreign exchange markets.

In contrast, Omitogun et al. (2018) employed Autoregressive Distributed Lag (ARDL) techniques to

investigate Nigeria's economic trajectory spanning from 1981 to 2016. Their analysis unveiled a positive and statistically significant impact of oil prices and revenues on both short- and long-term economic growth. Given Nigeria's classification as an oil-exporting nation, their findings engender inquiry into the applicability of analogous outcomes to an oil-importing country such as Ghana, thereby motivating our investigation.

Moreover, Gadae et al. (2016) observed that abrupt fluctuations in oil prices exhibited diminishing effects on GDP growth in the United States over time. They identified nonlinear associations, with adverse effects more pronounced during substantial oil price escalations. Their Vector Autoregression (VAR) estimation revealed no significant Granger-causal relationship between oil price fluctuations and GDP growth, indicating a nuanced interplay between these variables.

Meanwhile, in Kazakhstan, Kose and Baimaganbetov (2015) explored the differential impacts of real oil price shocks on industrial production, real exchange rates, and inflation, taking into account non-uniform effects. Utilizing monthly data spanning from 2000 to 2013 and employing the structural vector autoregression (SVAR) model, they deduced that real oil price shocks exerted adverse effects on the country's economic performance.

Chuku (2012) examined the indirect asymmetrical impacts of fluctuations in oil prices on the Nigerian economy spanning from 1970 to 2008. Employing SVAR and Granger causality analyses, the inquiry unveiled Nigeria's limited influence on global oil market dynamics, notwithstanding its substantial crude oil exports.

Brument et al. (2010) utilized VAR models to scrutinize the consequences of fluctuations in oil prices on economic growth across Middle Eastern and North African nations. Their findings indicated a positive and statistically significant impact of ascending oil prices on output in numerous countries, contrasting with the marginal impact observed in others. Importantly, their study encompassed both oil-importing and exporting nations, differing from our exclusive focus on an oil-importing jurisdiction.

Delavari et al. (2008) undertook an investigation into the correlation between oil prices and Iranian economic development, utilizing quarterly data from 1989 to 2007. Their analyses underscored the considerable influence of oil shocks on economic growth. Given that this inquiry was conducted within an oil-exporting nation, it provokes inquiry into whether analogous findings would be applicable to an oil-importing nation such as Ghana. This question served as a catalyst for our investigation.

Hamilton (1983) scrutinized the effects of fluctuations in oil prices on the US economy, analyzing data spanning from 1949 to 1972. Using the Granger causality test, Hamilton deduced the existence of a one-way causal link between production and oil prices.

In 2020, Akinsola and Odhiambo utilized Autoregressive Distributed Lag (ARDL) and Nonlinear Autoregressive Distributed Lag (NARDL) methodologies to investigate the influence of oil prices on economic growth across several oil-importing nations: Ethiopia, Gambia, Mali, Mozambique, Senegal, Tanzania, and Uganda. Spanning from 1990 to 2018, their investigation revealed that while escalations in oil prices exerted minimal short-term effects on economic development across all countries, they yielded substantial negative long-term repercussions. Conversely, declines in oil prices positively and significantly influenced economic growth, with the inverse effect observed for price escalations.

Bruckner et al. (2012) delved into the interplay between oil price shocks, income, and democracy, utilizing data spanning from 1960 to 2007. Using Two Stage Least Squares (2SLS) and Generalized Method of Moments (GMM) methodologies, they clarified a positive association between fluctuations in oil prices and growth in GDP per capita. Their analysis suggested that a 10% escalation in international oil prices corresponded to approximately a 1% augmentation in per capita income.

Cantavella (2020) conducted a study akin to our investigation, assessing the impact of crude oil prices on Spain's real per capita Gross Domestic Product (GDP), a nation akin to Ghana reliant on oil imports. Spanning from 1945 to 2018, the inquiry unveiled that reduced crude oil prices positively influenced per capita GDP, whereas escalated prices exerted a detrimental effect.

Yasmin & Siti (2019) used monthly data from 2007 to 2016 and employed the ARDL cointegration method to analyze the short- and long- run relationship between oil price and some economic activities such as FBMKLCI and FBMEMAS in Malaysia. The analysis revealed that oil prices are cointegrated with FBMKLCI and FBMEMAS and had a negative relationship in the long-run.

Azad & Serletis in 2020, did a study to assess the impact of crude oil price volatility on the economic activities of the seven-emerging economies. The employed the multivariate GARCH-in-Mean VAR model to analyze the data. Findings from their study indicated that the uncertainty in oil price has a significant impact on the GDP of the seven-emerging market economies. The findings further revealed that this uncertainty in oil price negatively affects the world crude oil production.

Kinyanjui's (2018) empirical inquiry concentrated on the influence of crude oil prices on Kenya's GDP growth, inflation rates, and real exchange rates. Examining time series data from 1970 to 2016, the study utilized three auto-regressive distributed lag models. Results unveiled a consistent favorable effect of increasing crude oil prices on GDP growth in the long run. Furthermore, a positive correlation between crude oil prices and long-term inflation was discerned, albeit exhibiting a negative trend over the short term due to a one-year lag effect. Additionally, a negative correlation surfaced among crude oil prices and the exchange rate. The author further highlighted a research gap concerning GDP growth in sub-Saharan African nations and its association with oil prices, contrasting with inquiries such as those by Filis and Chatziantoniou (2014), which predominantly focus on developed nations. These investigations underscored an inverse relationship between GDP growth and crude oil prices, accentuating the adverse ramifications on the manufacturing sector, thereby culminating in diminished production of industrial goods. Collectively, these findings underscored the dynamic nature of inter-nation relationships over time.

Jbir and Zouari-Ghorbel (2009) conducted a comparative study employing both linear and non-linear vector autoregressive (VAR) models to evaluate the impact of asymmetric effects of oil price shocks on the Tunisian economy. Despite their endeavors, no observable distinction

emerged between the linear and non-linear VAR models, resulting in the absence of evidence supporting asymmetry in the study's findings.

Sekkach and Boubrahimi (2020) engaged in research centered on Morocco, with the aim of elucidating the influence of oil prices on economic growth spanning from 1990 to 2020. Using the Co-integration Autoregressive Distributed Lag (ARDL) model for analysis, their results revealed no notable association between oil prices, human capital formation, and economic growth over the study duration. However, they observed a noteworthy positive impact of increased gross fixed capital formation on the Moroccan economy.

In 2021, Saidi conducted a study to evaluate the repercussions of rising oil prices on the Moroccan economy. Utilizing quarterly data from 1998 to 2018, the investigation's outcomes demonstrated no direct and substantial impacts of fluctuations in oil prices on economic expansion, except during the final four quarters of the study duration. Consequently, Saidi concluded that the upsurge in oil prices adversely affected the economy in the short term.

In 2022, Shiro & Ibekwe evaluated the effect of oil price changes on the revenue generation and the overall economic growth of Nigeria where they used data between 1997 and 2020 sourced from CBN Statistical Bulletin. Results of their study revealed that oil price changes had a significant impact on Nigeria's economic growth and that interest rate and inflation affected the economy negatively

In 2007, Jumah and Pastuszyn conducted a study concentrating on assessing the effect of fluctuations in oil prices on Ghana's GDP expansion through the interest rate channel. Their analysis employed time series data spanning from 1965 to 2004, utilizing co-integration analysis techniques. Their findings disclosed a positive long-term correlation between crude oil prices and output levels. However, they did not uncover a robust correlation between GDP and oil prices. The pertinence of their findings to this study lies in the resemblance of both the country of focus and the time series data, which covers the period from 1980 to 2020. Notably, this study diverges from Jumah & Pastuszyn (2007) as it employs the Vector Error Correction Model (VECM) for analysis, whereas the former utilized the co-integration method.

In a 2008 study, Tweneboah and Adam aimed to distinguish the immediate and prolonged consequences of crude oil prices on various macroeconomic variables in Ghana, including the exchange rate, GDP, interest rate, and inflation. Their investigation utilized data from 1970 to 2006, employing the Vector Error Correction Model (VECM) for analysis. Their findings indicated that crude oil exerted a positive impact on inflation but had an adverse effect on output.

According to Cantah and Asmah (2015), crude oil has emerged as a vital element of the Ghanaian economy. This reliance renders Ghana's economic growth susceptible to fluctuations in global crude oil prices, especially given the country's significant reliance on imported crude oil. Their study explored the correlation between crude oil prices and Ghana's economic growth, utilizing annual data from 1967 to 2012 and employing the Co-integration Autoregressive Distributed Lag (ARDL) methodology. The research revealed a long-term connection between Ghana's economic expansion and crude oil prices. Moreover, it highlighted that increasing oil prices adversely impacts economic development in the short and long run. This was exacerbated by the escalation in government spending on fuel subsidies in response to soaring oil prices.

Examining monthly data from 1998 to 2013, Kpogli (2015) explored the impacts of varying oil prices on inflation in Ghana. Employing the Vector Autoregression (VAR) model, the study investigated how oil price changes influenced inflation in the country. The analysis revealed a favorable influence of fluctuations in oil prices on inflation rates over both immediate and extended periods. The findings indicated that surging oil prices, directly and indirectly through the exchange rate, drove up inflation rates in Ghana, given its status as a developing economy. However, the author did not explore the relationship between GDP growth and oil price fluctuations, a gap addressed by this study.

In 2018, Awunyo-Vitor et al. investigated the causal relationship between oil prices and economic growth in Ghana. Their research spanned from 1970 to 2012, employing Johansen co-integration and Granger Causality tests for analysis. Although statistically insignificant, the findings suggested an inverse correlation between oil prices and Ghana's economic growth. Furthermore, the Granger Causality test revealed a one-way causal relationship from oil prices to economic development, concluding that fluctuations in oil prices do not notably affect Ghana's economic growth. While our current study shares similarities with Awunyo-Vitor et al. (2018) in investigating the oil price-GDP growth relationship, differences exist in study periods, variables, and data analysis methods, with Awunyo-Vitor et al. using the Johansen co-integration method, whereas we employed the Vector Error Correction Model (VECM) in our research.

Applying the ARDL technique on annual time series data spanning 1983 to 2017, Kamasa et al. (2020), explored the impact of crude oil price changes on economic welfare in Ghana. Their study results showed that crude oil price changes have a negative and significant impact on the Ghanaian economic welfare. The study further revealed that, Trade Openness, and gross fixed capital formation (GFCF) have positive and significant impact whilst foreign direct investment (FDI) has a positive but insignificant effect, interest rate had a negative impact on economic welfare of Ghana during the study period.

Abdul-Rahman et al. (2023) did a study in order to contribute to the oil price-economic growth nexus in Ghana, where the authors assessed the short-and long-run relationships. The authors used annual time series data from 1987 to 2020 and employed the ARDL and Bounds Co-integration methodology to analyze the data. Their findings indicated that oil price is a key determinant of economic growth in Ghana. However this current study is different from Abdul-Rahman et al (2023) in the sense that, our study uses the VECM technique to analyze the data, uses exchange rate, inflation, consumption and trade as control variables and also the data spans 1980 to 2020.

Antwi (2021) delved into the influence of changes in oil prices on Ghana's output, inflation, and currency exchange rate using vector autoregression (VAR). Analyzing annual data from 1980 to 2019, the study unveiled a one-way connection between oil prices and inflation, suggesting oil price fluctuations as a potential leading indicator for future inflation rates. Causality analysis indicated a one-way association between the price of oil and the exchange rate, with the

exchange rate Granger causing oil prices. Additionally, a direct causal link between GDP and oil prices was identified, implying that GDP Granger causes oil prices.

Additionally, it underscores the lack of consensus on how oil prices impact economic growth, potentially stemming from differences in geographical regions, research methodologies, and timeframes utilized for analysis. Furthermore, the literature review emphasizes a dearth of studies investigating the impact of changes in oil prices on the growth of Ghana's GDP specifically. Existing research has predominantly focused on the repercussions of oil price changes on inflation and exchange rates, neglecting the direct association with GDP. Hence, this study aims to address this gap in the literature and highlight the significance of exploring the influence of oil price fluctuations on GDP growth in Ghana, thereby augmenting the existing body of knowledge.

3. METHODOLOGY

This section delineates the methodology employed in this study, encompassing a description of the variables, the data sources and their types, as well as the analytical method utilized to scrutinize and present the findings.

3.1 Materials and Methods

The methodology employed in this study shares similarities with the approaches adopted by Antwi (2021) and Kpogli (2015). However, while Antwi (2021) incorporated four economic variables, namely; inflation, oil price, output, and exchange rate, Kpogli (2015) also integrated four variables: inflation, oil price, interest rate, and exchange rate. In contrast, this study diverges from theirs concerning the selection and quantity of variables employed. Specifically, the factors included in this examination consist of GDP growth, oil price, exchange rate, inflation, gross fixed capital formation (GFCF), consumption, and trade.

3.2 Data types and sources

The study utilized annual time series data sourced from the World Bank's Development Indicators (WDI) database. Specifically, information regarding oil prices were obtained from the US Energy Commission database (2021). Additionally, data on inflation, gross fixed capital formation (GFCF), consumption, and trade were retrieved from the WDI data source, spanning the period from 1980 to 2020, totalling 37 observations. The selection of this dataset and its timeframe for analysis was primarily guided by data availability.

Table 1. Definition and source of variables

Variable	Symbol	Definition/measurement	Source
Gross Domestic Product Growth	GDP	The annual percentage growth rate of GDP at market prices relies on constant local currency. Aggregates are calculated using constant 2015 prices, denominated in U.S. dollars.	World Bank, OECD, World Development Indicators
Oil price	OP	Oil price is specified as the value of crude oil on the global market. It is a measure of spot price of several barrels of oil in terms of US Dollars (Brent Crude oil).	US Energy Information Administration
Inflation	INF	Inflation is defined as the persistent increase in the price of goods and services in a country. It is measured by using the consumer price index (CPI) of country and in Percentage.	World Development Indicators
Consumption	CON	Total Energy Consumption here is in terms of general government final consumption expenditure. It was measured in percentage.	World Development Indicators
Trade	TRD	Trade openness here is in terms of balance of trade which has to do with a country's exports and imports. It is measured as a Percentages of GDP.	World Development Indicators
Gross fixed capital formation	GFCF	Gross fixed capital formation also known as investment is the net results of the production of assets for producers own use and the acquisition of such assets. It was measured as a percentage of GDP.	World Development Indicators
Exchange rate	EXR	The exchange rate is established by national authorities or by the rate set in the officially recognized exchange market. It is computed as an annual average derived from monthly averages (local currency units in relation to the U.S. dollar).	World Development Indicators

3.3 Model specification

The objective of this research is to examine the influence of oil price fluctuations on Gross Domestic Product (GDP) growth in Ghana. GDP growth serves as the dependent variable in the study, while oil price is considered the independent variable. Additionally, the econometric model integrates inflation rate, consumption, trade, and gross fixed investment (GFI) as covariate factors. The variables employed include GDP growth (growth), oil price (OP), inflation rate (INF), consumption (CON), trade (TRD), gross fixed investment (GFI), and currency exchange rate (CER). To mitigate potential issues such as exponential sequences and fluctuations in the stochastic process, all variables underwent transformation by employing the natural logarithm.

3.2 Empirical model specification

Prior to drawing any inferences regarding the association between fluctuations in oil prices and GDP growth, it is imperative to contemplate the dynamic responses of both the independent variable and the control variables within the model. To scrutinize the impact of oscillating oil prices on GDP growth in Ghana, we employed the Vector Error Correction Model (VECM). These model facilitates the depiction of the dynamics of non-stationary variables across both short and long terms. Co-integration analysis and the VAR approach, as advocated by Johansen (1988), were utilized to capture the interdependencies among the variables.

When dealing with time series data, addressing the issue of non-stationarity is paramount. Therefore, we conducted unit root tests utilizing the Augmented Dickey-Fuller (ADF) and Philips-Peron (PP) tests on the dataset to evaluate the level of stationarity before applying the VEC model. Subsequently, the empirical model is presented as follows:

$$Y = f(x, \alpha, \beta) \tag{1}$$

where *Y* is the dependent variable (GDP growth), *x* is the independent variable (OP), α is the control variables (INF,CON,TRD,GFCF,EXR) and β is the error term.

The model can be restated as:

$$y = \alpha_1 + \alpha_2 x + \alpha_3 B + \mu \tag{2}$$

The model can specifically be restated in an econometric form as

$$InGDP = \alpha_0 + \alpha_1 InOP + \alpha_2 \ln EXR + \alpha_3 InIN + \alpha_4 InGFCF + \alpha_5 InTRD + \alpha_6 InCON + \mathrm{E} \tag{3}$$

Where α_0 is the constant term, α_1, α_2, α_3, α_4, α_5, α_6 are the regression coefficients, *In* represents the natural logarithm and Ɛ is the error term. GDP is Gross Domestic Product, OP is the oil price, IN inflation, TR is trading, CON is consumption, GFCF is the gross fixed capital formation, and EX is the exchange rate.

3.4 Stationarity test

When conducting regression analysis on time series data, ensuring the stationarity of variables is imperative to prevent obtaining erroneous results. Stationarity denotes that a variable's mean and variance remain constant over time (Kuwornu & Owusu-Nantwi, 2011). To evaluate stationarity, several tests are employed, such as the Philips-Perron (PP) examination and the Augmented Dickey-Fuller (ADF) evaluation. In this study, both the ADF and PP tests were applied, incorporating an adequate number of lag terms from the explained variable to capture the dynamic nature of the process (Granger & Newbold, 1974).

3.5 Unit Root Test

Unit root testing plays a vital role in evaluating the statistical properties of each variable within a VEC model. A variable qualifies for inclusion in the regression model if it demonstrates a constant mean, variance, and covariance. The fundamental assumption of the regression model lies in the stability or predictability of the series. Unit root testing enables the assessment of the suitability of individual variables. The primary techniques for determining the stationarity of time series variables are the Phillips-Perron (PP) test (Phillips & Perron, 1988) and the Augmented Dickey-Fuller (ADF) examination (Dickey & Fuller, 1979).

The ADF test investigates the presence of a unit root for the *AR(1)* model. Conversely, the PP test, by incorporating lagged differences of the residual in the regression model to address any serial correlation, extends the ADF test. The underlying hypotheses are:

H_0: The unit root exists,

H_1: No unit root exists.

Rejecting H_0 suggests stationarity, while failure to reject it implies non-stationarity. A series is considered stationary *I(0)* if there is evidence of stationarity at the level series. If an *I(0)* variable is empirically stable and predictable, it does not require transformation. However, if a variable is non-stationary, transformation through first differencing is necessary to achieve stationarity.

3.6 Granger Causality Test

The Granger Causality Test assesses whether one time series aids in predicting another. This test evaluates the predictive power of a time series using prior values of another, thereby investigating causality in economics (Granger, 1969).

Engel and Granger (1987) introduced the error correction model to estimate bidirectional causality. This model allows for specifying the relationship between two variables as follows:

$$\Delta X_{1t} = \delta_{1t} + \sum_{i=1}^{k} a_{1i} \Delta X_{1t-i} + \sum_{i=1}^{k} \beta_{1i} \Delta X_{1t-i} + \delta_{1t} z_{t-1} + \varepsilon_{1t} \tag{4}$$

$$\Delta X_{2t} = \delta_{2t} + \sum_{i=1}^{k} a_{2i} \Delta X_{2t-i} + \sum_{i=1}^{k} \beta_{2i} \Delta X_{2t-i} + \delta_{2t} z_{t-1} + \varepsilon_{2t} \tag{5}$$

Where X_1 is the natural logarithm of growth (lnGDP), X_2 is the natural logarithm of oil price (lnOP), and z denotes the co-integration expression suggesting the enduring correlation between growth and oil price. The parameter estimates of the lagged oil price terms in the growth equation show the integration between growth and oil price.

3.7 Empirical Estimation Techniques

In this section, we delineate the model utilized in this study and outline its advantages compared to other time series models.

a) Vector Auto Regression (VAR)/ Vector Error Correction Model (VECM)

VECM is recognized as a constrained version of VAR owing to the presence of stationarity at different levels and co-integration among the variables, as asserted by Suharsono et al. (2017). VECM becomes applicable when a set of variables exhibits one or more co-integrating vectors, as emphasized by Andrei & Andrei (2015).

When co-integration is identified among the variables, the lagged residuals derived from the co-integration equation are utilized as error correction terms in the Error Correction Model (ECM) for estimating the short-term equilibrium association among the variables, as observed by Hill et al. (2008).

Consequently, the general formulation of our VEC model for the GDP growth model is as follows:

$$\Delta X_{2t} = \delta_{2t} + \sum_{i=1}^{k} a_{2i}\Delta X_{2t-i} + \sum_{i=1}^{k} \beta_{2i}\Delta X_{2t-i} + \delta_{2t} z_{t-1} + \varepsilon_{2t} \quad (6)$$

Where

$$\lambda ECT_{t-1} = \alpha(\beta_1 GDP_{t-1} + \beta_2 OP_{t-1} + \beta_3 EXR_{t-1} + \beta_4 INF_{t-1} + \beta_5 GFCF_{t-1} + \beta_6 TRD_{t-1} + \beta_7 CON_{t-1}) \quad (7)$$

The investigation employed a Vector Auto Regression/Vector Error Correction Model (VAR-VECM) to scrutinize fluctuating oil prices' impact on Ghana's GDP growth. VECM emerges as an apt tool for probing enduring correlations, as it offers a close approximation of the unknown economic structure by considering the dynamic interactions among pertinent variables. VAR models are employed when there is no co-integration among the variables, and all variables demonstrate stationarity at levels I(0) or first differences I(1). One notable advantage of VECM over other time series models is its capability to capture the long-term and short-term relationships between variables simultaneously. Additionally, the Error Correction Mechanism (ECM) estimates the rate of adjustment from short-term imbalance to long-term stability, elucidating how swiftly variables adapt to the long run. The statistical softwares Stata 14 and Eviews 12 facilitated the analysis.

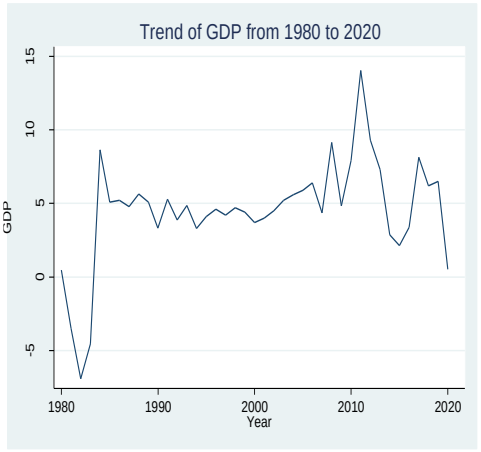
4. RESULTS AND DISCUSSION

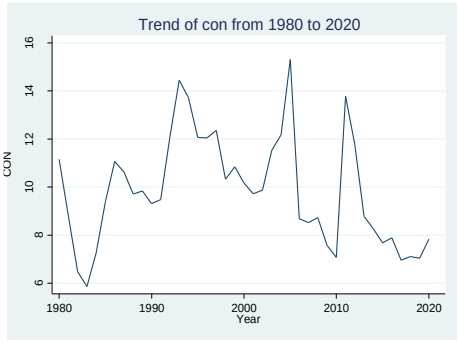
The aim of this study is to explore the potential influence of changes in oil prices on Ghana's GDP growth. In this section, we present the findings of the study. Trend analysis of the variables used in the study as well as the results of the Granger causality assessment and the Vector Error Correction Model (VECM) are presented.

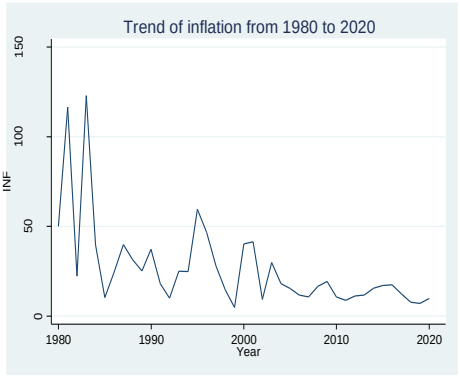
4.1 Trend of the variables used in the study

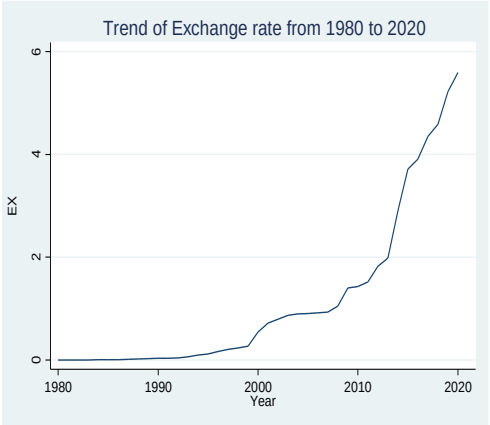
Figure 1 is a diagrammatic representation of the trend of the variables used in the study. These variables include GDP, Oil Price, Inflation, Exchange rate, Trade, and Gross Fixed Capital Formation (GFCF). In this study, GDP is the dependent variable, oil price is the independent variable and the rest are the control variables.

It can be seen from figure 1 that the trends of all the variables are not consistent during the study period. GDP has been exhibiting a fluctuating trend, it had its lowest value of -6.92 in 1984 and the highest value of 14.04 in 2011. Oil Price, Inflation, Trade and Gross Fixed Capital Formation (GFCF) exhibited similar trends. Exchange rate however, indicated an upward trend and has been rising since 1980.









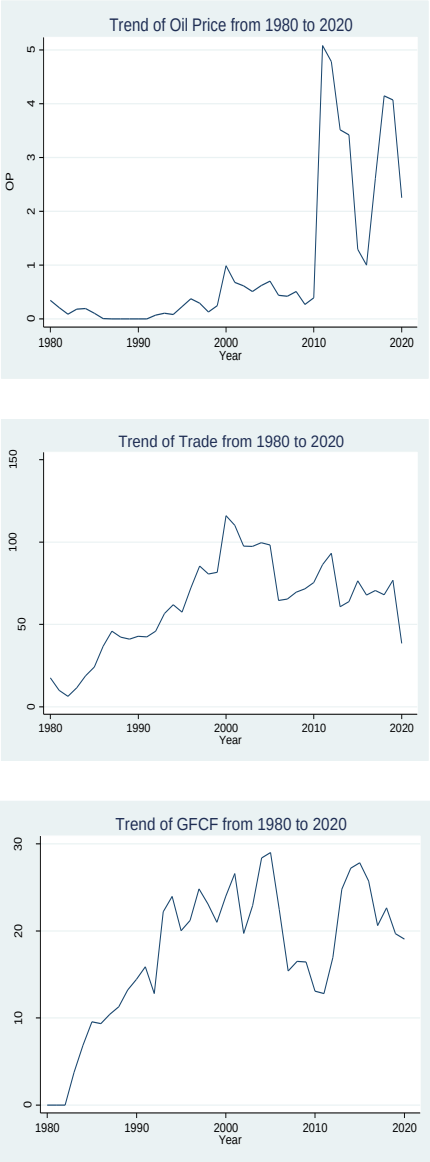


Fig. 1. Time Series Plots of the variables used in the study

Source: Authors' own computation, 2024

4.2 Unit Root Analysis

Table 2 displays the outcomes of the unit root tests conducted to evaluate the stationarity of the study variables. Both the Augmented Dickey-Fuller (ADF) and Philips-Perron tests were utilized for this purpose. The results indicate that all variables, except inflation and exchange rate, were non-stationary at their levels and required differencing once to achieve stationarity, as outlined in Table 2. Specifically, growth, oil price, consumption, gross fixed capital formation (GFCF), and trade demonstrated stationarity at the first-order difference, I(1), at a 1% significance level. However, inflation and exchange rate exhibited stationarity at level, I(0).

Considering the diverse stationarity properties of the variables, some at levels and others at first differences, several time series models could be considered, such as Vector Error Correction Model (VECM), Error Correction Model (ECM), or Autoregressive Distributed Lag (ARDL). However, to elucidate the long-run relationships among the variables, we selected the VECM, which accommodates short-term fluctuations and deviations from equilibrium.

The unit root test results presented in Table 2 indicate that the time series under examination possess distinct orders of integration. These findings are consistent with those reported by Gokmenoglu et al. (2015) and Elneel & AlMulhim (2022).

Table 2. Results of ADF and PP Unit Root tests at level and first difference

Variables	ADF		PP	
	Level	*First-order*	*Level*	*First-order*
GDP	-0.1640	-1.147***	0.835	-0.147***
OP	-0.0327	-0.896***	0.967	0.104***
EXR	0.114***		1.114***	
INF	-0.3251***		0.675***	
GFCF	-0.0344	-0.843***	0.966	0.157***
TRD	-0.0271	-0.979***	0.973	0.021***
CON	-0.0400	-1.081***	0.959	-0.081***

The superscripts *** as shown indicates significance at 1% level

4.3 Lag order Selection Criteria

The authors performed unit-root tests to assess the stationarity of the variables. Subsequently, we utilized the vector autoregression (VAR) lag order selection criteria to identify the suitable lag length for the Vector Error Correction (VEC) model. The results of the lag selection order criteria are presented in Table 3. It is apparent from the table that the optimal lag chosen is 4, as denoted by the asterisk (*) in Table 4. This determination is based on various criteria, including the sequential modified likelihood ratio test statistic (LR), the final prediction error (FPE), Akaike's information criteria (AIC), and Hannan-Quinn's information criteria (HQIC), and Schwarz-Bayesian information criteria (SBIC), all of which converged on selecting 4 as the optimal lag length with the aid of E-Views version 12.

Table 3. Table showing VAR lag selection order criteria

Lag	LL	LR	df	P	FPE	AIC	HQIC	SBIC
0	-803.395		49		2.5e+10	43.8051	43.9126	44.1099
1	-606.371	394.05	49	0.000	8.8e+06	35.8039	36.6634	38.242
2	-558.629	95.484	49	0.000	1.3e+07	3587 19	37.4835	40.4434
3	-453.573	210.11	49	0.000	1.5e+06	32.8418	35.2056	39.5467
4	-272.312	362.52*	49	0.000	1515 2.3*	25.6925*	28.8084*	34.5308*

** represents the selected lag order by E-Views version 12*

4.4 Co-integration test

The Engle-Granger co-integration test was executed to determine whether the variables displayed co-integration. The test results led to the rejection of the null hypothesis, indicating that the variables were indeed co-integrated. Thus, we inferred that the study variables exhibit co-integration at a significance level of 5%. This inference is based on the observation that the absolute value of the test statistic (Z(t) = -8.102) surpasses all critical values, as illustrated in Table 4. This signifies a long-term relationship between economic growth and the other variables in the study. Given the presence of co-integration among the variables, the Vector Error Correction Model (VECM) was considered appropriate for our analysis.

Table 4. Results of Engle-Granger test for co-integration

Engle-Granger test for co-integration			**N(1st step) = 40**	
			N(test) = 39	
	Test Statistics	1% critical value	5% critical value	10% critical value
Z(t)	-8.102	-6.314	-5.500	-5.103

Source: Authors own calculation using STATA 14

4.5 Causality Test

The Granger causality test functions as a hypothesis test aimed at determining whether one variable holds predictive power over another (Gujarati & Porter, 2009). In this study, the Granger causality test was employed to investigate the causal relationship and directionality between GDP and the examined variables. According to the Granger causality results, lagged values of Oil Prices were identified as causing GDP growth, with a chi-squared value of 53.956, indicating statistical significance at the 1% level. This suggests that fluctuations in oil prices can anticipate variations in GDP growth. This directional causation aligns with the conclusions drawn by Awunyo-Vitor (2018) and Hamilton (1983) regarding the influence of oil prices on economic output in the US, as well as the research conducted by Jimenez-Rodriguez and Sanchez (2004) on other economies.

Conversely, GDP growth was not found to Granger Cause Oil Price, with a chi-squared value of 5.231 and statistical insignificance. This indicates that changes in GDP growth do not reliably predict changes in oil prices, consistent with the findings of Antwi (2021). Hence, it can be inferred that there exists a unidirectional relationship between Oil Price and GDP growth.

Furthermore, the Granger causality test results presented in Table 4 reveal that inflation Granger causes GDP growth, and conversely, GDP growth Granger Causes inflation, with chi-squared values of 64.806 and 36.481, respectively, both statistically significant at the 1% level. This suggests a bi-directional relationship between inflation and Ghana's GDP growth, implying that inflation could accurately predict fluctuations in GDP growth in Ghana. This contradicts the conclusions drawn by Antwi (2021), who observed a unidirectional connection between inflation and GDP growth rather than vice versa.

The analysis also revealed that GFCF Granger causes GDP growth, evidenced by a chi-squared value of 21.725, which is statistically significant at the 1% level. However, it was noted that GDP does not Granger cause GFCF. This suggests that GFCF can anticipate fluctuations in GDP growth, indicating a unidirectional relationship between GFCF and GDP.

Similarly, the Exchange rate was found to Granger cause GDP, indicating that the exchange rate can impact Ghana's GDP growth and predict fluctuations in the country's GDP growth. With a chi-squared value of 54.387, statistically significant at the 1% level, there appears to be a unidirectional connection between the exchange rate and GDP growth. However, these findings contradict those of Antwi (2021), who identified a bi-directional connection between Ghana's GDP growth and the exchange rate.

The Granger Causality test results indicate a unidirectional relationship between trade and GDP growth, suggesting that trade Granger causes GDP growth with a chi-squared value of 29.129, which is statistically significant at the 1% level. This implies that changes in Trade can forecast changes in GDP growth. However, changes in GDP growth cannot predict changes in Trade, as indicated by its non-statistically significant chi-squared value of 0.8595.

Overall, the Granger causality test confirms that OP, INF, EXR, GFCF, and TRD influence GDP growth. These relationships are theoretically valid, and no other issues are observed.

Table 5. Granger Causality Wald Tests Results

Equation	**Excluded**	**Chi squared value**	**Degree of Freedom**	**P-value**
GDP	OP	5.231	4	0.391
OP	GDP	53.956	4	0.000***
GDP	CON	4.9612	4	0.175
CON	GDP	3.6621	4	0.300
GDP	INF	64.806	4	0.000***
INF	GDP	36.481	4	0.000***
GDP	GFCF	21.725	4	0.867
GFCF	GDP	0.7282	4	0.000***
GDP	EXR	54.387	4	0.243
EXR	GDP	4.1787	4	0.000***
GDP	TRD	29.129	4	0.835
TRD	GDP	0.8595	4	0.000***

*** significant at 1% level

4.6 Vector Error Correction Estimation, Discussion and Diagnostics

As stated by Suharsono et al. (2017), VECM stands as a constrained form of VAR, primarily attributed to the existence of stationarity at different levels and co-integration among the variables. Andrei & Andrei (2015) reinforce this notion by suggesting that VECM becomes pertinent when a set of variables displays one or more co-integrating vectors. Moreover, VECM facilitates the assessment of the pace at which the system shifts from short-term imbalance to long-term

stability, delineating the speed with which variables adjust to the long run.

a) Vector Error Correction Model (VECM) Results

Table 6 presents the outcomes derived from the VECM investigation. The coefficient associated with the adjustment term, _ce1 (ECT), indicates the rate of convergence towards long-term equilibrium within the GDP growth equation (-0.63408). This coefficient attains statistical significance at the 1% level, displaying a negative value. The negative coefficient suggests that departures from the state of long-term balance in the previous period are rectified within the current period at a rate of 63.41%. Moreover, it implies a causal relationship between GDP growth and the explanatory variables at the 1% significance level, consistent with the conclusions drawn by Banerjee et al. (1998).

Analysis of the Johansen Normalization equation reveals a constraint imposed on GDP growth. Specifically, the coefficient linked with oil price (1.9710) exhibits significance at the 1% level, with a positive value. This suggests that a rise in oil price by a percentage point corresponds to a 197.1% decline in GDP growth in the long run, assuming other variables remain constant. This outcome underscores the detrimental effect of escalating oil prices on Ghana's GDP growth. Given oil's pivotal role in production processes, heightened prices escalate production costs across sectors. Consequently, sustained increases may compel firms to scale back operations or halt altogether, ultimately constraining output and hindering GDP growth. Hence, the empirical evidence supports the theoretical assertion that elevated oil prices engender inflationary pressures and impede economic activity and growth.

Moreover, the findings demonstrate that the exchange rate coefficient (-0.8383) achieves significance at the 1% level, displaying a negative value. This suggests that a one percent shift in the exchange rate results in 83.83% increase in Ghana's GDP growth in the long run. Thus, under constant conditions, the exchange rate positively influences GDP growth over time.

Similarly, the inflation coefficient (0.07742) demonstrates statistical significance at the 1% level, with a positive value. This implies that a one percent increase in inflation yields a 7.74% decrease in Ghana's GDP growth in the long run. Likewise, the coefficient associated with Gross Fixed Capital Formation (GFCF) (0.7556) is significant at the 1% level and positive, indicating that a one percent change in GFCF results in a 75.56% reduction in GDP growth in the long term. Hence, inflation adversely affects GDP growth, while GFCF exerts a positive influence on it over an extended period.

Furthermore, the coefficient for Trade (-0.1029) is statistically significant at the 1% level, with a negative value. This suggests that a percentage increase in trade leads to a 10.29% increase in GDP growth in the long run, underscoring the positive impact of trade on GDP growth over time.

Concerning consumption, the coefficient of -1.4834, with a p-value of 0.000, attains significance at the 1% level, indicating a positive effect on GDP growth. Specifically, a one percent change in consumption translates to a 148.34% boost in GDP growth over the long term.

Overall, three explanatory variables exhibit a positive impact on GDP growth, while the remaining three exert a negative impact in the long run. All coefficients achieve statistical significance at the 1% level.

The analysis unveils that oil price, inflation, and Gross Fixed Capital Formation (GFCF) exhibit negative causal influences on Ghana's GDP growth. Conversely, the exchange rate, trade, and consumption demonstrate positive causal effects on GDP growth over the long term, assuming all other factors remain constant. This asymmetry highlights the diverse impacts on the long-term trajectory of GDP growth.

In summary, a strong causal relationship exists between GDP and the explanatory variables. Consequently, the GDP equation can be expressed as follows:

$$\begin{aligned}\Delta GDP_t = {} & -0.558 + 0.420GDP_{t-1} + 0.455GDP_{t-2} \\ & + 1.030OP_{t-1} + 0.7589OP_{t-2} \\ & - 4.956EXR_{t-1} + 15.407EXR_{t-2} \\ & + 0.0779INF_{t-1} - 0.0046INF_{t-2} \\ & + 0.270GFCF_{t-1} + 0.403GFCF_{t-2} \\ & + 0.0212TRD_{t-1} - 0.1228TRD_{t-2} \\ & - 1.0983CON_{t-1} - 0.8007CON_{t-2} \\ & - 0.634ECT_{t-1}\end{aligned} \quad (8)$$

While from the Johansen normalization results, the error correction term, ECT, (with restriction imposed on GDP growth, which is the target variable), equation can be written as:

$$\begin{aligned}ECT_{t-1} = {} & 1.1860 + 1.00GDP_{t-1} + 1.971OP_{t-1} \\ & - 0.8383EXR_{t-1} + 0.0774INF_{t-1} \\ & + 0.7560GFCF_{t-1} - 0.1029TRD_{t-1} \\ & - 1.4834CON_{t-1}\end{aligned} \quad (9)$$

Table 6. Johansen Normalization Results

	Variable	Coefficient	Standard Error
_ce1			
	GDP	1.000	
	OP	1.9710***	0.3111
	EXR	-0.8383***	0.3178
	INF	0.0774***	0.0110
	GFCF	0.7560***	0.0760
	TRD	-0.1029***	0.1176
	CON	-1.4834***	0.1996
	_cons	1.1860	

*** Significant at 1% level

b) Short-Run Causality equation and analysis for GDP

The VECM findings indicate that the adjustment term (-0.6341) is statistically significant at the 1% level, as demonstrated in Table 8, aligning with expectations. This suggests that imbalances from the long-term equilibrium in the preceding year are corrected within the current year at a rate of 63.41%. Hence, in the Ghanaian context, the economy adjusts to equilibrium in the long run by 63.41% in response to shocks from the immediate past year, affecting GDP growth.

Furthermore, the results unveil a short-run causal relationship between GDP of the immediate past years and current GDP growth, both at the first lag (GDPt-1) and the second lag (GDPt-2), significant at the 1% level. Specifically, a 1% increase in GDPt-1 leads to a 41.98% increase in current

GDP, while a 1% increase in GDPt-2 results in a 45.51% increase in Ghana's GDP growth.

Additionally, in the short run, an increase in Opt-1 (LD) from the immediate past year corresponds to a 102.5% increase in current-year GDP, significant at the 5% level. Similarly, a 1% increase in Opt-2 (L2D) from the past two years leads to a 75.89% increase in Ghana's current GDP growth. Consequently, it can be inferred that Opt has a positive impact on GDP in the short run.

In the short run, the first lag of EXR exerts a detrimental influence on current-year GDP, statistically significant at the 10% level. Specifically, a 1% increase in the first lag of EXR results in a 495.61% decrease in current-year GDP growth, while a 1% increase in the second lag of EXR leads to a 1540% decrease in current-year GDP. This suggests that a higher exchange rate in Ghana correlates with reduced GDP growth.

Regarding inflation (INF), the analysis reveals a positive short-run effect of INFt-1 (LD) on GDP, significant at the 1% level. A 1% increase in INFt-1 corresponds to a 7.93% increase in GDP. However, at the L2D level, INF lacks statistical significance.

Moreover, Gross Fixed Capital Formation (GFCF) exhibits a favorable immediate effect on GDP, significant at the 5% level for the immediate past year and the 1% level for L2D. Specifically, a 1% increase in GFCF in the immediate past year leads to a 7.9% increase in GDP, while a 1% increase in GFCF in the past two years results in a 40.29% increase in GDP growth in the short run.

In the short run, the impact of trade (TRD) in the immediate past year lacks statistical significance, indicating no discernible effect on current-year GDP growth. However, over the past two years, TRD has emerged as statistically significant at the 1% level, exhibiting a positive causal influence on short-run GDP growth. Specifically, a 1% increase in TRD corresponds to a 2.12% increase in short-run GDP growth.

Contrarily, consumption (CON) demonstrates a negative causal effect on short-run GDP growth, both in the immediate past year and over the past two years, with statistical significance at the 1% level in both cases. In the immediate past year, a 1% increase in CON resulted in a 109.8% decrease in GDP, while over the past two years, a 1% increase led to an 80.0% decrease in GDP growth in Ghana.

Table 7. Results of Short-run analysis on GDP growth

D_GDP	Coefficient.	Standard Error
-ce1		
L1	-0.6341***	0.1314
GDP		
LD	0.4198***	0.1614
L2D	0.4551***	0.1405
OP		
LD	1.0250**	0.4974
L2D	0.7589 *	0.4508
EXR		
LD	-4.956*	2.9865
L2D	15.4070***	2.5892
INF		
LD	0.0793***	0.0182
L2D	-0.0046	0.0162
GFCF		
LD	0.2700**	0.1143
L2D	0.4030***	0.1117
TRD		
LD	0.0212	0.0439
L2D	-0.1229***	0.0421
CON		
LD	-1.0983***	0.2564
L2D	-0.8001***	0.2086
_cons	-0.5577	0.4592

The asterisks ***, **, * in table 7 denote significance levels at 1%, 5%, and 10%, respectively

c) Diagnostic Test of the VEC model

To ensure the reliability of the Vector Error Correction Model (VECM), we conducted tests to address potential econometric time series issues such as normality, autocorrelation, and stability. The autocorrelation test utilized the LM test for residual autocorrelation, yielding a test statistic value of 48.9403, with a p-value of 0.475. Consequently, we did not reject the null hypothesis of no autocorrelation, indicating the absence of autocorrelation among the variables.

Similarly, the normality test for distributed disturbances revealed normally distributed results, with a test statistic of 9.998 and a p-value of 0.1887. Thus, we cannot reject the null hypothesis of customarily distributed disturbances.

Regarding stability, the test affirmed that the VECM specification adhered to a 6-unit modulus. This indicates that the stability condition is satisfied. The VEC model's stability criterion specifies that the specification should enforce a "$k - r$" unit modulus, where k represents the number of variables and r denotes the number of co-integrating equations. In our study, $K = 7$ and $r = 1$, yielding $K - r = 6$. Therefore, for our model to be deemed stable, it must impose 6 unit moduli.

In conclusion, the *analysis* confirms that our VEC model is devoid of autocorrelation, follows a normal distribution, and is stable, alleviating any concerns regarding econometric issues.

5. CONCLUSION AND RECOMMENDATION

This study aimed to explore the connection between fluctuating oil prices and GDP growth in Ghana. Using yearly time series data covering 1980 to 2020, obtained from the World Development Indicators (WDI) and U.S. Energy Commission databases, the analysis employed the Vector Error Correction Model (VECM). The findings reveal a positive correlation between oil prices and GDP growth in the short-term, while indicating a negative correlation in the long term.

Furthermore, the research revealed a sustained connection between GDP and oil price. Specifically, following a short-term shock, 197.10% of the oil price's short-term disequilibrium readjusts to long-term equilibrium. This aligns with theoretical expectations that increasing oil prices contribute to elevated general price levels, thereby impeding economic activity and growth. Similarly, 7.74% and 75.60% of short-term disequilibrium in inflation and Gross Fixed Capital Formation (GFCF), respectively, readjust to long-term equilibrium. Trade and Consumption undergo readjustments of 10.2% and 148.35%, respectively, while the exchange rate undergoes a readjustment of 83.83% from short-term imbalance to long-term stability.

The results emphasize that the exchange rate, trade, and consumption swiftly readjust to long-term equilibrium due to their negative values, whereas oil prices, inflation, and GFCF undergo slower readjustments owing to their positive values.

Moreover, results from the Granger test indicate a direct influence of increasing oil prices on GDP growth. Notably, all variables, except for inflation and exchange rate, which demonstrate stationarity at I(0), exhibit stationarity at the first difference according to unit root test results. Hence, it can be deduced that an increase oil price precipitates an economic downturn, necessitating a significant period for the economy to recalibrate to stability.

Based on the findings of this study, it is advisable for policymakers to devise strategies that leverage positive outcomes while mitigating negative consequences in alignment with the country's macroeconomic goals. To offset the adverse impacts of oil price surges, policymakers might contemplate implementing measures aimed at reducing the cost of oil imports, such as hedging strategies. Additionally, to diminish Ghana's reliance on oil, diversification into alternative energy resources like natural gas, solar-based, hydro, wind-powered, and potentially earth heat energy could be explored. Furthermore, during periods characterized by low oil prices, it is prudent to maintain adequate reserves for storage purposes.

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