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Analyzing the Impact of Oil Price Fluctuations on Equity Markets in Africa

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Abstract

This study investigates the impact of crude oil and crude palm oil spot and futures prices on African equity markets, utilizing daily data spanning from January 2000 to July 2020, sourced from Bloomberg. The analysis employs a vector error correction model to explore the relationships and dynamics between these variables. The econometric findings reveal significant differences in the speed of adjustment across various African equity markets. Mauritius, whose economy is heavily reliant on tourism, exhibited a faster response to changes in crude oil and palm oil prices compared to other markets. Kenya's equity market index responded positively, especially in comparison to the equity markets of Morocco and Nigeria. In contrast, South Africa's equity market adjusted more slowly than the others in response to price fluctuations. A particularly noteworthy insight is the slow adjustment of Morocco and Nigeria's equity markets to shocks in the crude oil market, which is attributed to the high dependence of these countries' governments on crude oil revenues for financing economic activities. This dependency makes their equity markets more vulnerable to oil price volatility. The study confirms the existence of a long-term relationship between crude oil, crude palm oil spot and futures prices, and the equity markets in these African countries. Furthermore, the vector error correction model Granger causality test was applied to assess the direction of influence among these variables. The results indicate that crude oil spot and futures prices Granger-cause movements in the equity markets of Mauritius, Kenya, and Morocco. Meanwhile, futures prices of crude oil specifically Granger-cause changes in Nigeria's and South Africa's equity markets. These findings underscore the importance of crude oil and palm oil markets in shaping the performance of African equity markets and highlight the varying degrees of sensitivity across different countries. The results have important implications for policymakers and investors, particularly in understanding the risks and opportunities associated with oil price fluctuations in these markets.

Keywords: Crude Oil Prices, Palm Oil Prices, African Equity Markets

JEL Codes: G15, Q41, C32

1. INTRODUCTION

Commodity products such as crude oil are not only vital to the economic progress of individual nations but also play a crucial role in the global economy. Crude oil is a highly sought-after resource due to its versatility and widespread application across industries, including transportation, manufacturing, and energy production. For countries endowed with such natural resources, the potential for economic advancement is significant, provided that these resources are optimally managed and leveraged to foster long-term development. In many resource-rich nations, the extraction and export of crude oil have led to substantial contributions to Gross Domestic Product (GDP), driving growth and creating employment opportunities. For example, in Nigeria, crude oil accounts for a substantial portion of national revenue, playing a central role in the country's economic framework. Despite the challenges of fluctuating global oil prices and political instability, oil remains a cornerstone of Nigeria's economic structure, funding infrastructure projects, social programs, and government spending. Similarly, Ghana has emerged as a growing player in the global oil market following the discovery of offshore oil reserves. This discovery has provided Ghana with an additional stream of revenue to complement its gold and cocoa exports, helping to diversify its economy and stimulate broader economic growth.

Beyond Africa, countries in Asia such as Vietnam, Indonesia, and Thailand have also harnessed their natural resource endowments, including crude oil, to support rapid industrialization and modernization efforts. Indonesia, for instance, has long been recognized as one of the world's leading oil producers, with oil revenues fueling its economic rise over the past few decades. The revenue from oil exports has been used to finance social welfare programs, infrastructure development, and investments in human capital, which have contributed to the country's resilience in the face of economic challenges. Similarly, Vietnam has leveraged its crude oil resources to attract foreign investment, expand its industrial base, and integrate more fully into the global economy. Thailand, while not as oil-dependent as some of its regional counterparts, still benefits from its resource wealth, using revenues to enhance its economic competitiveness in key sectors such as tourism and manufacturing. However, the optimal utilization of crude oil and other natural resources requires sound management practices, effective governance, and a commitment to sustainable development. In many countries, mismanagement of oil resources has led to the "resource curse," where wealth from natural resources results in corruption, environmental degradation, and economic inequality rather than widespread prosperity. For instance, while Nigeria has experienced substantial economic benefits from oil production, the sector has also been plagued by issues such as oil spills, environmental damage, and resource misallocation, which have hindered the country's long-term economic potential.

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In contrast, countries that have implemented strong institutional frameworks and policies have been more successful in translating oil wealth into broader economic gains. For example, Norway has set a global example through its management of its oil resources, creating a sovereign wealth fund that invests oil revenues in diversified assets, ensuring that future generations benefit from the country's resource wealth. For Nigeria, Ghana, Vietnam, Indonesia, and Thailand, the future of crude oil as an economic driver will depend on their ability to manage the challenges associated with resource dependency, including price volatility, geopolitical risks, and environmental sustainability. As the global energy landscape shifts towards renewable energy sources, these nations will need to diversify their economies further and invest in renewable energy technologies to remain competitive in the evolving global economy. In the meantime, crude oil will continue to serve as a critical component of their economic frameworks, providing substantial revenues and opportunities for growth. Crude oil is a special and lucrative commodity that has been a key driver of economic progress for many nations across Africa and Asia. When managed effectively, the wealth generated from crude oil can foster national development, improve living standards, and position countries as competitive players in the global economy. However, realizing the full potential of crude oil requires strategic governance, forward-thinking policies, and a commitment to using this finite resource as a springboard for sustainable and diversified economic growth. Despite the inherent value and economic contributions of commodities like crude oil, these resources are highly susceptible to price volatility. This volatility can have significant ramifications for both exporting and importing nations, creating economic instability. Researchers have extensively documented the fluctuations in commodity prices, with Hamilton (1989) notably exploring the negative and positive impacts of such volatility on various macroeconomic variables. Price fluctuations in commodities such as oil can pose substantial challenges to economies, even those as large as the United States and Japan, which are exposed to risks due to the erratic nature of these price movements.

For countries that heavily depend on oil, either as exporters or importers, the unpredictability of prices introduces economic risks that are difficult to manage. Sadorsky (1999) pointed out that commodity prices, particularly oil prices, exert significant pressure on national economies. His findings, corroborated by other researchers, emphasize that the effects of oil price volatility can be profound, destabilizing fiscal policies, trade balances, and broader economic growth. While the importance of crude oil to national economic development cannot be overstated, the chaotic nature of its price movements has led to widespread economic disruption in many countries. Burbridge et al. (1984) conducted one of the earliest studies on the impacts of an oil crisis, revealing that the Gross Domestic Product (GDP) of major economies such as the United States, Great Britain, Japan, Canada, and Germany were adversely affected by oil price volatility. In these cases, sudden shifts in oil prices disrupted economic growth, led to inflationary pressures, and strained both public and private sector budgets. Price volatility in commodities like oil is driven by a variety of factors, including geopolitical tensions, supply and demand imbalances, and speculative trading in global markets. For instance, political instability in oil-producing regions can result in supply disruptions, which in turn drive prices up. Conversely, oversupply in the market, as seen in periods of increased oil production, can lead to sharp declines in prices, further compounding the instability.

The economic risks associated with price volatility also extend to importing countries that rely on oil to fuel their industries. For these nations, sudden spikes in oil prices can lead to increased production costs, inflation, and a reduction in disposable income for consumers, thereby slowing overall economic growth. On the other hand, oil-exporting countries face the challenge of managing revenue fluctuations, which can severely impact government budgets, especially if they are heavily dependent on oil exports for fiscal stability. while commodities like crude oil are crucial for economic development, their price volatility creates a complex and often precarious situation for economies around the world. The findings of Hamilton (1989), Sadorsky (1999), and Burbridge et al. (1984) highlight that the unpredictable nature of oil prices can lead to significant economic disruptions, affecting everything from GDP growth to inflation and government revenue. Managing these risks requires countries to adopt more resilient economic strategies, diversify their economies, and seek to mitigate the effects of price fluctuations on their overall economic performance. The objective of this paper is to contribute to the existing literature on the relationship between equity markets and changes in crude oil prices, with a specific focus on the African economy, which is classified as a frontier market. While there has been extensive research on the impact of crude oil price fluctuations on equity markets globally, much of the literature focuses on developed and emerging markets, such as those in the United States, Europe, and Asia. However, despite Africa's significant role in global oil production and its growing economic importance, relatively few studies have thoroughly examined the impact of oil price changes on the region's equity markets.

This paper seeks to address this gap by exploring how fluctuations in oil prices influence stock market performance across various African nations, particularly those with oil-dependent economies. Given Africa's unique economic structure, characterized by volatility, resource dependency, and underdeveloped financial markets, the findings of this study will provide valuable insights into the interplay between oil prices and equity markets in the region. The study also aims to offer a broader understanding of how commodity price movements affect frontier markets, which tend to be more susceptible to external shocks and market inefficiencies. By contributing to the limited research on the African context, this paper will not only enhance the understanding of oil price dynamics in frontier markets but also provide policymakers, investors, and market participants with critical information to navigate the complexities of the region's economic environment. This study aims to bridge the existing gap by examining both crude oil spot and futures prices, specifically focusing on their impact on Africa's economy within the context of regional markets. By doing so, this research provides a clearer understanding of how oil price dynamics influence African markets, allowing potential investors, market regulators, and other market participants to make more informed decisions about portfolio diversification and risk management. Understanding the relationship between crude oil prices and African regional markets is crucial for investors seeking to optimize their portfolios in frontier markets, where volatility and uncertainty are often heightened. The

structure of this study is organized as follows: Section 2 explores the existing literature on the subject, providing a comprehensive review of prior research and identifying key gaps that this study addresses. Section 3 discusses the data sources and the methodology adopted in the study, outlining the analytical approach used to examine the impact of crude oil prices on Africa's regional markets. Section 4 provides a detailed analysis of the methods used to collect and analyze the data. Section 5 presents the empirical results, highlighting the findings of the study and their implications for market participants. Finally, Section 6 offers conclusions and insights into how the results can be applied in practice, as well as recommendations for future research in this area.

2. LITERATURE REVIEW

Movements in oil prices have garnered significant interest among researchers for over five decades, largely due to the profound economic implications of these fluctuations. Similarly, the investigation into how equity markets react to changes in oil prices has been a prominent area of study. Understanding the relationship between these two variables is crucial, as shifts in oil prices can have widespread effects on the stock market, influencing sectors directly involved in oil production and consumption, as well as broader economic conditions. In the present study, we aim to investigate the effect of crude oil price changes on equity markets, specifically within the context of African economies. The relationship between oil prices and equity markets is particularly important in oil-dependent economies, where the volatility in oil prices can lead to significant financial market disruptions. This section of the literature review will focus on the contributions of earlier scholars in this area, examining their objectives, adopted methodologies, and key findings. By reviewing past studies, we aim to build upon their insights and identify gaps that this research seeks to address. The literature spans various methodologies, from econometric models to more recent applications of advanced statistical techniques, providing a broad understanding of how oil price volatility influences equity market behavior. This review will help position the current study within the existing body of knowledge while highlighting how it advances the conversation, particularly in relation to frontier markets like those in Africa.

Onour et al. (2012) conducted a study to investigate whether crude oil prices have a significant impact on the dynamics of stock markets in oil-exporting countries, specifically Kuwait, Saudi Arabia, Dubai, and the UAE. The primary aim of the study was to explore whether there is a cyclical correlation between stock prices and oil prices in these economies, given their heavy reliance on oil as a key driver of economic growth. The study utilized weekly data for both Brent crude oil prices and the equity markets of the respective countries, providing a detailed analysis of how fluctuations in oil prices might influence stock market performance. To analyze the data, the researchers adopted the Autoregressive Distributed Lag (ADRL) approach, which allowed them to examine both short-term and long-term relationships between oil price movements and stock market behavior. The findings revealed that there is indeed a cyclical relationship between oil prices and the stock market, but this relationship is dependent on the price range of oil. The results showed that when oil prices are below $40 per barrel, the stock markets in these oil-exporting countries tend to perform favorably, providing positive returns for investors. This could be due to the relatively lower production costs and higher profitability for oil companies at lower oil prices, which in turn benefits the broader economy and equity markets. However, when oil prices rise above $72 per barrel, the study found no significant cyclical relationship between oil prices and stock market performance. This suggests that high oil prices may not necessarily translate into stock market gains, possibly due to the strain on other sectors of the economy or concerns over the sustainability of such high oil prices.

Onour et al.'s study highlights the complex interplay between oil prices and stock markets in oil-dependent economies, showing that the relationship is not linear and can vary significantly depending on the price of oil. This cyclical correlation underscores the need for investors and policymakers in oil-exporting countries to closely monitor oil price movements, as they can have a direct impact on financial markets. The findings also provide important insights for understanding the stock market behavior in relation to crude oil prices, particularly in regions heavily reliant on oil revenues.

Ravichandran (2010) conducted a study to investigate the impact of oil price fluctuations on the equity markets of Gulf Cooperation Council (GCC) countries. The study utilized daily data on stock market price indices and oil prices from the New York Mercantile Exchange (NYMEX) over a three-year period. To analyze the relationship between oil prices and stock market behavior, the study employed the Generalized Autoregressive Conditional Heteroscedasticity (GARCH-M) approach, which is particularly useful in examining volatility and market dynamics. The findings revealed that in the long run, oil price movements do indeed influence the equity markets of GCC countries. Specifically, changes in oil prices were found to affect the profitability of firms operating in the region, thereby influencing the overall stock market. However, the study also found that, in the short term, the equity markets of Kuwait and Bahrain behaved differently from other GCC markets. Unlike Saudi Arabia, UAE, and Qatar, where stock prices are more closely tied to oil price movements, Kuwait and Bahrain's equity markets were found to be more speculative, and their price movements were less predictable. This is attributed to the relative illiquidity of Kuwait and Bahrain's markets compared to the more liquid and developed markets of their GCC counterparts.

The study's results diverged from those of Onour et al. (2012), even though both studies focused on oil-exporting countries. Ravichandran's inclusion of more countries in the analysis and the use of daily data likely contributed to these differences. Additionally, the methodological approach differed, with Onour using the Autoregressive Distributed Lag (ADRL) approach and Ravichandran using GARCH-M, which focuses more on volatility and time-varying relationships. Moreover, Ravichandran's research was further supported by earlier findings from Bashar (2006), which demonstrated that oil price increases in Saudi Arabia and Muscat had predictive power over their equity markets. Similarly, Wassal (2005) also observed that oil price fluctuations significantly impacted equity markets, although his study considered a broader range of regions, including Asia, Africa, and Latin America, utilizing Vector Auto-Regressive (VAR) and co-

integration techniques. These studies collectively underscore the importance of oil prices in shaping equity market performance in oil-exporting regions, though the effects may vary by country and market liquidity. Ravichandran's findings highlight the complexity of the relationship between oil prices and stock markets in the GCC, with both long-term and short-term effects dependent on market conditions and the speculative nature of certain equity markets. The differences in results between various studies may be due to variations in data frequency, methodologies, and the liquidity of individual markets, demonstrating the need for tailored approaches when analyzing different economies within oil-dependent regions.

Rahman (2012) addressed the issue of asymmetric information by investigating the effect of crude oil futures price movements on various economic indicators in Malaysia, including stock prices, export volume, and production. The study utilized monthly data on spot prices for crude palm oil, along with data on closing stock, production, and export volumes from the Malaysia Palm Oil Board for the period between 1998 and 2010. To examine the causal relationships between these variables, Rahman applied the Vector Error Correction Model (VECM). The findings indicated that, based on the asymmetric effect, any news or changes related to crude palm oil prices had a significant impact on Malaysia's production, equity market, and export volumes. This implies that market participants in Malaysia react strongly to price signals in the oil futures market, which can influence broader economic activities. Similarly, El et al. (2012) examined the long-run connection between oil prices and equity markets in Gulf Cooperation Council (GCC) countries, including Bahrain, Kuwait, Oman, Qatar, UAE, and Saudi Arabia. For this study, the authors used monthly data from 1996 to 2007, sourced from the Arab Monetary Fund (AMF) database. The Organization of the Petroleum Exporting Countries (OPEC) spot price was used as a proxy for oil prices, while the equity market indices of the respective GCC countries were also considered. The authors employed Bootstrap panel co-integration and Seemingly Unrelated Regression (SUR) methods to analyze the data.

The results documented by El et al. (2012) indicated that oil price increases had a positive impact on equity markets in most GCC countries, with the exception of Saudi Arabia. Their findings, using the SUR model, contradicted previous studies such as those by Onour (2012) and Ravichandran (2010), both of which found that the Saudi Arabian equity market was positively influenced by changes in oil prices. El et al. (2012) suggested that the Bootstrap panel co-integration test demonstrated a long-run relationship between oil prices and equity markets across the GCC, but the effect on Saudi Arabia appeared to diverge from the rest of the region. The discrepancy in results between the studies may be attributed to differences in methodology and the data used. The use of SUR and Bootstrap panel co-integration in El et al.'s study provided a different lens through which to examine the connection between oil prices and equity markets. These contrasting findings for Saudi Arabia highlight the complexity of oil price impacts on equity markets and suggest that local economic conditions, market structure, and the level of dependence on oil revenues could result in varying degrees of sensitivity to oil price movements. Both studies emphasize the critical role of oil price movements in influencing broader economic variables, but the impact may vary based on the context, market structures, and methodologies used to assess these relationships. The divergence in findings, particularly regarding Saudi Arabia's equity market, underscores the need for further research to reconcile these differences and understand the nuanced ways in which oil prices affect different economies.

Narayan and Narayan (2010) conducted a study focusing on the relationship between oil prices and Vietnam's equity market, with the aim of modeling the effect of oil price fluctuations on Vietnam's stock market performance. The study covered the period from 2000 to 2008 and utilized daily data from two key stock markets in Vietnam: the Ho Chi Minh City Securities Trading Centre (HSTC) and the Hanoi Securities Trading Centre (HASTC). Additionally, the authors incorporated the nominal exchange rate and the West Texas Intermediate (WTI) spot price index, with the data obtained from the Bloomberg database. The findings of the study revealed that there was a long-term relationship between oil prices, stock prices, and exchange rates. Specifically, oil prices and exchange rates were found to have a statistically significant positive impact on the Vietnamese equity market in the long run. This suggests that as oil prices and exchange rates rise, Vietnam's stock market tends to perform better, indicating a degree of dependency between these variables. However, the study's short-run estimates presented a different scenario. It was discovered that none of the variables, including oil prices, exchange rates, or stock prices, had a significant influence on equity returns during the short-term period of the study. This result indicates that, although oil price movements and exchange rate fluctuations may shape the broader long-term trends in Vietnam's equity market, they do not exert immediate or short-term effects on stock returns.

The authors acknowledged that their findings did not fully align with theoretical expectations, which often suggest that oil prices should have a more pronounced and immediate impact on stock market performance. They attributed this divergence to various factors that may have contributed to Vietnam's equity market boom during the period under study, particularly when oil prices were increasing rapidly. The rapid growth in Vietnam's equity market during this time may have been driven by broader economic developments, investor sentiment, or other structural factors, which diluted the immediate influence of oil price changes on stock returns. Narayan and Narayan's study highlights the complexity of the relationship between oil prices and equity markets, particularly in emerging markets like Vietnam. While oil prices and exchange rates were found to have significant long-term effects on stock prices, the lack of short-term influence suggests that other dynamics, such as market sentiment or broader economic trends, may play a more significant role in the short run. This underscores the importance of considering both long-term and short-term dynamics when analyzing the impact of global commodity prices on developing markets.

Mohanty et al. (2010) investigated the relationship between oil price volatility and stock values at both the industry level and firm level in the oil and gas sectors of Central and Eastern European (CEE) countries, including the Czech Republic, Hungary, Poland, Romania, Slovenia, and Austria. The study employed monthly data on West Texas Intermediate (WTI)

returns from December 1998 to March 2010, with the equity prices for all the CEE countries obtained from the DataStream database. To explore the relationship between oil prices and stock returns, the researchers used a two-factor model, which allowed them to estimate how oil price movements affected stock returns. Additionally, they applied the Seemingly Unrelated Regression (SUR) method to analyze the relative sensitivity of stock returns to various macroeconomic risk factors. This approach enabled a more detailed understanding of how stock returns in the oil and gas industry of CEE countries reacted to changes in oil prices, factoring in broader economic conditions. The findings revealed that the market sensitivity representation (βm) was positive and statistically significant for the oil and gas companies in all CEE countries except for Romania, where the result was significant but only at the 5% level of significance, compared to 1% significance for the other countries. This suggests that, except for Romania, the oil and gas companies in the CEE region were significantly exposed to increases in oil prices. In other words, as oil prices rose, the stock returns for oil and gas companies in these countries also increased, demonstrating a direct link between oil price fluctuations and company performance in the energy sector. The results of Mohanty et al.'s study aligned with previous research, particularly the findings of Boyer and Filion (2007), which also documented the significant exposure of oil and gas companies to changes in oil prices. The study's conclusions underscored the importance of oil price movements as a key driver of stock returns in the CEE region's oil and gas industry, showing that companies in these countries were particularly sensitive to oil price increases. This sensitivity reflects the central role that oil and gas play in the economies of these nations, where energy production and consumption are closely tied to broader economic performance. Mohanty et al. (2010) demonstrated that oil price volatility significantly impacts stock returns in the oil and gas industry across most CEE countries, with Romania being a notable exception. Their research supports the broader findings that companies in oil-dependent industries are exposed to macroeconomic risks associated with fluctuating oil prices, and their analysis provides valuable insights for investors and policymakers looking to understand the regional dynamics of the energy sector.

Fayyad and Daly (2011) extended earlier research on the Gulf Cooperation Council (GCC) countries by examining the long-run relationship between oil prices and stock market returns in seven countries. For comparative purposes, the study included the United Kingdom and the United States, alongside Kuwait, Oman, UAE, Bahrain, and Qatar. The primary goal was to investigate how oil price fluctuations influenced stock market returns in these economies. The study utilized daily weighted equity market indices from September 2005 to February 2010, alongside Brent oil spot prices obtained from MSCI and the Energy Information Administration. To analyze the data, Fayyad and Daly used the Vector Autoregressive (VAR) model, a method suited for assessing the impact of random series data over time. Their research divided the study period into three distinct phases. The first phase spanned from 2005 to 2006, when oil prices were relatively stable. During this period, they found no significant relationship between oil prices and stock market returns in any of the countries examined. This finding suggests that during times of price stability, oil prices did not exert considerable influence over the stock markets in the GCC countries or in the UK and the USA. The second period, from 2006 to 2008, coincided with a significant rise in oil prices. During this time, the authors identified a strong relationship between oil prices and stock market returns in most of the countries, except for the United Arab Emirates and Bahrain. The study noted a direct relationship between oil prices and stock markets in the GCC, meaning that increases in oil prices were generally associated with positive stock market performance. Additionally, they observed a two-directional relationship between Kuwait, Oman, USA, and Qatar, indicating that stock market movements and oil prices influenced each other during this time.

The third phase, from 2008 to 2010, occurred during the global financial crisis. Fayyad and Daly documented that changes in oil prices could predict equity market performance in five of the seven countries they studied. However, Kuwait and Bahrain were exceptions, where the relationship between oil prices and stock market returns seemed to weaken. This was likely due to the broader market volatility and economic instability triggered by the financial crisis. Overall, the study demonstrated how the relationship between oil prices and stock markets evolved over time, with stronger connections during periods of oil price surges, and disruptions during financial crises. The inclusion of the UK and USA provided a valuable comparative perspective, underscoring the distinctive dynamics of oil-exporting nations when faced with oil price volatility. Arouri et al. (2011) conducted a study investigating the return and volatility spillover between the equity market and oil in the Gulf Cooperation Council (GCC) countries. Using daily data from the MSCI equity index and spot oil prices from 2005 to 2010, sourced from the Energy Information Administration (EIA), the authors applied the Vector Autoregressive Generalized Autoregressive Conditional Heteroscedasticity (VAR GARCH) model. This model was particularly suitable as it enabled the analysis of joint conditional returns, volatility, and the correlation between oil prices and equity markets. Their findings indicated that in three of the six GCC countries—Bahrain, Qatar, and Oman—there was a significant impact of lagged oil returns on their equity markets. For Bahrain, the impact of oil returns on the equity market was negatively significant, while for Qatar and Oman, the impact was positive. These results highlight the varying influence of oil price changes on the different equity markets within the GCC region, depending on country-specific factors and the nature of their economies.

Similarly, S.K. Mohanty et al. (2011) focused on the relationship between oil price movements and equity market returns in the GCC countries, considering both industry and country-level perspectives. Their study utilized weekly data from June 2005 to December 2009 on equity indices in the GCC, obtained from the Thomson DataStream database. The industries examined across the countries varied, and West Texas Intermediate (WTI) was used as a proxy for oil prices. By employing a linear factor pricing model, the researchers estimated the impact of changes in oil prices on the equity markets. They found that in four of the six countries—Oman, UAE, Qatar, and Saudi Arabia—the equity markets responded positively to changes in oil prices. However, Bahrain's equity market displayed only a weakly positive reaction, while Kuwait's equity market showed no significant relationship with oil price changes. These studies underline the

heterogeneous impact of oil price movements on equity markets in the GCC region. While most countries displayed a positive correlation between rising oil prices and stock market performance, there were exceptions like Kuwait, where the relationship was non-existent, and Bahrain, where the market's reaction was relatively muted. The differences in how these markets react to oil price fluctuations can be attributed to the diversity in industrial composition, market liquidity, and the varying levels of dependence on oil revenues across the GCC countries. Both studies provide valuable insights into the broader dynamics at play in oil-exporting economies and their stock markets, highlighting the complexities of the oil-equity relationship within the region. Various studies have presented contrary findings on the relationship between oil prices and equity markets. For instance, Papapetrou (2001) applied the vector error correction model to analyze the effect of oil prices on equity returns in Greece using monthly data from January 1989 to June 1996. The study found that oil prices had a negative impact on stock returns, particularly in the first four months, based on the variance decomposition analysis. This finding aligns with the earlier work of Sadorsky (1999), who also documented that oil price fluctuations had a negative effect on the US equity market using monthly data. Similarly, Jones et al. (1996) reported that the equity market reacts negatively to changes in oil prices, suggesting that increases in oil prices could dampen investor confidence and economic performance, thereby pulling down stock returns.

Further supporting this negative impact, Cologni and Manera (2009) explored how oil price shocks influence the growth rates of output in a subset of developed countries. Using Markov-Switching (MS) regime autoregressive models, they aimed to capture the different phases of the business cycle. The study extended univariate MS models by incorporating asymmetric oil shocks as an independent variable to assess whether their inclusion improved the model's ability to detect business cycle phases. Using quarterly data from 1970Q1 to 2005Q1, their findings indicated that oil price shocks significantly affect economic growth and market cycles, underscoring the volatility and unpredictability oil prices inject into developed economies.

In contrast, Zhang (2008) found no linear relationship between financial markets and economic activity in relation to oil price movements in G-7 countries and Japan. Using quarterly data obtained from international financial statistics between 1957Q1 and 2006Q4, Zhang concluded that oil price fluctuations do not always have a predictable or linear impact on financial markets, further complicating the understanding of the oil-equity market relationship. These mixed findings suggest that the relationship between oil prices and stock markets may vary significantly depending on the economic structure, the time period analyzed, and the models used, highlighting the complexity of global oil market dynamics and their varied impacts across different regions and economies. Toraman et al. (2011) conducted a study on the Istanbul Exchange Market (ISE) to investigate whether oil price changes positively or negatively impact market returns on various indices, including the ISE100 Composite Index, Technology Index, Industrial Index, and Service Index. Using daily data from 2009 to 2011 for these respective indices, and Brent oil prices as the benchmark for each market, they adopted the Vector Error Correction Model (VECM). The findings documented that a long-term relationship between oil price movements and market indices exists, particularly noting that oil price fluctuations significantly affected the Istanbul equity market, especially the ISE 100 index. The study highlighted that investors should pay close attention to oil prices when making decisions regarding the ISE index, as the Istanbul index was found to be heavily and negatively influenced by changes in crude oil prices.

Similarly, Lee et al. (2011) concluded that there is a negative relationship between rising oil prices and equity markets. Their research, based on daily data from 1992 to 2008, reinforced the notion that increases in oil prices tend to exert downward pressure on stock market returns. In line with these findings, Apergis & Miller (2009) studied the effect of oil price fluctuations on the equity markets of eight countries: Australia, France, Canada, Germany, Italy, Japan, the UK, and the USA. Their research contributed to earlier findings by asserting that oil price changes negatively impact the stock market returns in all these countries. Using the VECM model, they examined three different types of oil price shocks: oil supply shocks, global aggregate-demand shocks, and global oil demand shocks. Their results indicated that regardless of the type of shock, changes in oil prices consistently had a negative impact on equity market returns. On the other hand, Wang et al. (2013) took a different approach by categorizing countries into oil-importing and oil-exporting nations to analyze the impact of oil price shocks on equity market returns. Their study used monthly data from January 1999 to December 2011 for 16 countries and utilized West Texas Intermediate (WTI) as a proxy for oil prices, with data sourced from DataStream and the Energy Information Administration. The authors adopted the VAR model, which assumes a linear relationship between variables. To ensure the stability of the model, they conducted a non-linearity test and found no significant non-linear causality between oil price changes and market returns in the majority of the countries.

Furthermore, the Structural VAR (SVAR) model introduced by Kilian et al. (2009) was employed to examine the reaction of equity markets to oil price changes. Their findings indicated that while there was no significant reaction to oil price changes in several cases (attributed to the insignificant effect of oil supply changes on prices), positive aggregate and precautionary demand shocks were shown to have a higher degree of impact on stock markets in oil-exporting countries. However, no such relationship was found in oil-importing countries, implying a positive relationship between oil prices and equity markets in oil-exporting nations, while the relationship in oil-importing countries tended to be negative. These studies illustrate the complex dynamics between oil prices and equity markets, revealing that oil-exporting countries tend to benefit from rising oil prices, while oil-importing countries suffer negative effects. This divergence is often influenced by the structure of the economy, dependency on oil, and the role of oil in national exports or imports. The findings also suggest that the impact of oil price changes is not always straightforward, as various factors, including demand shocks and market structure, play a significant role in shaping the oil-equity relationship across different countries and regions.

3. METHODOLOGY

This section outlines the methodology and data used for the research. The study utilizes daily data for West Texas Sour (WTS) as a proxy for crude oil spot and futures prices, while the Morgan Stanley Composite Index (MSCI) serves as the proxy to measure the frontier equity markets of countries including Kenya, Mauritius, Morocco, Nigeria, and South Africa. The data spans from 18 September 2003 to 31 July 2013 and was obtained from the Bloomberg database. West Texas Sour was chosen as a proxy for crude oil because it is widely traded and frequently used by firms in Africa, Europe, and South America for hedging purposes. Additionally, the Morgan Stanley Composite Index was adopted because it is used as a benchmark by 99% of portfolio managers for evaluating portfolio performance, making it a reliable measure of the equity market. The methodology involves a series of empirical steps to achieve the study's objectives. The first step is to test for stationarity in the series data by employing the Augmented Dickey-Fuller (ADF) and Phillip-Peron (PP) tests. These tests determine whether the data contains a unit root, which is necessary to understand the underlying properties of the time series. Following this, the Johansen co-integration test is conducted to establish whether there is a long-run association between the crude oil prices and the equity market indices of the selected countries. The next step involves the use of the Vector Error Correction Model (VECM) to capture both the long-term and short-term relationships between the data. This model also helps in determining how quickly the dependent variable, which in this case is the Equity Index, returns to equilibrium after experiencing shocks caused by the independent variables (i.e., crude oil spot and futures prices). Lastly, the Granger Causality test is used to examine whether there is a uni-directional effect of crude oil prices on the equity market, thereby determining the predictive power of crude oil price movements over the stock market in the frontier economies considered in this study. These sequential steps help in analyzing the dynamic relationship between crude oil prices and the equity markets in these African countries, providing insights into both short-term fluctuations and long-term trends, as well as the direction of causality between these key economic variables.

4. RESULTS AND DISCUSSION

Table 1: Unit root analysis

	LEVEL				FIRST DIFFERENCE			
	ADF		PP		ADF		PP	
	I	I&T	I	I&T	I	I&T	I	I&T
FP	-2.1364	-2.5788	-2.1368	-2.5842	-53.4872[a]	-53.4806[a]	-53.5094[a]	-53.5031[a]
SP	-2.2722	-2.9112	-2.1683	-2.7395	-51.1608[a]	-51.1536[a]	-51.3040[a]	-51.2979[a]
MSCIKEN	-1.5872	-1.8544	-1.4438	-1.6893	-37.2366[a]	-37.2299[a]	-36.9668[a]	-36.9595[a]
MSCIMAU	-1.4093	-1.3600	-1.4431	-1.4867	-46.2852[a]	-46.2852[a]	-46.7908[a]	-46.7837[a]
MSCIMO	-1.5239	-0.7934	-1.4721	-0.6455	-43.0566[a]	-43.1214[a]	-42.6487[a]	-42.6754[a]
MSCING	-1.5542	-1.5404	-1.4228	-1.4058	-32.3227[a]	-32.3248[a]	-31.3725[a]	-31.3638[a]
MSCISA	-2.2157	-2.8967	-2.1001	-2.6893	-50.0582[a]	-50.0548[a]	-50.3959[a]	-50.4030[a]

The table 1 presents the results of unit root analysis using the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests, which help determine if time series data is stationary. Stationarity is a crucial property for time series analysis, indicating that the mean, variance, and autocorrelation structure remain consistent over time. The analysis was conducted at both the original series level and after applying the first difference. Two versions of the tests were used: one without a trend (I) and one with an intercept and trend (I&T). The results for the FP series show that, at the level, both ADF and PP test results are non-significant, indicating that the series is non-stationary. However, after applying the first difference, the results become highly significant, suggesting that the series becomes stationary. Similar patterns emerge for the SP series, where non-significance at the level indicates non-stationarity, while the first difference results suggest a stationary series. For the MSCIKEN series, which likely represents a financial index for Kenya, non-significant results at the level imply non-stationarity. The series becomes stationary upon first differencing, as indicated by the significant test results. The MSCIMAU series follows the same trend, being non-stationary at the original level but achieving stationarity after first differencing.

The MSCIMO series, possibly related to Morocco, also shows non-stationary characteristics in its original form, transitioning to a stationary series once differenced. The MSCING series, associated with Nigeria, exhibits non-stationarity at the level, with stationarity achieved after the first difference, a typical outcome in time series analysis. Lastly, the MSCISA series, which could pertain to South Africa, reflects a similar pattern of non-stationarity at the level but becomes stationary after applying the first difference. This pattern is consistent across all the tested series, highlighting a common characteristic in financial time series data where initial non-stationarity requires differencing to stabilize their statistical properties.

The table summarizes the results of a Johansen co-integration analysis for different variables, indicating the presence of long-term equilibrium relationships among the time series data. This analysis assesses whether the variables are co-integrated, meaning they share a stable, long-term relationship despite potential short-term fluctuations. The Johansen method provides two test statistics: the Trace statistic (T-STA) and the Max-Eigenvalue statistic (MAX ENG), compared against critical values (C.V). For MSCIKEN, the results show that the null hypothesis of "None" is rejected, as indicated by a Trace statistic of 124.8706, which exceeds the critical value of 29.7971. This suggests that there is at least one co-

integrating relationship among the variables. Similarly, the Max-Eigenvalue statistic is significant, further confirming the presence of a co-integrating vector. For "At most 1" and "At most 2" hypotheses, the Trace and Max-Eigenvalue statistics are also significant, indicating additional co-integrating relationships. In the case of MSCIMAU, the "None" hypothesis is rejected, with a Trace statistic of 148.5782, well above the critical value, indicating the presence of a co-integrating relationship. However, for "At most 1" and "At most 2" hypotheses, the results are mixed. While the Trace statistic for "At most 1" is higher than the critical value, indicating some level of co-integration, "At most 2" suggests no further significant relationships.

Table 2: Johansen co-integration analysis

VARIABLE	NULL HYPOTHESIS	TRACE T-STA	C.V	MAX ENG T-STA	C.V
	None *	124.8706	29.7971		110.108921.1316
MSCIKEN	At most 1 *	14.7617	15.4947		8.762614.2646
	At most 2 *	5.9991	3.8415		5.99913.8415
	None *	148.5782	29.7971		118.326821.1316
MSCIMAU	At most 1	30.2514	15.4947		26.511514.2646
	At most 2	3.7399	3.8415		3.73993.8415
	None *	134.6124	29.7971		116.104821.1316
MSCIMO	At most 1 *	18.5076	15.4947		13.335714.2646
	At most 2 *	5.1718	3.8415		5.17183.8415
	None *	127.8110	29.7971		118.012821.1316
MSCINIG	At most 1	9.7982	15.4947		6.337814.2646
	At most 2	3.4604	3.8415		3.46043.8415
	None *	129.8676	29.7971		110.914421.1316
MSCISA	At most 1	18.9531	15.4947		15.000814.2646
	At most 2	3.9523	3.8415		3.95233.8415

For MSCIMO, the analysis reveals a significant co-integrating relationship at "None" with a Trace statistic of 134.6124. Both the "At most 1" and "At most 2" hypotheses also display significant results, as their statistics surpass the critical values, indicating the presence of multiple co-integrating relationships. The results for MSCINIG show a co-integrating relationship at "None," with a Trace statistic of 127.8110, surpassing the critical value. However, for the "At most 1" and "At most 2" hypotheses, the statistics fall below their respective critical values, suggesting no further significant co-integration beyond the first identified relationship. Lastly, for MSCISA, the "None" hypothesis is rejected, as the Trace statistic of 129.8676 exceeds the critical value, indicating a co-integrating relationship. For "At most 1," the statistics are slightly above the critical value, suggesting a possible but weaker co-integration, while "At most 2" shows minimal significance. Overall, the analysis indicates that the variables exhibit co-integrating relationships at different levels, suggesting that while there may be short-term deviations, the time series tend to move together in the long run, maintaining equilibrium. The presence of multiple significant relationships for certain variables highlights the complexity and depth of their interconnectedness.

Table 3: Vector error correction model

	MSCIKEN	MSCIMAU	MSCIMO	MSCINIG	MSCISA
ECT	-0.0483	-0.0514	-0.0482	-0.0481	-0.0452

The table 3 presents the results of a Vector Error Correction Model (VECM) analysis for various indices (MSCIKEN, MSCIMAU, MSCIMO, MSCINIG, and MSCISA), focusing on the error correction term (ECT). The ECT represents the speed of adjustment towards long-term equilibrium after a deviation, showing how quickly any disequilibrium is corrected. The ECT coefficients for each variable are negative, ranging from -0.0452 for MSCISA to -0.0514 for MSCIMAU. A negative ECT indicates that the variables correct deviations back towards equilibrium, which is expected in a stable long-term relationship. The magnitude of each ECT provides insight into the speed of this adjustment. For MSCIKEN, the ECT coefficient of -0.0483 suggests that approximately 4.83% of the disequilibrium is corrected in the next period, indicating a relatively moderate pace of adjustment. MSCIMAU, with an ECT of -0.0514, adjusts slightly faster, correcting around 5.14% of the disequilibrium per period. MSCIMO has an ECT of -0.0482, similar to MSCIKEN, suggesting a comparable speed of adjustment toward long-term equilibrium. MSCINIG's ECT of -0.0481 also indicates a similar adjustment rate, showing that deviations are corrected at a pace of about 4.81% per period. Finally, MSCISA has the smallest ECT coefficient at -0.0452, suggesting that it adjusts slightly slower compared to the others, with about 4.52% of any disequilibrium corrected per period. Overall, all the indices exhibit negative ECT coefficients, indicating that they are adjusting toward a long-term equilibrium after short-term deviations. The relatively close values of the ECTs

suggest a consistent adjustment process among the different indices, though MSCIMAU shows the fastest adjustment, while MSCISA is the slowest in returning to equilibrium.

Table 4: VECM pairwise Granger causality analysis

	VARIABLES	F-STAT	PROB
MSCIKEN	SP	3.5319	0.0294
	FP	3.5560	0.0287
MSCIMAU	SP	12.3022	0.0000
	FP	12.0684	0.0000
MSCIMO	SP	5.0413	0.0065
	FP	6.4160	0.0017
MSCINIG	SP	1.0043	0.3664
	FP	3.1252	0.0441
MSCISA	SP	2.2295	0.1078
	FP	3.0894	0.0457

The table provides the results of a Vector Error Correction Model (VECM) pairwise Granger causality analysis, which examines whether one variable can predict changes in another over time. Specifically, it assesses the causal relationships between stock indices (MSCIKEN, MSCIMAU, MSCIMO, MSCINIG, and MSCISA) and two variables, SP and FP. The analysis includes the F-statistic and the associated probability (PROB), where a lower probability indicates a stronger rejection of the null hypothesis of no causality. For MSCIKEN, the relationship with both SP and FP shows significance, with F-statistics of 3.5319 ($p = 0.0294$) and 3.5560 ($p = 0.0287$), respectively. The probabilities are below the typical significance level of 0.05, suggesting that MSCIKEN Granger-causes SP and FP, implying that past values of MSCIKEN can help predict movements in these variables. MSCIMAU shows a very strong causality with both SP and FP, evidenced by high F-statistics of 12.3022 ($p = 0.0000$) for SP and 12.0684 ($p = 0.0000$) for FP. The p-values being 0.0000 indicate a highly significant relationship, suggesting that changes in MSCIMAU have a robust predictive power over both SP and FP. MSCIMO also displays significant causal relationships with SP and FP, as indicated by F-statistics of 5.0413 ($p = 0.0065$) and 6.4160 ($p = 0.0017$), respectively. These results suggest that MSCIMO can predict changes in SP and FP, as the probabilities fall well below the 0.05 threshold.

In the case of MSCINIG, the causality towards SP is not significant, with an F-statistic of 1.0043 ($p = 0.3664$), indicating that MSCINIG does not Granger-cause SP. However, the relationship with FP is significant (F-statistic of 3.1252, $p = 0.0441$), suggesting that past values of MSCINIG have some predictive power over FP. Lastly, MSCISA shows no significant causality with SP, as the p-value is 0.1078 (F-statistic of 2.2295). However, there is a significant relationship with FP, with an F-statistic of 3.0894 ($p = 0.0457$), indicating that MSCISA can predict changes in FP. Overall, the results reveal varied levels of causality between the indices and the two variables. MSCIMAU demonstrates the strongest predictive power over both SP and FP, while MSCINIG and MSCISA only show significant causality with FP. MSCIMO and MSCIKEN have significant relationships with both variables, highlighting their relevance in forecasting these movements.

5. CONCLUSION

This study investigated the impact of crude oil and palm oil spot and futures prices on the equity markets of five African countries: South Africa, Morocco, Mauritius, Nigeria, and Kenya. These countries were chosen as they represent frontier economies, characterized by developing equity markets that are sensitive to international market dynamics and regional political challenges. The analysis revealed the existence of a long-term relationship between crude oil spot and futures prices and the equity markets of these nations, suggesting that oil price movements significantly affect market behavior over time. Additionally, the study found that the sensitivity of each market to shocks originating from the crude oil market varied across the countries, implying that while all these markets are affected by oil price volatility, the degree of impact differs based on each country's economic structure and dependence on oil. This result holds relevance for investors, researchers, and market regulators, both within Africa and globally, as it highlights the intricate connections between oil prices and stock market performance in these economies.

Given these findings, it is recommended that the selected countries diversify their economies to reduce their dependency on oil and mitigate the risks associated with oil price volatility. By restructuring their productive bases and expanding into other sectors, these countries can better shield their economies from external shocks and ensure more stable economic growth. This approach could help frontier economies build resilience against global market fluctuations and regional instabilities, ultimately leading to more sustainable development. This study opens the door for further exploration in this research area. Future research should consider expanding the scope by including other commodities such as soya oil, rubber, and gold, which could provide more comprehensive insights into how different commodity markets influence equity markets in African frontier economies. Additionally, it is important to acknowledge that various international events during the study period, such as political and economic instability in African countries and the global financial crisis of 2007/2008, could have impacted the variables under investigation, potentially leading to less precise results.

Moreover, factors like country-specific policies, including public holidays and non-trading days, may also have influenced the findings, and these should be taken into account in future research. For a more accurate analysis, it would be advisable to focus on periods when the global market is not facing significant challenges or disruptions. This approach would help in isolating the effects of oil prices on equity markets without the confounding influence of extraordinary global events, thereby yielding clearer and more reliable results.

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