# THE VALUATION CHALLENGES IN UPSTREAM OIL AND GAS PROJECTS: A FOCUS ON ONSHORE NORTH AMERICAN E&P

by

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# THE VALUATION CHALLENGES IN UPSTREAM OIL AND GAS PROJECTS: A FOCUS ON ONSHORE NORTH AMERICAN E&P

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## ABSTRACT

This study aims to examine the relationship between crude oil price fluctuations and the stock performance of onshore independent exploration and production (E&P) companies in North America. Specifically, it seeks to investigate how changes in crude oil prices influence market valuation, investor perceptions, and the financial stability of these companies. The research will analyze historical data on crude oil price movements alongside financial and operational metrics of E&P firms, utilizing a quantitative secondary methodology. The study will also explore how factors such as operational efficiency, hedging strategies, and regional market conditions may moderate the impact of crude oil price changes on stock performance. By addressing these questions, this research aims to highlight the critical role of market-specific characteristics and company-level strategies in shaping financial outcomes for independent E&P companies. Future exploration could incorporate additional variables, such as technological advancements and regulatory impacts, to further understand the dynamic interplay between commodity prices and stock performance in the upstream oil and gas sector.

## INTRODUCTION

In March 2020, the global oil market faced an unprecedented shock when crude oil prices collapsed, triggered by a combination of the COVID-19 pandemic and a price war between major oil producers such as Saudi Arabia and Russia. West Texas Intermediate (WTI), the U.S. benchmark crude oil price, famously plummeted to negative territory for the first time in history, briefly reaching -$37.63 per barrel (Zou et al., 2020). This historic collapse exposed the vulnerabilities of the global energy market and the industries tied to crude oil prices, particularly the upstream oil and gas sector (Zou et al., 2020). Among the most affected were onshore independent exploration and production (E&P) companies in North America, whose financial performance is highly sensitive to crude oil price fluctuations. Unlike integrated oil and gas companies, which mitigate price volatility through diversification into downstream operations such as refining and retail, independent E&P companies are heavily reliant on their upstream activities, making them disproportionately exposed to market shocks (Misund, 2016).

The price of crude oil plays a pivotal role in shaping the stock performance of upstream oil and gas companies. Crude oil is not only a primary revenue driver for these firms but also a key determinant of investor sentiment and market valuation (Baghestani et al., 2016). Research suggests that changes in crude oil prices have far-reaching implications for stock prices, particularly in commodity-dependent industries. For independent E&P companies, these price changes directly influence cash flows, production decisions, and, ultimately, shareholder value (Baghestani et al., 2016). This dynamic has become even more pronounced with the rise of unconventional oil production in North America, particularly in regions like the Permian Basin, where operational costs and breakeven prices vary significantly among producers (Zou et al., 2020). Despite the critical importance of this relationship, the literature on how crude oil price changes affect the stock performance of independent E&P firms remains relatively underdeveloped, with most studies focusing on broader indices or integrated oil companies.

The challenges faced by independent on-shore E&P companies due to crude oil price volatility are multifaceted. On one hand, oil price spikes often lead to rapid revenue increases and heightened investor confidence, driving stock prices upward (Misund, 2016). On the other hand, sudden price declines can lead to operational cutbacks, impaired asset valuations, and even bankruptcy for highly leveraged firms (Misund, 2016). This cyclical nature of the oil market creates significant uncertainty for investors, policymakers, and corporate leaders alike. Understanding how crude oil price fluctuations specifically impact the financial performance of independent E&P companies is therefore critical for making informed investment decisions, developing resilient business strategies, and crafting effective regulatory policies.

Recent studies have attempted to analyze the broader relationship between crude oil prices and stock markets, providing a foundation for this research (Misund, 2016). For instance, Kumar et al. (2022) found evidence of significant volatility spillovers between crude oil prices and stock market indices, highlighting the interconnectedness of energy markets and financial systems. However, these studies often aggregate data across various sectors, overlooking the unique characteristics and risks associated with independent E&P companies, such as basin exposure or commodity mix. Moreover, while integrated oil companies benefit from economies of scale and diversified operations, independent firms are far more exposed to the direct effects of oil price changes because they typically operate in individual basins (Misund, 2016). This lack of diversification amplifies their sensitivity to market volatility, making them an ideal subject for a focused analysis.

The significance of crude oil prices extends beyond financial markets, influencing broader economic and geopolitical landscapes. For oil-dependent economies, price fluctuations can affect government revenues, trade balances, and currency values (Zou et al., 2020). For companies, particularly independent E&P firms, price changes influence not only revenue but also strategic decisions such as capital investment, production levels, and hedging strategies.

This study examines how changes in crude oil prices influence the stock performance of onshore independent E&P companies in North America (Zou et al., 2020). By focusing on this specific segment of the oil and gas industry, the research aims to fill a critical gap in the existing literature. While previous studies have explored the general impact of oil price changes on stock markets, few have addressed the unique vulnerabilities and dynamics of independent E&P firms. These companies play a vital role in the U.S. energy market, accounting for approximately 83% of domestic oil production and driving technological advancements in hydraulic fracturing and horizontal drilling (Zou et al., 2020). Understanding how price fluctuations affect their financial performance is essential for stakeholders ranging from investors to policymakers.

The study employs a quantitative, secondary analysis methodology, drawing on data from financial reports, market indices, and commodity price trends. By synthesizing insights from existing literature and analyzing real-world data, this research seeks to provide a nuanced understanding of the interplay between crude oil prices and stock performance. The findings will offer valuable insights for investors seeking to optimize portfolio strategies, policymakers aiming to stabilize energy markets, and industry leaders striving to navigate an increasingly volatile environment.

The remainder of this paper is organized as follows. Chapter 2 provides a comprehensive literature review, synthesizing key studies on the relationship between crude oil prices and stock performance, with a particular focus on independent E&P companies. It highlights the theoretical frameworks and empirical findings that underpin this research, while identifying gaps and opportunities for further exploration. Chapter 3 outlines the methodology used to analyze the impact of crude oil price changes on stock performance, detailing the data sources, analytical techniques, and research design. Finally, the paper concludes with an analysis of the findings, discussing their implications for stakeholders and offering recommendations for future research. By addressing this critical topic, the study aims to contribute to a deeper understanding of the

financial and operational challenges faced by independent E&P companies in a volatile global energy market.

## LITERATURE REVIEW

### Introduction to the Oil and Gas Industry and Market Relevance

The oil and gas industry is a vital component of the global economy, providing the primary energy source for transportation, manufacturing, and electricity (Xavier et al., 2024; Craig & Quagliaroli, 2020). Oil and natural gas account for roughly 80% of global energy needs, making price fluctuations in these resources highly influential on both economic stability and market performance (Xavier et al., 2024; Craig & Quagliaroli, 2020). Price changes affect various sectors, including transportation, agriculture, and manufacturing, with significant repercussions for national budgets, trade balances, and currency stability, especially in oil-dependent nations (Siddiqui et al., 2020; Suresh et al., 2022). Furthermore, oil's role as a financial asset has increased volatility, amplifying spillover effects across financial markets (Degiannakis, Filis, & Arora, 2018).

The oil and gas sector operates across three main stages: upstream, midstream, and downstream. The upstream segment—responsible for exploration, development, and production—is the most capital-intensive and risky due to factors like geological uncertainty and technical challenges (Mardiana & Saputra, 2023). High extraction costs and significant infrastructure requirements mean that even small fluctuations in oil prices can impact profitability and lead companies to scale operations up or down based on market conditions. For example, during downturns such as the 2014–2016 slump, upstream companies delayed or canceled projects to maintain financial stability (Scholvin, 2021; Baghestani et al., 2016).

North America’s oil market is distinctive in its private and corporate ownership of mineral rights, allowing landowners to receive royalty interests. This structure, uncommon globally, incentivizes private investment and flexibility in adjusting production in response to price changes (Misund, 2016). In contrast, oil production in regions like the Middle East is predominantly state-owned, giving governments direct control over production, which often leads to more stable output

but less adaptability to market shifts (Mardiana & Saputra, 2023).

Independent exploration and production (E&P) companies, particularly in North America, focus solely on upstream activities, making them more exposed to crude price volatility than integrated firms. While high prices boost their profitability and cash flows, low prices often force independent E&Ps to reduce spending and prioritize efficiency (Xavier et al., 2024; Siddiqui et al., 2020). This study explores how price volatility affects the financial health and stock performance of these North American independent E&P firms, highlighting their unique challenges and strategies in a volatile market.

**Crude Oil Price Dynamics and Influencing Factors**

Crude oil prices are among the most volatile of all commodities, affected by a blend of supply and demand fundamentals, geopolitical events, and broader economic trends (Kumar et al., 2020; Suresh et al., 2022). As a globally traded commodity, oil responds not only to immediate market pressures but also to long-term shifts in policy, technology, and energy consumption patterns (Kumar et al., 2020; Suresh et al., 2022). This volatility can cause significant ripple effects, impacting exchange rates, stock markets, and even other commodities, reflecting the interconnected nature of global markets (Degiannakis, Filis, & Arora, 2018; Zou et al., 2020).

One of the main drivers of oil prices is the balance of global supply and demand. Key producers, including OPEC member countries, exert influence by adjusting output to stabilize or shift prices (Degiannakis, Filis, & Arora, 2018; Zou et al., 2020). For instance, when OPEC reduces supply, prices typically rise, while production expansions can ease prices. The recent North American shale boom has added flexibility to global supply, with U.S. producers able to quickly increase or decrease output based on price incentives, further contributing to price fluctuations (Misund, 2016; Baghestani et al., 2016). This adaptability contrasts with more rigid production levels seen in state-controlled industries, which tend to maintain stable outputs even during market disruptions (Mardiana & Saputra, 2023).

Demand-side factors also play a central role. Global economic growth, especially in

emerging markets, drives energy demand as industrialization and urbanization increase (Xavier et al., 2024; Scholvin, 2021). Recent shifts in consumer behavior, such as the rise in electric vehicle use and renewable energy adoption, may gradually reduce oil demand in the long term, although oil remains vital in both industrial and transportation sectors, particularly in Asia and North America (Xavier et al., 2024; Scholvin, 2021).

Investors and speculators actively trade oil futures, responding not only to physical market conditions but also to market sentiment and risk strategies, which can lead to short-term price swings that deviate from fundamental supply-demand dynamics (Suresh et al., 2022; Degiannakis et al., 2018). In recent years, these price fluctuations have been further intensified by the rise of high-frequency or algorithmic trading. These trading strategies, which rely on speed and automation to exploit small price differentials, have been shown to increase intraday volatility and amplify price reversals in commodity markets, including oil (Kumar et al., 2020). As such, algorithmic trading introduces an additional layer of complexity to oil price behavior by generating rapid, non-fundamental shifts in pricing patterns that can obscure underlying market signals. Oil prices also tend to move inversely to the strength of the U.S. dollar; a weaker dollar makes oil cheaper in foreign currencies, boosting demand, whereas a stronger dollar raises oil's relative cost globally and can dampen prices (Craig & Quagliaroli, 2020).

In summary, crude oil price dynamics are influenced by multiple, overlapping factors. Supply adjustments from key producers, demand patterns in emerging markets, and the financial market's speculative activities collectively shape the landscape. Understanding these dynamics is essential for assessing the operational strategies of oil-dependent companies, particularly independent E&P firms, which face heightened exposure to price fluctuations due to their upstream focus.

**Economic Impact of Oil Price Fluctuations on E&P Companies**

The exploration and production (E&P) sector is highly sensitive to crude oil price fluctuations, given its reliance on market-driven revenue and substantial capital expenditure

requirements (Scholvin, 2021; Kumar, Singh, & Kumar, 2022). Rising oil prices typically boost E&P companies' profitability and investor confidence, leading to higher stock valuations and increased capital for expansion (Scholvin, 2021; Kumar, Singh, & Kumar, 2022). However, during price downturns, E&P firms face pressures to cut costs, delay projects, and optimize operations to sustain financial stability as they have one-hundred percent exposure to oil prices (Degiannakis, Filis, & Arora, 2018; Siddiqui et al., 2020). This cyclical nature underscores the challenging financial environment these companies operate in, as they balance growth with risk management in a volatile market (Zou et al., 2020).

The 2014–2016 oil price collapse illustrates the sector's vulnerability to downturns. During this period, oil prices fell from over $100 per barrel to lows near $30, severely impacting cash flows and profitability across the industry (Siddiqui, Mahmood, & Margaritis, 2020; Craig & Quagliaroli, 2020). Many E&P firms responded by curtailing capital expenditures, reducing workforces, and halting drilling all together. The collapse highlighted how heavily these firms depend on stable or rising prices to maintain production and development operations, as prolonged low prices can force them to forego activities and downsize to stay afloat (Siddiqui, Mahmood, & Margaritis, 2020; Craig & Quagliaroli, 2020).

Investor sentiment also plays a significant role in shaping the stock performance of E&P companies in response to oil price changes. When oil prices rise, E&P stocks generally experience upward momentum due to higher revenue expectations and profit margins (Kumar, Singh, & Kumar, 2022; Misund, 2016). Conversely, during price declines, the financial strain on E&P companies is reflected in rapid stock devaluations, as investors often lose confidence in these firms' ability to sustain operations under lower prices (Watson, 2010). This dynamic is especially pronounced in oil-exporting regions, where stock markets are more directly impacted by energy sector fluctuations (Kumar, Singh, & Kumar, 2022; Misund, 2016).

Moreover, oil price volatility complicates financial strategies for E&P companies, influencing cash flow management and long-term planning. High oil prices allow firms to generate

cash reserves, reinvesting profits in exploration, development, and technology upgrades to enhance productivity and prepare for future demand (Watson, 2010). During periods of low prices, however, E&P firms often have to conserve cash, stop investing in shareholder growth, and cut back on growing production all together. This cyclical adjustment highlights the need for adaptive financial strategies to ensure survival and competitiveness over time (Baghestani et al., 2016; Scholvin, 2021).

Speculative trading in oil derivatives and futures amplifies price volatility, significantly impacting the financial performance of exploration and production (E&P) companies (Knittel & Pindyck, 2016; Watson, 2010). This trading is often driven by sentiment and macroeconomic trends rather than supply-demand fundamentals, causing price swings that complicate revenue forecasting and investment planning (Jackson Walker LLP, 2016). To manage these risks, firms use hedging strategies like futures contracts to stabilize cash flows, though such strategies can be limited when speculative activity creates unpredictable distortions (Knittel & Pindyck, 2016). When E&Ps are considered “over-hedged” in terms of volume contracts, investors may lose confidence, which may lead to stock price instability and reduced access to capital during volatile periods (Watson, 2010).

In summary, oil price fluctuations deeply impact the E&P sector's profitability, operational strategies, and investor sentiment. The sector’s dependency on crude prices and susceptibility to financial market forces make it one of the most vulnerable commodity-driven businesses in the world.

**Stock Market Response to Commodity Price Changes in Oil and Gas**

Stock market responses to oil price fluctuations are heavily influenced by a country’s oil production and consumption profile, as well as the broader economic structure (Jackson Walker LLP, 2016). Generally, higher oil prices tend to benefit the stock valuations of oil-exporting countries and oil-dependent sectors, as revenue potential rises, strengthening investor confidence. Conversely, lower prices often trigger stock market declines in oil-dependent regions, as seen

during the 2014–2016 oil price slump, which led to notable downturns in stock markets of oil-exporting nations like those in the Gulf Cooperation Council (GCC) (Siddiqui, Mahmood, & Margaritis, 2020; Degiannakis, Filis, & Arora, 2018). This cyclical sensitivity reflects the interconnectedness between oil prices and the economic outlook of energy-exporting regions.

The nature of the oil price changes, whether driven by supply-side factors, such as OPEC's production adjustments, or demand-side shifts—also impacts stock market reactions (Baghestani et al., 2016; Zou et al., 2020). For example, supply-driven price hikes, often due to geopolitical disruptions, tend to create sharper market volatility as investors become cautious about the potential for broader economic instability. In contrast, demand-driven price increases, which align with economic growth, generally elicit more positive stock market responses, as they signal strong demand fundamentals (Baghestani et al., 2016; Zou et al., 2020). The response also varies between sectors, with energy-intensive industries like transportation and manufacturing showing negative effects from rising oil prices due to increased operational costs, while the energy sector often sees stock gains under these conditions (Scholvin, 2021; Kumar, Singh, & Kumar, 2022). However, it is important to note that effects may be amplified dependent upon where the E&P operates, access to terminals, and downstream refining (Scholvin, 2021; Kumar, Singh, & Kumar, 2022).

The financial-driven oil price volatility has added complexity to stock market responses. Speculative trading in oil futures markets can intensify price movements, amplifying the interconnected effects between oil prices and stock performance (Watson, 2010). This activity often deviates from fundamental supply-demand dynamics, increasing volatility for stocks in oil-related sectors. Companies in regions with strong ties to the oil sector, such as North America, are particularly susceptible to these short-term price fluctuations (Suresh et al., 2022; Misund, 2016).

Exchange rate dynamics further complicate the relationship between oil prices and stock markets. Since oil is globally traded in U.S. dollars, fluctuations in the dollar's strength impact oil price levels in different countries (Kumar et al., 2020; Craig & Quagliaroli, 2020). A stronger dollar raises oil prices in non-dollar economies, often dampening demand and investor sentiment in

those markets, while a weaker dollar can boost demand and support stock market stability in oil-importing countries (Kumar et al., 2020; Craig & Quagliaroli, 2020). This currency influence is especially significant in emerging markets, which are often sensitive to exchange rate movements that impact both commodity prices and capital flows.

In conclusion, the stock market response to oil price changes reflects a complex interplay of economic fundamentals, speculative trading, and exchange rate fluctuations. These dynamics highlight the varied impact that oil price volatility has across regions and sectors, underscoring the importance of understanding the way oil and sector-specific sensitivities within the broader economy.

**Comparative Performance of Independent E&P vs. Integrated Oil Companies in Response to Oil Price Changes**

Independent exploration and production (E&P) companies and integrated oil companies respond differently to oil price fluctuations due to distinct operational structures, revenue streams, and risk exposure. Independent E&P firms, which focus solely on upstream activities such as exploration and extraction, are highly sensitive to oil price changes (Misund, 2016; Siddiqui et al., 2020). Their revenue and profitability are directly tied to crude prices, making them particularly vulnerable during downturns (Misund, 2016; Siddiqui et al., 2020). When oil prices rise, independent E&Ps see substantial gains as each barrel produced generates higher revenue, dependent upon their hedging strategies. However, in periods of price decline, these companies often scale back production, reduce exploration budgets, and adopt cost-saving measures to maintain financial stability (Misund, 2016; Siddiqui et al., 2020).

In contrast, integrated oil companies operate across the entire value chain, including upstream, midstream, and downstream activities. This vertical integration provides a built-in hedge against oil price volatility, as downstream operations, such as refining and petrochemicals, often benefit from lower input costs when crude prices drop (Baghestani et al., 2016; Scholvin, 2021). For example, during the 2014–2016 oil price collapse, integrated firms were able to offset some

upstream revenue losses with gains in refining margins, as the cost of crude inputs decreased (Baghestani et al., 2016; Scholvin, 2021). This operational diversity generally makes integrated oil companies more resilient to price swings, allowing them to continue investing in growth projects and R&D despite upstream revenue pressures (Baghestani et al., 2016; Scholvin, 2021).

Investor sentiment towards these two types of companies also reflects their differing risk profiles. Integrated oil companies are often seen as safer investments, offering stability through diversified revenue streams that buffer against market fluctuations (Kumar, Singh, & Kumar, 2022; Zou et al., 2020). Conversely, independent E&P stocks are perceived as higher-risk assets, given their direct reliance on oil prices for revenue, which makes them attractive to risk-tolerant investors during price rallies but more vulnerable to rapid devaluation in downturns (Kumar, Singh, & Kumar, 2022; Zou et al., 2020).

Financial market trends have also made these distinctions. The oil market integration has intensified speculative trading on oil futures, leading to heightened volatility in independent E&P stocks, which are more exposed to short-term price swings (Suresh et al., 2022; Craig & Quagliaroli, 2020). In contrast, integrated companies attract a broader investor base looking for steady returns, as their diversified operations reduce exposure to sudden price shocks (Suresh et al., 2022; Craig & Quagliaroli, 2020). This market perception further underlines the comparative stability of integrated firms in volatile market conditions, with more consistent investor confidence in integrated stocks regardless of short-term oil price movements (Suresh et al., 2022; Craig & Quagliaroli, 2020).

In summary, while both independent E&P and integrated oil companies are influenced by oil price fluctuations, their structural and operational differences shape distinct financial responses and investor perceptions. Independent E&Ps experience higher revenue volatility and are more exposed to downturns, whereas integrated firms leverage their diversified operations to maintain stability, underscoring the importance of operational diversity in mitigating risks associated with commodity price volatility in the oil sector (Suresh et al., 2022; Craig & Quagliaroli, 2020).

**Regional Analysis: The North American Oil Market**

The North American oil market, particularly in the United States and Canada, has emerged as a global leader in recent decades, driven by abundant shale reserves and advancements in extraction technology (Craig & Quagliaroli, 2020; Mardiana & Saputra, 2023). Hydraulic fracturing and horizontal drilling have enabled the United States to significantly increase its oil output, transitioning from a net importer to a prominent exporter (Craig & Quagliaroli, 2020; Mardiana & Saputra, 2023). This shift has reshaped the global oil landscape and strengthened North America's influence in energy markets, while reducing its reliance on foreign oil (Craig & Quagliaroli, 2020; Mardiana & Saputra, 2023). However, these extraction methods are cost-intensive, making North American producers highly sensitive to crude price volatility (Misund, 2016; Scholvin, 2021).

One unique characteristic of the North American market is the private and corporate ownership of mineral rights, which contrasts sharply with the state-owned oil production models found in many other major oil-producing regions, such as the Middle East. In North America, individual landowners and corporations hold royalty interests, allowing them to directly benefit from oil production on their land (Baghestani et al.). This private ownership structure incentivizes exploration and development activities, as landowners are financially motivated to lease their mineral rights (Baghestani et al.). This setup is uncommon globally and creates a highly responsive production environment where firms can adjust output based on price signals, rather than state directives (Baghestani et al., 2016; Zou et al., 2020). Canada's oil production, on the other hand, is largely centered in the Alberta oil sands, which present both opportunities and challenges (Scholvin, 2021; Suresh et al., 2022). The oil sands have high extraction costs and require complex, environmentally intensive processes (Scholvin, 2021; Suresh et al., 2022). Additionally, Canadian producers face logistical constraints due to limited pipeline infrastructure, which restricts access to global markets and often results in Canadian crude selling at a discount compared to global benchmarks (Scholvin, 2021; Suresh et al., 2022). These infrastructure limitations make Canadian

oil producers particularly vulnerable to global price declines, as lower prices can erode already narrow profit margins, forcing firms to scale back operations (Scholvin, 2021; Suresh et al., 2022).

In contrast, oil production in the Middle East is predominantly state-owned, with governments exercising control over oil fields and production capacities (Krane, n.d.). This ownership model allows Middle Eastern countries to maintain stable output levels through direct government intervention, often prioritizing national strategic interests over market responsiveness (Krane, n.d.). For instance, countries like Saudi Arabia and the UAE can absorb price downturns more readily than North American producers due to government subsidies and fiscal support, which stabilize production even during market fluctuations (Krane, n.d.). This state-owned structure provides a counterpoint to the private, market-driven model in North America, highlighting regional differences in the oil market's responsiveness to price changes (Siddiqui, Mahmood, & Margaritis, 2020; Kumar, Singh, & Kumar, 2022).

The composition of hydrocarbon production varies significantly across different basins in North America, influencing how operators respond to crude oil price volatility and affecting their stock valuations. The Permian Basin, spanning West Texas and southeastern New Mexico, is the most prolific oil-producing region in North America, with a high crude oil-to-natural gas ratio. Operators in this basin are highly sensitive to fluctuations in crude oil prices, as their revenue is primarily tied to oil markets rather than natural gas fundamentals (Craig & Quagliaroli, 2020). In contrast, the Appalachian Basin, which includes the Marcellus and Utica shale formations, is heavily weighted toward natural gas production. Companies operating in this region are more exposed to Henry Hub natural gas prices, meaning their valuation may not always track movements in crude oil markets as closely as oil-heavy producers (Scholvin, 2021).

Some basins produce a more balanced mix of oil and natural gas, leading to a diversified revenue stream. The Eagle Ford Shale in South Texas contains both crude oil and natural gas, allowing operators to benefit from price fluctuations in multiple commodity markets. Similarly, the DJ Basin in Colorado and the Bakken Shale in North Dakota are primarily oil-driven but also

generate associated natural gas, creating a hedge against oil price volatility through exposure to gas markets (Suresh et al., 2022). Operators with a more even commodity mix may experience less extreme stock price swings in response to crude oil price movements, as their revenue sources are not entirely dependent on the oil market (Misund, 2016).

This variation in commodity exposure across basins plays a critical role in determining how independent exploration and production firms react to crude oil price volatility. While some companies face direct financial impacts from oil price crashes, others may have more stable earnings due to their reliance on natural gas, which is often influenced by separate market dynamics such as domestic heating demand and liquefied natural gas exports (Baghestani et al., 2016). These differences highlight why crude oil price fluctuations do not uniformly affect all upstream oil and gas operators. Investors and analysts must consider not only a company's production strategy but also its geographic and commodity exposure when assessing how its stock price will respond to shifts in crude oil markets. By incorporating basin-specific production profiles into the analysis, this study provides a more comprehensive understanding of the financial and market dynamics affecting independent E&P firms in North America (Zou et al., 2020).

In summary, the North American oil market stands out for its private ownership model, technological adaptability, basin exposure, and responsiveness to overall market conditions. While this structure enables flexibility, it also introduces heightened sensitivity to price volatility compared to state-owned producers, underscoring the unique regional dynamics that define the North American oil industry.

**Methodological Approaches in Oil Price and Stock Performance Studies**

Research on the relationship between oil price fluctuations and stock performance has employed a variety of quantitative methods to analyze both short-term and long-term effects. Among the most commonly used approaches are descriptive analysis, vector autoregression (VAR), and event study methodology, each offering distinct insights into how crude oil prices interact with financial markets.

Descriptive analysis serves as the foundation for understanding the behavior of crude oil prices and stock performance over time. By summarizing key statistical measures such as mean, median, standard deviation, and historical trends, researchers can identify volatility patterns and anomalies that may require further econometric investigation (Degiannakis, Filis, & Arora, 2018). Time series visualizations and correlation assessments are frequently used at this stage to detect relationships between oil price fluctuations and stock returns before applying more advanced econometric models.

A more structured econometric technique widely applied in this field is vector autoregression, which is used to assess the interdependencies between multiple economic variables, including crude oil prices, stock indices, and macroeconomic indicators such as exchange rates or interest rates. The advantage of VAR models lies in their ability to capture how shocks to one variable propagate over time across the system. Research has shown that oil price movements influence stock performance differently depending on whether a country is a net oil exporter or importer. For oil-exporting economies, stock indices tend to be more directly affected by crude oil price changes, while in oil-importing countries, the effects are often mediated through inflation and broader macroeconomic conditions (Kumar, Singh, & Kumar, 2022; Siddiqui, Mahmood, & Margaritis, 2020). Additionally, VAR modeling is useful for identifying lagged effects, helping to determine whether stock market reactions to oil price shocks occur immediately or unfold over extended periods.

Event study methodology is another widely used approach in examining the short-term impact of specific market events, such as OPEC announcements, geopolitical crises, or unexpected supply disruptions, on stock prices. This technique isolates key events to measure abnormal stock returns, allowing researchers to determine whether oil price movements lead to statistically significant deviations in stock performance beyond normal market fluctuations (Baghestani, Genc, & Kherfi, 2016; Zou et al., 2020). Event studies have demonstrated that sudden oil price shocks, particularly those driven by geopolitical tensions, often lead to increased stock volatility in oil-

dependent sectors, while the broader market response varies depending on the nature and scale of the disruption (Baghestani, Genc, & Kherfi, 2016; Zou et al., 2020).

By integrating descriptive statistics, VAR modeling, and event study methodology, prior studies have provided valuable insights into how crude oil price fluctuations affect financial markets. These methodologies have been instrumental in understanding the extent to which oil price volatility influences stock valuations, investor sentiment, and market stability, forming a strong foundation for further research in this domain.

**Synthesis and Gaps in Existing Research**

Research on the effects of oil price fluctuations on stock performance provides valuable insights into how financial markets respond to commodity price movements, but also reveals significant areas for further exploration. Studies have shown that the relationship between oil prices and stock market performance varies across regions, largely depending on whether a country is a net oil exporter or importer. In oil-exporting countries, stock indices often exhibit a direct correlation with oil prices, as higher prices increase corporate revenues, strengthen government budgets, and enhance investor confidence in oil-dependent sectors (Degiannakis, Filis, & Arora, 2018). Conversely, in oil-importing economies, rising oil prices tend to have negative effects on stock markets, as higher energy costs reduce corporate profit margins, constrain consumer spending, and contribute to inflationary pressures that can slow economic growth (Degiannakis, Filis, & Arora, 2018; Kumar et al., 2020). While these contrasting dynamics are well documented, much of the existing literature focuses on one group of countries at a time, leaving a gap in research that systematically compares these effects across different economic contexts (Scholvin, 2021; Siddiqui et al., 2020).

Methodological approaches in prior studies have primarily relied on statistical models to assess the link between oil prices and stock performance. Descriptive statistical analysis has been widely used to identify patterns in price volatility and stock returns, providing an initial framework for more complex econometric modeling (Suresh et al., 2022; Zou et al., 2020). Vector

autoregression (VAR) modeling has been a key tool in examining how oil price shocks propagate through financial markets, capturing both direct effects and lagged responses over time. VAR models have revealed that oil price changes do not always have immediate stock market implications, with some effects emerging gradually as firms adjust operations and investors reprice risk (Kumar, Singh, & Kumar, 2022; Siddiqui, Mahmood, & Margaritis, 2020). These lagged effects highlight the importance of considering not only the immediate stock price reaction to oil price shifts but also the structural adjustments that firms make in response to prolonged volatility.

Event study methodology has also played a critical role in assessing the short-term effects of specific oil price-related events, such as OPEC production announcements, geopolitical conflicts, and extreme price shocks. By measuring abnormal stock returns around these events, researchers have been able to isolate the effects of oil price movements from broader market trends (Baghestani, Genc, & Kherfi, 2016; Zou et al., 2020). Findings suggest that while oil price shocks can lead to temporary spikes in volatility, the magnitude of their impact varies by industry and region. Companies in the energy sector typically experience the strongest reaction to oil-related events, but firms in other oil-intensive industries, such as transportation and manufacturing, may also be significantly affected depending on the duration and severity of the shock (Baghestani, Genc, & Kherfi, 2016; Misund, 2016).

One limitation of the current literature is that most studies focus on broad market indices or the energy sector as a whole, with limited attention given to how oil price movements affect individual companies within different basins and commodity mixes. In North America, the financial exposure of exploration and production (E&P) firms varies significantly depending on whether they operate in an oil-weighted or gas-weighted basin. For example, firms in the Permian Basin, where production is primarily oil-driven, are more directly affected by crude oil price fluctuations, while operators in the Marcellus and Utica formations, which are gas-heavy, are more influenced by natural gas market dynamics (Craig & Quagliaroli, 2020). Additionally, companies with a diversified commodity mix, such as those operating in the Eagle Ford or DJ Basin, may

experience a more balanced response to market fluctuations, reducing their exposure to extreme price swings in either crude oil or natural gas (Suresh et al., 2022). Understanding these basin-specific differences is crucial for accurately assessing how oil price volatility translates into financial market reactions.

Another emerging gap in the literature is the evolving role of renewable energy in shaping the oil-stock relationship. Many studies have focused on traditional oil market dynamics without fully incorporating the long-term effects of the global energy transition. As investments in renewable energy expand, the historical correlation between oil prices and stock performance may weaken, particularly in regions where clean energy adoption reduces the demand for fossil fuels (Craig & Quagliaroli, 2020; Scholvin, 2021). The extent to which this shift alters financial market sensitivity to oil price shocks remains an open question, with potential implications for investment strategies, risk management, and economic policy.

Future research could address these gaps by applying more granular analyses that consider differences in commodity exposure across basins and by integrating insights from the ongoing energy transition. Expanding event study methodologies to compare the effects of oil price shocks on firms with varying commodity mixes could provide a more nuanced understanding of stock market reactions. Additionally, extending VAR models to account for the interplay between oil prices, natural gas markets, and renewable energy adoption could offer deeper insights into how different energy sectors interact under volatile market conditions. By incorporating these factors, future studies can build on the existing body of work to provide a more comprehensive understanding of how oil price fluctuations impact financial markets at both a sectoral and regional level.

# METHODOLOGY

This chapter outlines the methodology used to analyze how fluctuations in crude oil prices influence the stock performance of independent exploration and production (E&P) companies in North America. As a critical segment of the upstream oil and gas sector, these companies are particularly vulnerable to crude oil price volatility due to their reliance on revenue generated exclusively from extraction activities, with no downstream operations to hedge against market fluctuations. This dependence on crude oil prices affects their financial stability and investor sentiment, making them an important focus for understanding the broader relationship between commodity markets and stock performance. Given the complexity of these interactions, a systematic approach is required to capture both short-term market reactions and longer-term financial implications.

To address these dynamics, this study employs a quantitative research design, leveraging secondary data from credible and publicly available sources, including historical crude oil price indices, financial market data, and macroeconomic indicators. The analysis integrates descriptive statistics, econometric modeling, and event study methodology to assess both broad market trends and firm-specific stock performance. Descriptive analysis provides an initial understanding of the dataset, identifying patterns in crude oil prices and stock returns. Vector autoregression (VAR) modeling is used to examine how oil price shocks propagate through financial markets over time, capturing both direct impacts and lagged effects on E&P stock valuations. Additionally, event study methodology is employed to assess the short-term stock market response to specific oil price-related events, such as OPEC announcements or geopolitical crises, isolating abnormal stock returns from broader market movements.

The chapter begins by outlining the purpose of the study and the research questions, establishing a structured approach for the analysis. It then discusses the relevant literature and theoretical frameworks that inform the research design, including the efficient market hypothesis

and concepts related to risk exposure in commodity-driven industries. The data collection process is described in detail, specifying the sources, time periods, and variables used to measure crude oil price fluctuations, stock performance, and key macroeconomic indicators. The methodology section concludes with a discussion of the analytical techniques applied in the study, ensuring clarity in how relationships between oil prices and stock market reactions are evaluated.

The primary objective of this chapter is to ensure methodological rigor and transparency, providing a clear and replicable process for analyzing how crude oil price movements influence independent E&P firms. By structuring the methodology in a systematic manner, the study aims to produce reliable findings that contribute to both academic literature and practical decision-making for investors, industry participants, and policymakers. The focus on independent E&P companies reflects a significant gap in existing research, as most prior studies have concentrated on integrated oil firms or broad market indices without isolating the financial dynamics specific to non-diversified upstream operators. This research seeks to bridge that gap by providing insights into how market conditions, firm characteristics, and regional commodity exposure shape stock price reactions to crude oil price volatility.

In addition to its academic contributions, this study has practical applications for stakeholders in energy finance. Investors can use the findings to better understand the risk-return profile of E&P stocks under varying oil price conditions. Policymakers can gain insights into the vulnerabilities of independent operators in times of market stress, informing regulatory decisions related to capital markets and resource development. Corporate decision-makers can apply the results to enhance risk management strategies, such as hedging practices or capital allocation adjustments, in response to oil price fluctuations. The research is guided by the following questions, which frame the data collection and analysis process:

1. How do crude oil price fluctuations correlate with the stock performance of independent E&P companies?

This question aims to determine whether changes in crude oil prices have a direct impact on the stock valuations of E&P firms. It focuses on identifying trends and patterns during periods of both price increases and decreases.

2. To what extent does crude oil price volatility affect the financial stability and investor sentiment of these firms?

   This question quantitatively examines how periods of heightened oil price volatility influence firm-level revenue stability, profitability metrics, and investor behavior as proxied through stock return volatility and trading volumes.

3. Are there significant time-lagged effects in the response of stock prices to crude oil price changes?

   Stock price adjustments to crude oil price changes may not always be instantaneous. This question investigates whether there are any delays in how stock markets respond to fluctuations in crude oil prices and explores the potential reasons for these lagged effects.

4. How do external macroeconomic factors, such as interest rates and exchange rates, moderate the relationship between crude oil prices and E&P stock performance?

   This question seeks to identify the role of broader macroeconomic conditions in shaping the relationship between crude oil prices and the stock performance of independent E&P firms. These factors, such as a strong U.S. dollar or fluctuating interest rates, can significantly influence market behavior.

These research questions are designed to address the core objectives of the study while aligning with the theoretical frameworks and methodologies discussed in the subsequent sections. Together, they ensure a structured approach to understanding the interplay between crude oil prices and the financial dynamics of independent E&P firms.

The existing literature highlights the critical role of crude oil prices in influencing the financial performance of energy companies. Studies like Misund (2016) emphasize that oil price increases positively affect stock valuations, while price declines result in financial strain. However,

much of this research focuses on integrated oil companies, leaving a gap in understanding how independent exploration and production (E&P) firms respond to price fluctuations.

Crude oil price volatility, driven by geopolitical events, supply-demand imbalances, and financial speculation, amplifies risks for independent E&P firms, which lack downstream diversification (Degiannakis et al., 2018). Additionally, research by Kumar et al. (2020) highlights that stock prices often exhibit time-lagged responses to price changes, influenced by market and operational delays. External macroeconomic factors, such as exchange rates and interest rates, also moderate these relationships, as discussed by Craig and Quagliaroli (2020).

Despite these insights, limited research has focused specifically on independent E&P firms in North America, which operate in a unique market environment characterized by private mineral ownership and the rapid scalability of shale production. This study addresses these gaps, offering a focused analysis of the relationship between crude oil prices and the stock performance of these firms.

This study adopts a quantitative research framework to investigate the relationship between crude oil price fluctuations and the stock performance of independent exploration and production (E&P) companies in North America. A quantitative approach is particularly appropriate given the reliance on numerical data, including historical crude oil prices, stock market metrics, and macroeconomic indicators. This method ensures objectivity and provides a robust basis for identifying patterns, testing hypotheses, and drawing statistically significant conclusions. By employing econometric modeling, the study captures the dynamic and often complex interactions between crude oil prices and financial market performance.

**Hypotheses**

To guide the analysis, the following hypotheses were formulated:

- **H1**: Increases in crude oil prices are positively associated with the stock performance of independent E&P companies in North America.
- **H2**: Declines in crude oil prices have a negative effect on the stock performance of

independent E&P companies in North America.

- **H3**: There are significant lagged effects in the response of stock prices to crude oil price changes.
- **H4**: Macroeconomic factors, such as interest rates and exchange rates, moderate the relationship between crude oil prices and E&P stock performance.

These hypotheses are grounded in existing literature and theoretical frameworks, such as the efficient market hypothesis and risk management theory, which provide a foundation for understanding the relationship between commodity prices and stock valuations.

**Rationale for the Approach**

The chosen research approach is driven by the availability of high-quality secondary data, including historical crude oil prices and stock performance metrics for independent E&P companies. Quantitative methods, particularly econometric modeling, are well-suited to analyzing these data because they allow for the identification of causal relationships, the examination of lagged effects, and the incorporation of external moderating variables. Given the sensitivity of independent E&P firms to crude oil price volatility, this method is essential for uncovering actionable insights.

By focusing on quantitative analysis, this study ensures a systematic and replicable approach to answering the research questions, offering a deeper understanding of the unique dynamics at play in the upstream oil and gas sector.

**Sources of Data**

The data for this study were obtained from reputable and publicly available sources to ensure accuracy and reliability. The following datasets were used:

1. Crude Oil Price Data
    - Historical daily and monthly price data from 2013 – 2023 for West Texas Intermediate (WTI) crude oil, sourced from the U.S. Energy Information Administration (EIA) and Bloomberg.

- Price volatility metrics were calculated using standard deviations and moving averages to capture market fluctuations over time.

2. Stock Performance Data
    - Historical stock price data were collected for a representative sample of independent exploration and production (E&P) companies operating in onshore North America, including Diamondback Energy (FANG), Matador Resources (MTDR), Civitas Resources (CIVI), Coterra Energy (CTRA), SM Energy (SM), and Baytex Energy (BTE). These companies were selected due to their diverse geographic and commodity exposure across major oil and gas basins in North America.
        1. **Diamondback Energy (FANG)** – 80% Oil, 20% Gas
            1. Operations: Focuses on horizontal development of unconventional shale formations, particularly Wolfcamp, Spraberry, and Bone Spring intervals in the Permian Basin (Midland and Delaware sub-basins).
            2. Production Strategy: Primarily a crude oil producer with high-margin assets and a strong focus on enhanced completions (e.g., high-intensity fracs) to improve recovery rates in tight reservoirs.
            3. Oil Weighting: Highly oil-weighted, making it highly sensitive to crude oil price fluctuations.
        2. **Matador Resources (MTDR)** – 60% Oil, 40% Gas
            1. Operations: Operates in both the Delaware Basin (Permian) and Haynesville Shale, with a mix of oil-rich and dry gas acreage.
            2. Production Strategy: High-intensity horizontal drilling with a growing focus on natural gas, particularly in Haynesville, where it benefits from rising LNG export demand.
            3. Oil Weighting: Moderate oil exposure, with increasing diversification into natural gas.

3. **Civitas Resources (CIVI)** – 70% Oil, 30% Gas
    1. Operations: Largest pure-play operator in the DJ Basin (Niobrara & Codell formations, Colorado), focusing on unconventional, low-decline, tight oil reservoirs.
    2. Production Strategy: Develops high-margin oil assets but operates under strict regulatory frameworks in Colorado, requiring efficiency in well spacing and water management.
    3. Oil Weighting: Predominantly oil-weighted, but subject to regulatory risks affecting drilling permits.
4. **Coterra Energy (CTRA) – 30% Oil, 70% Gas**
    1. Operations: A diversified E&P company with gas-heavy production from the Marcellus Shale in the Appalachian Basin and additional assets in the Permian and Anadarko Basins.
    2. Production Strategy: Focuses on low-cost dry gas production in Marcellus with long-lateral wells and some oil exposure in the Permian.
    3. Oil Weighting: Gas-dominant, making it more correlated with Henry Hub natural gas prices rather than WTI crude.
5. **SM Energy (SM) – 55% Oil, 45% Gas**
    1. Operations: Primarily active in the Eagle Ford Shale and Midland Basin (Permian), targeting liquids-rich unconventional plays.
    2. Production Strategy: Uses multi-zone completions and pad drilling to optimize oil recovery while maintaining a balanced commodity mix.
    3. Oil Weighting: Balanced oil and gas exposure, with more resilience against crude price shocks than oil-heavy peers.
6. **Baytex Energy (BTE) – 85% Oil, 15% Gas**

1. Operations: Focused on heavy oil production in the Western Canada Sedimentary Basin, including the Clearwater, Viking, and Lloydminster formations.
2. Production Strategy: Employs thermal recovery techniques (SAGD, CSS) and waterflooding to extract heavy oil from shallow reservoirs.
3. Oil Weighting: Highly oil-weighted, but exposed to Western Canadian Select (WCS) price differentials, which can lead to pricing volatility separate from WTI movements.

- Stock market data were collected from financial platforms, including Yahoo Finance and Bloomberg, and adjusted for splits and dividends to ensure consistency.

3. Macroeconomic Indicators
   - Relevant macroeconomic data, including interest rates, exchange rates, and GDP growth figures, were sourced from the Federal Reserve, World Bank, and other publicly available economic databases.

**Timeframe**

The study focuses on a 10-year period, spanning 2013 to 2023. This timeframe was selected to capture a range of market conditions, including the 2014–2016 oil price collapse, the 2020 COVID-19 pandemic, and subsequent recovery periods. This ensures that the analysis reflects a comprehensive view of the volatility and trends within the crude oil and financial markets.

**Data Collection Process**

The data collection process was structured to ensure consistency, reliability, and comparability in analyzing the relationship between crude oil price fluctuations and the stock performance of independent exploration and production (E&P) companies in North America. The process involved multiple stages, including data compilation, cleaning, variable selection, and standardization for econometric analysis.

**1. Compilation**

- Relevant datasets were extracted from publicly available and authoritative sources, including financial platforms, government agencies, and economic databases.
- Data were compiled into time series formats to facilitate consistency in statistical analysis and econometric modeling.

**2. Cleaning**

- All datasets were reviewed and cleaned to remove missing values, outliers, and inconsistencies, ensuring the accuracy and reliability of results.
- Cross-referencing with multiple sources (e.g., EIA, Bloomberg, Yahoo Finance) was conducted to validate the completeness of stock price and macroeconomic data.

**3. Cleaning**

- Key financial and economic variables were identified and standardized across firms and time periods to ensure comparability.
- The selected variables include:
    - Crude oil prices: Daily and monthly WTI crude prices, oil price volatility metrics (standard deviations, moving averages).
    - Stock performance metrics: Daily returns, cumulative returns, stock price volatility.
    - Macroeconomic indicators: Interest rates, exchange rates, and GDP growth.

**4. Standardization and Organization**

- Time series datasets were structured uniformly, allowing for robust statistical comparisons across firms.
- Adjustments were made for stock splits and dividends to ensure stock performance data accurately reflected market valuation changes over time.

By applying these systematic data collection procedures, the study ensures a consistent and

replicable framework for evaluating the impact of crude oil price fluctuations on the stock performance of independent E&P firms. The following sections detail the specific data sources and analytical tools used in the study.

**Techniques Used**

1. Descriptive Analysis
    a. Calculated key statistical metrics (mean, median, standard deviation, trends) for crude oil prices, stock performance, and macroeconomic indicators.
    b. Created time series graphs to visualize trends and identify patterns/anomalies.
2. Econometric Modeling
    a. Vector Autoregression (VAR): Used to analyze interdependencies between crude oil prices, stock returns, and macroeconomic variables, capturing lagged effects.
3. Event Study Methodology
    a. Examined the impact of significant market events (OPEC announcements, geopolitical crises, oil price shocks) on E&P stock performance
    b. Measured abnormal stock returns to isolate event-specific effects from general market trends.

**Addressing Research Questions**

Each analysis technique was mapped to the study's research questions:

- The correlation between crude oil price fluctuations and E&P stock performance (Research Question 1) was examined using VAR modeling and descriptive statistics.
- Time-lagged effects (Research Question 2) were identified using VAR modeling and time series analysis to capture delayed responses in stock performance.
- The impact of significant market events (Research Question 3), such as OPEC announcements and geopolitical crises, was assessed using event study methodology, measuring abnormal stock returns.
- The moderating role of macroeconomic factors (Research Question 4) was explored using

regression analysis, incorporating exchange rate and interest rate variations to determine their influence on stock performance.

### Software and Tools

The data analysis was conducted using industry-standard software:

- Microsoft Excel: For initial data organization and descriptive statistics.
- Python: For econometric modeling, including VAR analysis.

### Ethical Considerations

Since this study relied exclusively on secondary data, all analyses adhered to ethical standards by ensuring transparency and proper attribution of data sources. The researcher maintained thorough documentation of all analytical procedures, enhancing replicability and validation for future researchers. No human subjects were involved, eliminating concerns related to informed consent or privacy.

## DATA ANALYSIS AND RESULTS

This section presents the empirical findings of the study, beginning with a descriptive analysis of crude oil prices, stock performance of independent exploration and production (E&P) companies, and key macroeconomic indicators. The purpose of this preliminary analysis is to provide a foundational understanding of the dataset and highlight observable trends that may inform the econometric analysis.

Following the descriptive statistics, econometric models, including vector autoregression (VAR) and event study methodology, were employed to analyze the relationships between crude oil price fluctuations and E&P stock performance. The event study approach was used to measure abnormal stock returns in response to significant market events, such as OPEC announcements and geopolitical crises. Additionally, regression analysis was conducted to explore the moderating effects of macroeconomic factors, including exchange rate and interest rate variations.

By integrating both descriptive and econometric analyses, this section establishes the robustness of findings and evaluates the financial dynamics of independent E&P firms in response

to market volatility.

**Descriptive Statistics**

To establish an empirical foundation for the econometric analysis, this section summarizes the key characteristics of the dataset, including crude oil price trends, stock market behavior of independent E&P firms, and macroeconomic influences. Descriptive statistics such as **mean,** median, standard deviation, minimum, and maximum values provide insight into the variability and central tendencies of these variables over the 2013–2023 study period.

**Crude Oil Price Trends and Volatility**

Crude oil is one of the most volatile commodities in global markets, subject to rapid price swings driven by supply and demand imbalances, geopolitical events, macroeconomic policies, and speculative trading. The dataset captures daily price movements of West Texas Intermediate (WTI) crude oil, the key benchmark for North American oil markets.

Over the 2013–2023 period, WTI crude oil prices exhibited considerable fluctuations, with significant price shocks occurring during major market events:

- **April 2020 Price Collapse:** WTI crude prices plunged to negative territory (-$37.63 per barrel) due to a demand shock caused by the COVID-19 pandemic and storage constraints.
- **2022 Price Surge:** Prices peaked above $120 per barrel following Russia's invasion of Ukraine and global supply disruptions.
- **2014–2016 Downturn:** A prolonged price decline, driven by OPEC's decision to maintain production levels amid a U.S. shale boom, resulted in significant market oversupply.

The summary statistics for crude oil prices are presented below:

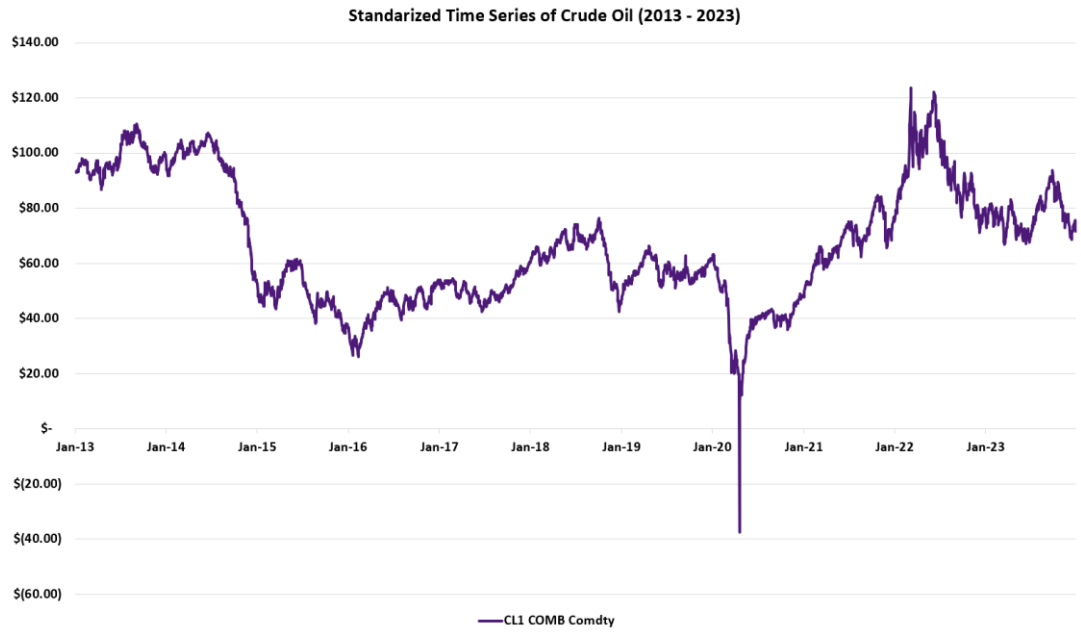
| CL1 COMB Comdty | | |
|---|---|---|
| Statistic | | Price ($) |
| Mean | $ | 66.83 |
| Median | $ | 62.87 |
| Standard Deviation | $ | 21.88 |
| Minimum | $ | (37.63) |
| Maximum | $ | 123.70 |



The standard deviation of $21.88 suggests substantial volatility, reinforcing crude oil's

reputation as one of the most unpredictable financial assets. The minimum price of ($37.63) per barrel corresponds to the historic 2020 crash, while the maximum price of $123.70 per barrel reflects the market rally in response to geopolitical tensions and supply constraints.

A time-series visualization of crude oil prices over the study period further highlights the cyclical nature of the market. These price fluctuations are of critical importance to independent E&P firms, as they directly influence revenue streams, capital investment decisions, and investor sentiment.




**Stock Performance of Independent E&P Companies**

The financial performance of independent E&P companies is closely tied to crude oil price movements due to their lack of downstream integration and dependence on upstream activities. Unlike major integrated oil companies, which can offset losses in one segment with gains in another, independent E&Ps are highly vulnerable to crude price swings. The descriptive statistics for the daily stock returns from 2013 – 2023 of the representative sample of independent E&P firms are summarized below:

| FANG US Equity | |
|---|---|
| Statistic | Stock Return (%) |
| Mean | 0.122% |
| Median | 0.16% |
| Standard Deviation | 3.14% |
| Minimum | -44.65% |
| Maximum | 30.96% |

| MTDR US Equity | |
|---|---|
| Statistic | Stock Return (%) |
| Mean | 0.163% |
| Median | 0.13% |
| Standard Deviation | 4.17% |
| Minimum | -64.12% |
| Maximum | 35.90% |

| CIVI US Equity | |
|---|---|
| Statistic | Stock Return (%) |
| Mean | 0.099% |
| Median | 0.07% |
| Standard Deviation | 3.61% |
| Minimum | -32.99% |
| Maximum | 22.95% |

| CTRA US Equity | |
|---|---|
| Statistic | Stock Return (%) |
| Mean | 0.028% |
| Median | -0.03% |
| Standard Deviation | 2.33% |
| Minimum | -12.07% |
| Maximum | 15.63% |

| SM US Equity | |
|---|---|
| Statistic | Stock Return (%) |
| Mean | 0.120% |
| Median | -0.03% |
| Standard Deviation | 5.15% |
| Minimum | -61.26% |
| Maximum | 74.60% |

| BTE CN Equity | |
|---|---|
| Statistic | Stock Return (%) |
| Mean | 0.001% |
| Median | -0.11% |
| Standard Deviation | 4.32% |
| Minimum | -41.94% |
| Maximum | 31.90% |

Key observations from the stock return data include:

1. **High Volatility Across E&P Stocks**
    a) The standard deviation of stock returns is notably high across all companies, reflecting the inherent volatility in the upstream oil and gas sector.
    b) SM Energy (SM) and Matador Resources (MTDR) have the highest standard deviations (5.15% and 4.17%, respectively), indicating that their stock prices fluctuate more significantly compared to peers.
    c) Baytex Energy (BTE) and Civitas Resources (CIVI) also exhibit substantial volatility (4.32% and 3.61%).
    d) Coterra Energy (CTRA) has the lowest standard deviation (2.33%), suggesting that it is relatively less volatile, likely due to its diversified asset base, which includes a higher proportion of natural gas production.

These findings highlight the price sensitivity of independent E&P firms to oil market movements and macroeconomic factors, with stocks experiencing large swings in response to commodity price fluctuations, geopolitical events, and investor sentiment.

2. **Extreme Stock Return Movement During Market Shocks**
    a) The largest single-day losses coincide with major oil price downturns, such as the 2014–2016 oil price collapse and the COVID-19 crisis in March–April 2020.

1. MTDR (-64.12%) and SM (-61.26%) saw the steepest declines, demonstrating their high exposure to crude oil price crashes.
2. BTE (-41.94%) and CIVI (-32.99%) also experienced significant losses, reflecting broader market distress.
3. CTRA (-12.07%) had the smallest drop, consistent with its gas-weighted portfolio, which buffers against oil price volatility.

b) The largest single-day gains align with oil price recoveries, such as in 2016 (post-OPEC cuts) and late 2020 (post-COVID rebound).

1. SM (74.60%) and FANG (30.96%) recorded the most substantial gains, showing their high sensitivity to crude oil price increases.
2. CTRA (15.63%) again had the most stable performance, reinforcing its lower exposure to crude price shocks.

3. **Oil vs. Gas Exposure and Risk Profiles**

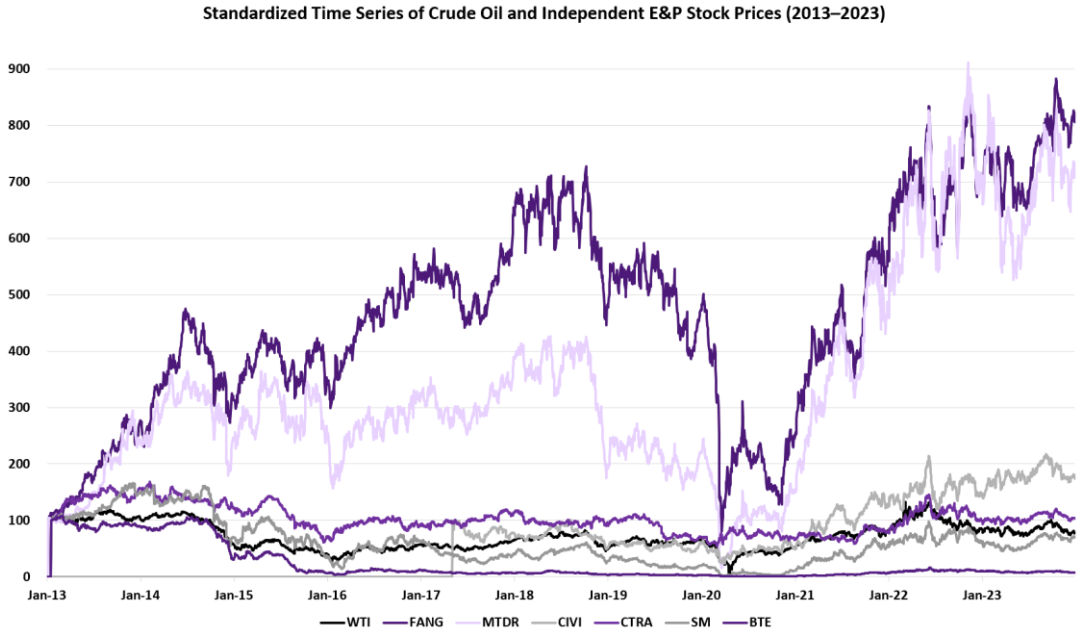
a) Oil-weighted firms (FANG, MTDR, SM, BTE, CIVI) show greater stock return variability, as their revenue depends heavily on crude oil price movements.

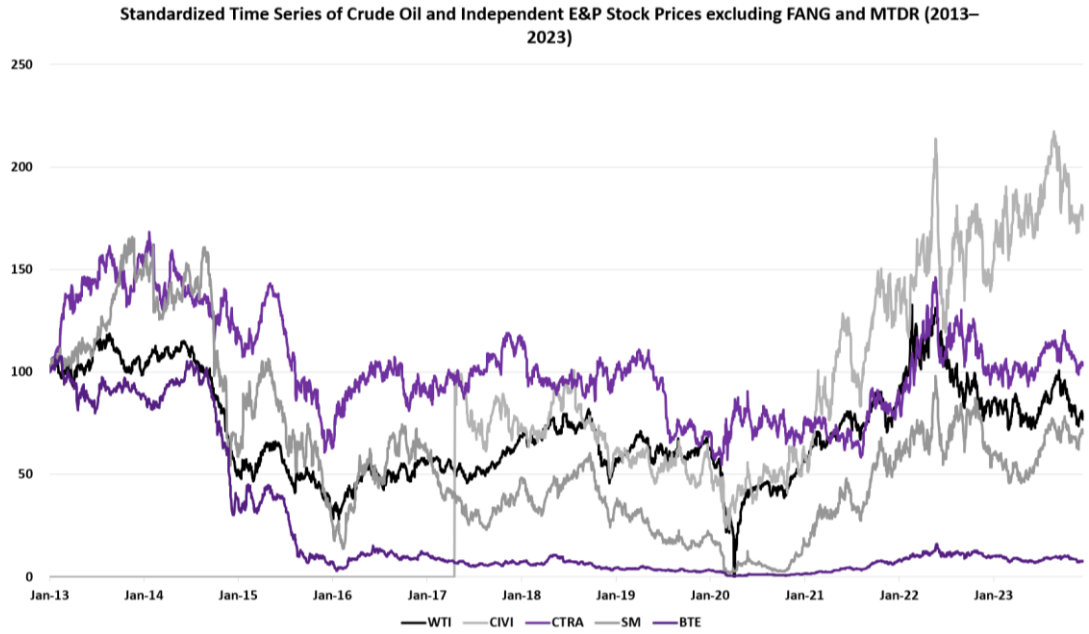
b) Gas-weighted firms (CTRA) exhibit more stability, as natural gas markets follow different supply-demand fundamentals, reducing exposure to crude oil price shocks.

c) Investors should consider commodity mix diversification when evaluating risk exposure and return potential in E&P stocks.

A visual comparison of standardized stock price movements and crude oil prices illustrates the close relationship between commodity markets and E&P stock valuations. This strong correlation will be further analyzed in the econometric modeling section. The descriptive statistics for the daily standardized stock returns from 2013 – 2023 benchmarked against standardized WTI are seen below:

| Standarized Stock Price Data 2013-2023 | | | | | | | |
|---|---|---|---|---|---|---|---|
| Date | WTI | FANG | MTDR | CIVI | CTRA | SM | BTE |
| 12/29/23 | 77 | 806 | 706 | 174 | 103 | 70 | 8 |
| 12/28/23 | 77 | 807 | 714 | 177 | 104 | 70 | 8 |
| 12/27/23 | 80 | 822 | 733 | 181 | 104 | 72 | 8 |
| 12/26/23 | 81 | 826 | 736 | 181 | 105 | 72 | 8 |
| 12/22/23 | 79 | 813 | 716 | 178 | 104 | 70 | 8 |
| 12/21/23 | 79 | 812 | 716 | 178 | 104 | 69 | 8 |
| 12/20/23 | 80 | 810 | 707 | 177 | 102 | 68 | 8 |
| 12/19/23 | 79 | 817 | 722 | 178 | 104 | 70 | 8 |
| 12/18/23 | 78 | 809 | 716 | 177 | 103 | 69 | 8 |
| 12/15/23 | 77 | 796 | 698 | 176 | 102 | 68 | 8 |
| 12/14/23 | 77 | 798 | 699 | 177 | 103 | 68 | 7 |






**Macroeconomic Influences on E&P Stock Performance**

Beyond crude oil prices, broader macroeconomic factors shape the financial landscape for E&P firms. Three key variable interest rates, exchange rates, and GDP growth—have been identified as potential moderators of stock performance. Attached below are the descriptive statistics for commonly respected macroeconomic influences in the broader E&P space.

| Federal Funds Rate | |
|---|---|
| Stastic | Rate (%) |
| Median | 1.54% |
| Standard Deviation | 1.84% |
| Minimum | 0.04% |
| Maximum | 5.33% |

| US/CAD Spot Rate | |
|---|---|
| Stastic | Rate ($) |
| Median | $ 1.27 |
| Standard Deviation | $ 0.10 |
| Minimum | $ 0.98 |
| Maximum | $ 1.46 |

| GDP Growth | |
|---|---|
| Stastic | Rate ($Bn) |
| Median | $ 21,779 |
| Standard Deviation | $ 3,901 |
| Minimum | $ 16,648 |
| Maximum | $ 29,720 |

- Federal Funds Rate: Higher borrowing costs have historically reduced capital expenditure for E&P firms, particularly those engaged in leveraged drilling programs.
- US/CAD Spot Rate: The USD/CAD exchange rate directly impacts North American energy trade, influencing revenues for companies operating in both the U.S. and Canada.
- GDP Growth : Energy demand is closely linked to economic expansion, with downturns leading to decreased consumption and lower oil prices.

These macroeconomic variables will be incorporated into regression models to assess their role in moderating the crude oil-stock price relationship.

**Preliminary Insights on Hypothesis Testing**

The descriptive analysis provides **initial support** for the study's hypotheses:

- **H1 & H2:** Crude oil price increases are associated with positive stock returns, while declines correspond to losses.
- **H3:** The potential for lagged stock price responses will be explored using Vector Autoregression (VAR).
- **H4:** Macroeconomic variables exhibit variability that suggests they may moderate the crude oil-stock price relationship.

These preliminary findings establish a foundation for the econometric analysis, which will formally test the statistical significance of these relationships.

**Econometric Analysis**

This section presents the empirical findings from the econometric models used to analyze the relationship between crude oil price fluctuations and the stock performance of independent exploration and production (E&P) companies. The primary econometric techniques employed in this study include Vector Autoregression (VAR) and Event Study Analysis, both of which provide insights into the dynamic interactions between crude oil prices and stock market reactions.

**Vector Autoregression (VAR) Analysis**

The VAR model was chosen due to its ability to estimate interdependencies between multiple time-series variables. By incorporating lagged values of crude oil prices and stock returns, the model helps identify the timing and magnitude of stock price reactions to oil price fluctuations. The estimated VAR model is based on the following equation:

$$R_t = \alpha + \sum_{i=1}^{p} \beta_i R_{t-i} + \sum_{j=1}^{p} \gamma_j P_{t-j} + \epsilon_t$$

- Rt = daily stock return of an independent E&P company
- Pt = daily return of WTI Crude prices

- P = optimal lag length determined using the AIC
- Bi and Yj represent the estimated coefficients capturing the impact of lagged stock and oil price changes
- Et = error term

**Key Findings from the VAR Model**

The VAR model results reveal several important insights regarding the relationship between crude oil prices and independent E&P stock returns.

**Crude Oil Price Increases Positively Impact E&P Stock Returns (H1 Supported)**

The lagged coefficient for WTI crude oil price changes indicated a positive relationship with stock returns for certain firms, including Coterra Energy and Matador Resources. This suggests that increases in crude oil prices contribute to higher stock returns for these companies, aligning with H1. These findings reinforce the notion that some independent E&P firms exhibit a delayed but positive response to rising oil prices, highlighting their sensitivity to market fluctuations and potential for enhanced investor returns during periods of price appreciation.

**Crude Oil Price Declines Have Asymmetric Effects on Stock Returns (H2 Partially Supported)**

The VAR analysis reveals that some firms, including SM Energy and Baytex Energy, exhibit negative coefficients for oil price changes, indicating that their stock returns tend to decline following an increase in crude oil prices. This suggests that certain independent E&P firms may respond differently due to factors such as operational hedging strategies, financial leverage, or exposure to specific market conditions. While the expected negative impact of oil price declines on stock returns is evident in some cases, the results also indicate that firm-specific factors—such as basin exposure, proximity to pricing hubs, or midstream contract structures—play a significant role in shaping stock performance. These elements can influence realized pricing both in the immediate term and over longer periods. These findings partially support H2, confirming that while oil price declines generally have a negative effect on stock returns, the magnitude and direction of this

relationship vary across firms, emphasizing the importance of company-specific dynamics.

**Lagged Effects and Time-Delayed Stock Price Responses (H3 Supported)**

The VAR model confirms that stock price reactions to crude oil price fluctuations are not immediate, with the impact peaking at a one-day lag for some firms and extending over multiple days for others. The statistical significance of lagged crude oil price changes and prior stock returns indicates that stock price movements exhibit persistence, meaning past oil price fluctuations and stock performance influence future returns. This suggests that independent E&P firms do not adjust instantaneously to crude price shocks but instead respond with a delay, potentially due to market absorption, investor sentiment shifts, or operational adjustments. These findings support H3, demonstrating that stock price reactions to crude oil price movements exhibit measurable time lags, reinforcing the importance of incorporating lag structure in modeling price dynamics.

**Stock Price Mean Reversion and Firm-Specific Volatility**

The negative and statistically significant lagged stock price coefficients for Diamondback Energy (FANG), SM Energy (SM), and Coterra Energy (CTRA) indicate mean reversion in response to oil price movements, where initial stock price reactions to commodity shocks are followed by corrections as markets reassess underlying fundamentals. This behavior aligns with the elevated volatility characteristic of independent E&P firms, which are highly sensitive to fluctuations in crude oil prices, capital investment cycles, and investor sentiment. Firm-specific exposures—such as FANG's growth-driven capital allocation in the Permian, SM's sensitivity to regional basis differentials, and CTRA's operational footprint in both oil and gas markets—likely magnify these dynamics. These results suggest that stock prices in this sector do not just statistically revert to the mean, but do so in relation to external shocks in the oil market and the subsequent absorption of new information by investors.

**Macroeconomic Moderation and Mixed Firm Reactions (H4 Partially Supported)**

The inclusion of macroeconomic variables, such as interest rates and exchange rates, in the VAR model highlights their role in shaping the relationship between crude oil prices and stock

returns. Firms like Coterra Energy (CTRA) and Baytex Energy (BTE), which have relatively high debt levels, are more sensitive to shifts in interest rates, as higher borrowing costs can constrain capital expenditures and cash flow stability. These companies also exhibit higher betas, making them more exposed to systematic market risk, which amplifies the effects of crude oil price fluctuations. As a result, macroeconomic conditions, particularly monetary policy changes, can moderate the oil-stock return relationship, partially supporting H4.

**Implications of the Findings**

The VAR model results provide key insights for investors, industry stakeholders, and policymakers. For investors, the findings confirm that crude oil price changes do not uniformly impact independent E&P firms—some exhibit strong positive correlations with oil price movements, while others respond weakly or even inversely. This variation underscores the importance of firm-specific analysis for portfolio diversification and risk management. For industry stakeholders, the lagged effects suggest that factors such as hedging policies, leverage, and production flexibility influence stock price behavior. Firms with stronger balance sheets and lower debt exposure tend to experience less volatility, mitigating the impact of crude price swings. For policymakers, the results highlight the role of macroeconomic conditions in shaping energy sector stability. Changes in interest rates and exchange rates can amplify or dampen crude price effects on stock performance, suggesting that fiscal and monetary policies indirectly influence investment dynamics in the oil and gas industry.

**Events Study Analysis**

This section analyzes the impact of major crude oil price shocks on the stock performance of independent exploration and production (E&P) companies using Event Study Analysis. By identifying abnormal stock price movements around key oil market events, this approach evaluates both the immediate and cumulative effects of price shocks on investor sentiment and market valuation. This analysis helps determine whether crude oil fluctuations trigger significant deviations from expected stock performance, providing insights into market efficiency and firm-

specific sensitivities to oil price volatility.

**Methodology for Event Study Analysis**

The event study methodology isolates abnormal returns (ARs) by comparing actual stock returns around significant oil price shocks to expected returns. This is done using the market model, which accounts for overall market movements and isolates the event-driven impact. The abnormal return (AR) for each stock is calculated as:

$$AR_t = R_t - (\alpha + \beta M_t)$$

- AR_t = the abnormal return on day *t*
- Rt = actual return of the E&P stock on day *t*
- Mt = return of broader market or crude oil price index
- α and $\beta$ = regression parameters estimated from pre-event period data

The Cumulative Abnormal Return (CAR) aggregates ARs over [-5, +5] event window, capturing both immediate and lagged effects. This method allows us to test whether oil price shocks have statistically significant impacts on E&P stock returns and whether these effects persist beyond the initial event date.

$$CAR = \sum_{t=-5}^{+5} AR_t$$

**Key Events Analyzed**

**April 20, 2020 – WTI Crude Oil Prices Turned Negative**

The April 20, 2020, oil price crash triggered immediate and prolonged negative stock returns for independent E&P firms. The unprecedented plunge of WTI crude into negative territory—driven by COVID-19 demand destruction and storage constraints—sent shockwaves through the industry. Baytex Energy and SM Energy, both with higher leverage and weaker financial positions, suffered steep stock price declines as investors questioned their ability to

withstand an extended downturn. The cumulative abnormal returns (CARs) confirmed that the sell-off extended beyond the immediate event, reinforcing H2, which posits that crude oil price declines negatively impact stock performance.

In contrast, firms with stronger balance sheets and hedging strategies, such as Diamondback Energy (FANG) and Coterra Energy (CTRA), experienced smaller declines but still followed a downward trajectory. Notably, Matador Resources (MTDR) saw its stock price bottom out two days after the event, suggesting that market participants required additional time to fully process the implications of negative oil prices. This delayed response further supports H3, indicating that stock price adjustments to crude oil price shocks are not always immediate, with firm-specific risk exposure and market sentiment influencing reaction times.

| Absolute Returns April 2020 Price Crash | | | | | | |
|---|---|---|---|---|---|---|
| Date | WTI | FANG | CIVI | CTRA | SM | BTE |
| 4/15/20 | 1.19% | 4.49% | 0.36% | 2.30% | 9.42% | 13.17% |
| 4/16/20 | 0.00% | 7.28% | 7.92% | 3.40% | 10.40% | 8.02% |
| 4/17/20 | 8.05% | 12.45% | 9.14% | 8.54% | 8.39% | 12.47% |
| 4/20/20 | 305.97% | 2.09% | 6.10% | 2.19% | 10.12% | 9.20% |
| 4/21/20 | 126.60% | 1.75% | 7.03% | 1.82% | 7.95% | 2.41% |
| 4/22/20 | 37.66% | 9.04% | 16.50% | 1.47% | 3.07% | 10.22% |
| 4/23/20 | 19.74% | 8.35% | 1.47% | 3.28% | 10.12% | 15.81% |
| 4/24/20 | 2.67% | 3.56% | 2.41% | 2.00% | 0.54% | 9.42% |



The April 20, 2020, WTI crude oil crash, where prices turned negative for the first time in history, triggered significant volatility across independent E&P stocks. The absolute returns table highlights the extreme price movement, with WTI showing an unprecedented absolute return of 305.97% on April 20 due to the collapse in demand and storage constraints caused by the COVID-19 pandemic.

Several firms experienced heightened volatility, with SM Energy, Baytex Energy, and Civitas Resources showing absolute returns above 10% on multiple days. Baytex Energy (13.17%) and SM Energy (10.12%) saw particularly high absolute returns on April 15 and April 20, respectively. Civitas Resources recorded a 16.50% absolute return on April 22, suggesting a delayed reaction to the shock.

The data suggests that while crude oil's extreme price movement had a direct impact on

E&P stocks, the magnitude of stock price reactions varied across firms. This may be due to differences in financial positioning, hedging strategies, and investor sentiment. The sustained volatility beyond April 20 indicates that market participants took time to fully process the implications of negative oil prices.

**November 30, 2016 – OPEC Announced Production Cuts**

The November 30, 2016, OPEC production cut announcement provided much-needed relief to the E&P sector following a prolonged downturn that began in 2014. The market viewed the production cuts as a turning point for crude oil prices, leading to a broad rally in independent E&P stocks. Diamondback Energy, which had positioned itself for growth through efficient capital allocation, saw a sharp rise in stock price immediately following the announcement, reflecting increased investor confidence in the company's ability to capitalize on higher oil prices. Coterra Energy also experienced significant stock price appreciation, though its returns showed a more gradual upward trend over the event window.

On the other hand, SM Energy displayed a delayed reaction, with positive abnormal returns materializing days after the event. The variation in stock price responses suggests that while some firms benefited immediately, others required additional time for investors to fully reassess their valuation in light of stabilized oil prices. This event confirms H1, as higher crude oil prices positively correlated with stock performance. The delayed responses in certain firms also partially support H3, suggesting that some investors take time to adjust to market-changing news.

| Absolute Returns November 2016 Oil Price Collapse | | | | | |
|---|---|---|---|---|---|
| Date | WTI | FANG | CTRA | SM | BTE |
| 11/25/16 | 3.96% | 1.32% | 1.89% | 1.44% | 3.34% |
| 11/28/16 | 2.21% | 2.71% | 0.48% | 7.00% | 0.90% |
| 11/29/16 | 3.93% | 1.40% | 1.36% | 3.60% | 3.13% |
| 11/30/16 | 9.31% | 13.05% | 4.08% | 24.91% | 17.01% |
| 12/1/16 | 3.28% | 1.99% | 3.21% | 0.78% | 4.12% |
| 12/2/16 | 1.21% | 1.69% | 0.74% | 3.16% | 1.82% |
| 12/5/16 | 0.21% | 1.12% | 4.28% | 2.54% | 2.35% |
| 12/6/16 | 1.66% | 0.60% | 0.25% | 1.79% | 0.14% |



The absolute returns data further highlights the market's reaction to the November 30, 2016, OPEC production cut announcement. WTI crude oil exhibited a significant absolute return of 9.31% on the event date, reflecting the market's recognition of a structural shift in supply

expectations. This volatility was mirrored in Diamondback Energy (13.05%) and Baytex Energy (17.01%), indicating that firms with higher operational leverage and growth-oriented capital structures experienced outsized gains as investors priced in stronger future cash flows.

Interestingly, SM Energy (24.91%) recorded the highest absolute return on November 30, reinforcing the observation that its stock had a more delayed response. The firm's continued price movement in the days following suggests that market participants took additional time to reassess its valuation, likely due to its debt exposure and production mix.

Additionally, the moderate absolute returns in Coterra Energy (4.08%) indicate a more measured investor response, possibly due to the company's diversified exposure to both oil and natural gas markets. The contrast in return magnitudes across firms suggests that financial positioning, leverage, and investor sentiment played key roles in determining how individual stocks reacted to this structural shift in crude oil markets.

**February 24, 2022 – Russia-Ukraine Invasion and Oil Price Spike**

The February 24, 2022, Russia-Ukraine invasion led to a dramatic increase in oil prices, yet the stock price reaction of independent E&P firms was more complex. Firms with significant operational scale and strong free cash flow, such as Diamondback Energy, experienced positive abnormal returns as investors anticipated rising oil revenues. However, heightened geopolitical uncertainty created volatility in the stock market, particularly for smaller and more leveraged firms like Baytex Energy and SM Energy, which saw sharp swings in stock price rather than a clear upward trend. Some firms benefited from rising crude prices, while others faced concerns over potential supply chain disruptions, government intervention, and macroeconomic instability. The mixed reactions among firms highlight the influence of external economic conditions on oil price-stock performance relationships.

| Absolute Returns 2022 Oil Jump | | | | | | |
|---|---|---|---|---|---|---|
| Date | WTI | FANG | CIVI | CTRA | SM | BTE |
| 2/22/22 | 1.41% | 2.62% | 0.22% | 0.13% | 1.11% | 1.70% |
| 2/23/22 | 0.27% | 1.20% | 0.97% | 2.88% | 1.42% | 1.07% |
| 2/24/22 | 0.77% | 1.29% | 2.18% | 4.18% | 1.28% | 0.16% |
| 2/25/22 | 1.31% | 4.21% | 1.37% | 2.11% | 6.38% | 14.98% |
| 2/28/22 | 4.51% | 3.62% | 6.32% | 2.73% | 9.03% | 1.92% |
| 3/1/22 | 8.03% | 0.92% | 7.57% | 4.41% | 5.66% | 3.23% |
| 3/2/22 | 6.95% | 0.12% | 6.43% | 5.38% | 2.35% | 0.05% |
| 3/3/22 | 2.65% | 1.87% | 3.62% | 0.62% | 0.89% | 3.68% |



The absolute returns data for the February 2022 oil price jump further illustrates the uneven impact across independent E&P firms. While WTI crude oil exhibited moderate absolute returns leading up to and following the invasion, firm-level stock price reactions varied significantly, reflecting differences in financial structure, investor expectations, and exposure to geopolitical risks. One of the most notable observations is the 14.98% absolute return in Baytex Energy (BTE) on February 25, suggesting heightened volatility for smaller, highly leveraged firms as investors reassessed risk in the wake of the crisis. SM Energy (SM) also experienced elevated absolute returns, particularly on February 28 (9.03%), reinforcing the pattern of increased volatility among firms with higher financial risk exposure.

In contrast, Diamondback Energy (FANG) and Coterra Energy (CTRA) displayed relatively stable absolute returns, with no extreme spikes. This suggests that investors perceived these firms as less risky due to their strong balance sheets and more predictable cash flow generation. The gradual increase in absolute returns for Civitas Resources (CIVI) and Coterra Energy (CTRA) in early March further supports the idea that not all firms reacted immediately, with some experiencing delayed volatility as macroeconomic concerns evolved. The varying stock price reactions align with H4, demonstrating that while crude oil price spikes can drive significant movement in E&P stocks, macroeconomic factors such as inflation concerns, supply chain disruptions, and investor sentiment toward financial risk play a crucial role in shaping stock performance.

**Results and Hypothesis Testing**

The event study analysis confirms that crude oil price shocks significantly impact E&P stock performance, though the effects vary across firms and are not always immediate. The April

2020 oil price crash demonstrated that sharp price declines trigger strong negative stock reactions, with some firms experiencing extended losses due to concerns over financial stability. This supports H2, as stock prices broadly declined, and H3, as certain firms exhibited delayed reactions before fully adjusting to market conditions.

The 2016 OPEC production cuts reaffirmed that rising oil prices generally lead to stock price appreciation. However, the magnitude and timing of these gains varied, reflecting differences in financial positioning and operational exposure. While Diamondback Energy (FANG) experienced an immediate price increase, SM Energy (SM) exhibited a more gradual response, reinforcing H3 by suggesting that some investors took longer to adjust their valuations. The 2022 geopolitical oil shock highlights the influence of macroeconomic and political factors on investor sentiment. Although rising crude prices typically benefit E&P firms, heightened uncertainty led to increased volatility, particularly for more leveraged companies such as Baytex Energy (BTE) and SM Energy (SM). This supports H4, as it demonstrates that external economic risks—such as inflation, government intervention, and geopolitical instability—can moderate the expected positive impact of oil price increases on stock performance.

**Summary of Findings**

The event study analysis confirms that oil price shocks significantly impact E&P stock performance, though the nature and timing of these effects vary depending on the type of shock.

The April 2020 oil price crash resulted in immediate and prolonged negative abnormal returns, confirming H2, while the presence of delayed reactions in firms like Matador Resources supports H3. The November 2016 OPEC production cuts led to positive stock price reactions, supporting H1, while delayed reactions in certain firms suggest that market adjustments take time, partially supporting H3.

The February 2022 Russia-Ukraine invasion demonstrated that macroeconomic factors influence how firms respond to oil price changes, supporting H4, as some companies experienced gains while others faced volatility due to broader economic uncertainty.

These findings illustrate the complex relationship between crude oil prices and E&P stock performance, emphasizing the need for risk management strategies among investors and industry stakeholders. While higher oil prices typically boost E&P stock values, the downside risks from oil price collapses tend to be more severe and prolonged. Furthermore, lagged effects in stock price reactions indicate that investor sentiment and market positioning evolve over time rather than adjusting instantly.

This study's insights reinforce the importance of financial resilience, capital discipline, and strategic hedging in mitigating exposure to oil price volatility.

## DISCUSSIONS AND IMPLICATIONS

The findings from the VAR model and Event Study Analysis confirm that crude oil price fluctuations significantly impact E&P stock performance, though effects vary based on the type of shock, company fundamentals, and macroeconomic conditions. This section interprets these results within the broader industry and financial context, highlighting key takeaways for investors, industry leaders, and policymakers. It explores how firms can manage oil price volatility, the role of external economic forces in stock performance, and potential policy measures to stabilize the energy market.

### Interpreting the Results

The VAR model results demonstrate that crude oil price changes exhibit statistically significant effects on stock returns, though these effects are not uniform across all firms. Companies such as Diamondback Energy (FANG) and Coterra Energy (CTRA) showed a strong positive correlation with oil price increases, reinforcing the hypothesis that higher crude oil prices boost E&P stock valuations. However, firms with higher leverage, such as Baytex Energy (BTE) and SM Energy (SM), exhibited greater volatility, with stock prices showing both delayed reactions and more extreme movements following oil price fluctuations. This suggests that financial health plays a role in determining how quickly and effectively a company's stock adjusts to changes in oil prices.

The presence of lagged effects in stock price reactions further supports the hypothesis that investors and markets do not always immediately adjust to oil price shocks. The VAR model's lag structure indicates that for firms like Matador Resources (MTDR), the strongest correlation between crude oil price changes and stock returns appears one to two days after the initial price movement. This delay suggests that while traders and institutional investors may respond quickly, broader market sentiment and portfolio adjustments take additional time to fully reflect in stock prices. The event study results reinforce this conclusion, as firms displayed delayed abnormal returns following major oil market events, particularly the 2016 OPEC production cut announcement.

The impact of oil price declines was particularly pronounced during the April 2020 price crash, where the VAR model revealed that negative oil price movements had a stronger and more prolonged negative impact on stock returns compared to positive price movements. This asymmetry suggests that downside risk in the oil market is more severe than the upside potential from price recoveries, as investors react more aggressively to financial distress signals than to opportunities for price appreciation. Firms like Baytex Energy and SM Energy suffered extended periods of negative returns, reinforcing the hypothesis that E&P firms are more vulnerable to oil price downturns than they are positioned to benefit from price surges.

Finally, the February 2022 Russia-Ukraine invasion introduced additional complexities, as the VAR model showed that macroeconomic conditions played a moderating role in how oil prices influenced stock returns. While companies with strong free cash flow and low debt exposure experienced gains as crude oil prices surged, smaller, debt-heavy firms showed increased volatility and uncertainty in stock movements. This confirms that external economic forces, such as interest rates, inflation, and geopolitical uncertainty, significantly affect stock price sensitivity to crude oil price movements, aligning with the study's hypothesis that macroeconomic conditions shape the oil-stock price relationship.

These results emphasize that while crude oil price changes are a major determinant of E&P

stock performance, the effects are not uniform and depend on financial positioning, market conditions, and investor sentiment. The presence of lagged effects, asymmetric responses to price declines, and macroeconomic influences highlights the need for robust risk management and financial stability within the sector.

**Industry and Investment Implications**

The results of this study provide valuable insights for investors, corporate executives, and policymakers navigating the energy sector. The demonstrated relationship between crude oil price fluctuations and independent E&P stock performance highlights the need for strategic financial management, investment timing, and regulatory awareness to mitigate risk and optimize market outcomes.

The investment implications of this study suggest that E&P stocks are highly sensitive to oil price movements, but not all firms react in the same way. Investors looking to capitalize on crude oil price swings should consider firm-specific factors such as leverage, hedging policies, and operational efficiency rather than assuming a uniform response across the sector. The VAR model results confirm that firms with stronger balance sheets, such as Diamondback Energy and Coterra Energy, experience more stable and positive stock returns following oil price increases, while companies with higher debt exposure, such as Baytex Energy and SM Energy, show more volatility and greater downside risk during price collapses. The presence of lagged effects also suggests that investment strategies incorporating short-term price momentum should account for delayed stock price reactions to oil price changes, particularly in companies where market sentiment takes longer to adjust.

For corporate strategy, the findings emphasize the importance of risk management and financial resilience in the face of oil price volatility. Firms that actively hedge their exposure to crude oil price swings tend to exhibit more stable stock performance, reinforcing the need for effective hedging strategies using futures contracts and derivatives. Additionally, capital discipline is crucial—companies that maintained low debt levels and efficient cost structures, such as

Diamondback Energy, performed better during market downturns compared to those that relied on aggressive expansion funded by high leverage. This study's results indicate that E&P firms should prioritize cash flow management and maintain financial flexibility to navigate commodity price cycles effectively.

From a policy perspective, the findings suggest that government intervention and macroeconomic conditions play a role in moderating the impact of oil price fluctuations on stock performance. The Russia-Ukraine invasion in 2022 showed that geopolitical risk amplifies volatility, and policymakers should consider strategies to stabilize energy markets during global disruptions. Additionally, OPEC's role in influencing oil prices was evident in the 2016 production cut event, reinforcing the importance of international coordination in maintaining market balance. Regulatory bodies may need to assess the impact of central bank policies, interest rate adjustments, and fiscal measures on the financial stability of independent E&P firms, as these factors influence investor confidence and capital availability.

The broader implication of this study is that crude oil price movements remain a dominant force in shaping E&P stock performance, but financial positioning, investor behavior, and macroeconomic conditions dictate the extent and timing of these effects. Investors and corporate executives alike must adopt data-driven strategies to navigate this volatility, while policymakers must remain aware of the external shocks and structural risks affecting energy markets

**Policy and Market Stability Considerations**

The findings of this study highlight the critical role of energy policy and macroeconomic stability in shaping E&P stock performance. Given the strong link between crude oil price fluctuations and stock returns, policymakers and regulatory bodies must carefully consider how their decisions influence market volatility and investor confidence in the energy sector.

One of the most evident factors affecting oil market stability is OPEC's role in managing supply levels. The 2016 OPEC production cuts, which triggered positive stock price reactions in independent E&P firms, demonstrate that coordinated supply reductions can restore investor

confidence and stabilize crude oil prices after prolonged downturns. However, OPEC's influence is not always predictable, and unexpected policy shifts can introduce additional volatility. Governments and financial institutions must account for these risks when formulating strategic petroleum reserve policies, energy subsidies, and import/export regulations to ensure price stability.

Beyond oil supply management, macroeconomic conditions also shape how crude oil price fluctuations impact stock performance. The Russia-Ukraine invasion in 2022 highlighted how geopolitical risks can create uncertainty in oil markets, leading to mixed stock price reactions among E&P firms. While larger companies benefited from rising oil prices, smaller, more leveraged firms experienced volatility due to concerns over supply chain disruptions and macroeconomic instability. Central banks and policymakers must recognize that interest rate decisions, inflationary pressures, and fiscal policies play a role in moderating the effects of oil price shocks on financial markets. This reinforces the need for a coordinated approach between energy policymakers and financial regulators to ensure that oil price volatility does not translate into broader economic instability.

Looking ahead, long-term energy policy decisions will increasingly impact oil and gas market dynamics. As governments worldwide push for a transition to renewable energy, independent E&P firms may face growing financial pressures, particularly as investors shift capital toward sustainable energy projects. The results of this study indicate that crude oil price fluctuations remain a dominant force in shaping E&P stock performance, but the long-term viability of these firms depends on their ability to adapt to shifting regulatory and environmental standards. Policymakers must balance energy security concerns with climate objectives, ensuring that regulatory frameworks allow for a gradual transition rather than abrupt disruptions that could create unintended market instability.

In summary, policy decisions at both the national and international levels play a crucial role in moderating oil market volatility and ensuring financial stability within the energy sector.

Governments, financial institutions, and industry leaders must work together to implement policies that mitigate risk, encourage responsible financial management, and support a balanced energy transition that preserves market confidence while addressing long-term sustainability goals.

## CONCLUSION

The relationship between crude oil prices and independent E&P stock performance remains a critical area of study, given the sector's reliance on commodity market dynamics. This research provides empirical evidence on how oil price fluctuations influence stock returns, confirming that both immediate and lagged effects exist, with firm-specific factors and macroeconomic conditions shaping the extent of these impacts.

This section summarizes the key findings, discusses the broader significance of the study, and outlines potential avenues for future research. By integrating insights from the VAR model and Event Study Analysis, this research contributes to a deeper understanding of how E&P firms react to crude oil price movements and how investors, corporate executives, and policymakers can better navigate these fluctuations.

### Summary of Key Findings

This study confirms that crude oil price fluctuations significantly impact the stock performance of independent E&P firms, though the magnitude and timing of these effects vary depending on market conditions, company fundamentals, and macroeconomic factors. The Vector Autoregression (VAR) analysis demonstrated that stock price reactions are not always immediate, with firms such as Matador Resources (MTDR) and SM Energy (SM) exhibiting lagged responses to oil price movements. The strongest correlations between crude oil prices and stock returns appeared one to two days after initial price changes, supporting the hypothesis that investors and markets take time to process oil price shocks.

The Event Study Analysis further revealed asymmetric effects in stock price reactions. The April 2020 oil price crash had the most prolonged and severe negative impact, disproportionately affecting highly leveraged firms like Baytex Energy (BTE) and SM Energy (SM), which suffered

extended abnormal returns due to bankruptcy fears. In contrast, the 2016 OPEC production cut announcement triggered positive stock returns for firms positioned for growth, such as Diamondback Energy (FANG) and Coterra Energy (CTRA). However, not all firms reacted immediately, reinforcing the notion that price shocks do not generate uniform responses across the sector.

Additionally, the 2022 Russia-Ukraine invasion underscored the role of macroeconomic conditions in moderating the crude oil-stock price relationship. While some firms benefited from rising crude prices, smaller companies with high debt exposure experienced heightened volatility, indicating that external factors such as inflation, interest rates, and geopolitical uncertainty influence investor sentiment and stock price reactions.

These findings reinforce the importance of firm-level financial positioning, hedging strategies, and broader economic forces in determining stock performance. While higher oil prices generally boost E&P stock valuations, downside risks from price collapses tend to be more severe and prolonged, emphasizing the need for financial resilience and risk management within the sector.

**Contributions to Industry and Academia**

This study provides valuable insights for both financial researchers and industry professionals by offering a data-driven analysis of how crude oil price fluctuations influence independent E&P stock performance. The combination of Vector Autoregression (VAR) analysis and Event Study Analysis enhances the understanding of both short-term and lagged stock price responses, making this research relevant for investors, corporate executives, and policymakers navigating the energy sector.

For the investment community, this study confirms that crude oil price movements are a major driver of E&P stock returns, but the effects are not uniform across all firms. Investors seeking to capitalize on oil price swings should not assume that all E&P stocks react in the same way, as

company-specific factors such as debt levels, hedging strategies, and operational efficiency significantly impact stock price sensitivity. The findings highlight the importance of tracking lagged effects, particularly in firms like Matador Resources (MTDR) and SM Energy (SM), which exhibited delayed stock price reactions following major oil price movements.

For corporate executives and industry leaders, the study underscores the need for strong financial discipline and risk management practices in mitigating the risks associated with oil price volatility. The analysis suggests that firms with low debt levels, efficient capital allocation, and effective hedging strategies, such as Diamondback Energy and Coterra Energy, experienced less volatility and stronger stock performance following oil price shocks. These findings emphasize the importance of financial resilience in weathering downturns, particularly in crisis events like the April 2020 oil price collapse, which disproportionately affected highly leveraged companies such as Baytex Energy and SM Energy.

From an academic standpoint, this research builds on existing literature by providing quantitative evidence of lagged stock price reactions in the E&P sector, reinforcing the argument that market participants do not always immediately adjust to oil price changes. Additionally, the study demonstrates that macroeconomic factors, such as inflation, interest rates, and geopolitical risk, play a moderating role in stock price responses, adding depth to previous research on crude oil-stock return relationships.

Overall, this study contributes to both practical investment strategies and academic financial research, offering a more nuanced understanding of how crude oil price shocks impact independent E&P firms. The findings provide a framework for future research and financial decision-making, particularly as the energy sector continues to evolve amid market volatility, regulatory changes, and the global energy transition.

**Limitations and Areas for Future Research**

While this study provides meaningful insights into the relationship between crude oil price fluctuations and independent E&P stock performance, several limitations must be acknowledged.

These limitations present opportunities for future research to expand upon and refine the findings.

One limitation of this study is its focus on a select group of independent E&P firms, which, while representative of the sector, may not capture the full spectrum of market reactions across larger integrated oil companies, midstream operators, or smaller privately held producers. Future research could broaden the dataset to include a wider range of energy firms, allowing for a more comprehensive assessment of how different segments of the oil and gas industry respond to price volatility.

Another limitation lies in the time frame and macroeconomic scope of the study. While the analysis spans multiple years and includes key market events, it does not fully account for long-term structural changes in the energy sector, such as the increasing role of renewables, evolving regulatory policies, and shifts in investor sentiment toward sustainable energy investments. Future research could extend the time horizon to examine how E&P stock performance evolves over longer commodity cycles and in response to the global energy transition. Additionally, while the VAR model effectively captures short-term price dynamics and lagged effects, it does not explicitly differentiate between company-specific operational decisions and broader market forces. Future studies could incorporate firm-level financial metrics, such as capital expenditures, production growth, and hedging strategies, to better isolate the role of corporate decision-making in stock price sensitivity to oil price changes.

Macroeconomic factors also play a significant role in oil price-stock return relationships, as demonstrated by the Russia-Ukraine invasion event, which introduced geopolitical uncertainty and inflationary pressures. Future research could incorporate additional economic variables, such as Federal Reserve interest rate policies, global trade disruptions, and currency fluctuations, to better understand how external macroeconomic conditions influence E&P stock performance beyond crude oil price movements.

Lastly, this study primarily focuses on statistical relationships between crude oil prices and stock returns but does not examine the behavioral aspects of market participants, such as hedge

fund trading patterns, retail investor sentiment, and algorithmic trading influences. Future research could integrate market microstructure analysis and investor behavioral studies to gain a deeper understanding of how trading dynamics amplify or mitigate the effects of crude oil price shocks on E&P stocks.

Despite these limitations, this study provides a strong empirical foundation for understanding crude oil price-stock return dynamics, reinforcing the need for continued research in an increasingly complex and evolving energy market. Future studies that expand the scope of analysis, integrate additional economic factors, and incorporate firm-level decision-making insights will help further refine our understanding of how independent E&P firms navigate oil price volatility and broader market challenges.

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