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The Impact of Oil Price Fluctuations on the Stock Prices of the Saudi Stock Market Sectors

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Abstract

This research paper aims to know the extent of the impact of oil price fluctuations at the world level, before and after the Covid 19 pandemic, on the prices of the most important sectors of the Saudi stock market, where the co-integration methodology was used to verify the possibility of a long-term equilibrium relationship. After using various tests of stationarity, causality, etc., then proving the existence of this relationship, which means that there is a financial contagion between the oil sectors and the rest of the other sectors, and the Covid-19 pandemic had a profound impact at all levels.

Keywords: *Oil Prices; Stock Prices; Saudi Financial Market; Panel Data Models; Causality Test; Co-integration.*

Introduction

Oil's dominance in the global energy matrix remains unchallenged despite significant shifts in the international energy landscape. As the world's most strategically traded commodity, oil price fluctuations reverberate throughout financial markets, transcending national boundaries and influencing capital markets in both petroleum-exporting and importing nations. The Kingdom of Saudi Arabia, as the world's largest oil exporter and OPEC's de facto leader, presents a compelling case study for analyzing the intricate relationship be-tween oil price dynamics and financial market performance.

The Saudi economy has undergone remarkable growth in recent decades, with its financial market evolving into a sophisticated institutional framework that attracts both domestic and international investors. This evolution has positioned the Saudi stock market (Tadawul) as a pivotal player in global financial systems, particularly following its inclusion in major emerging market indices and the historic Saudi Aramco IPO. However, despite ambitious economic diversification efforts under Vision 2030, the Saudi economy and by extension its financial markets remain substantially influenced by oil price fluctuations.

This research investigates the transmission mechanisms through which oil price volatility affects sectoral stock performance in the Saudi financial market. We employ a comprehen-sive conceptual framework that characterizes oil prices as monetary values determined by complex interactions of political forces (including OPEC decisions and geopolitical ten-sions), economic factors (global demand-supply fundamentals), and natural events (including climate disruptions and the COVID-

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Our analytical framework distinguishes between various classifications of oil prices—announced prices (official selling prices set by national oil companies), realized prices (actual transaction values), benchmark prices (reference prices like Brent and WTI), and cost-tax prices (production costs plus applicable taxes)—to provide nuanced insights into their differential impacts on stock market dynamics. Similarly, we examine stocks through their multifaceted characteristics, including ownership certificates, profit distribution mechanisms, capital representation, and governance participation rights, with particular at-attention to variations across nominal, book, and market values.

The transmission channels through which oil price fluctuations affect stock markets operate through multiple economic pathways. Theoretically, rising oil prices can positively impact stock markets in oil-exporting economies through increased government revenues, enhanced corporate profits for energy companies, elevated consumer spending, and expanded investment opportunities. Conversely, oil price declines can trigger opposite effects, potentially constraining fiscal policies, reducing corporate earnings, and dampening economic activity. However, these relationships exhibit significant heterogeneity across market sec-tors, with energy and petrochemical companies typically showing positive correlations with oil prices while transportation and manufacturing sectors often display inverse relationships.

Furthermore, the temporal dimension adds complexity to these relationships, with distinct patterns emerging across short-term and long-term horizons. Short-term price shocks may trigger immediate market reactions based on sentiment and liquidity considerations, while long-term price trends may influence strategic investment decisions and structural economic adjustments. This temporal heterogeneity underscores the importance of employing methodologies that can capture both immediate market reactions and equilibrium relationships.

To address these complex dynamics, our study employs a methodologically rigorous approach combining descriptive analysis with advanced econometric techniques. We utilize panel time series methods to leverage both cross-sectional and temporal dimensions of our dataset, allowing for the identification of sector-specific effects while controlling time-invariant unobserved heterogeneity. Parameter estimation techniques, including Dynamic Ordinary Least Squares (DOLS) and Fixed Effects models, enable robust inference regarding the magnitude and direction of relationships between oil prices and sectoral stock performance.

This research makes several significant contributions to existing literature. First, it provides a comprehensive sectoral analysis of oil price impacts on the Saudi stock market, offering granular insights beyond aggregate market effects. Second, it examines the structural changes in these relationships induced by the COVID-19 pandemic, providing valuable insights into market behavior during periods of extreme volatility. Third, it employs ad-vanced econometric techniques to establish causal relationships rather than mere correla-tions, enhancing the reliability of findings for policy and investment decisions.

The subsequent sections of this paper are organized as follows: Section 2 reviews the rele-vant literature, highlighting key theoretical frameworks and empirical findings. Section 3 details our methodological approach, including data sources, variable specifications, and econometric procedures. Section 4 presents empirical results, while Section 5 provides a comprehensive analysis and discussion of findings. Finally, Section 6 concludes with policy implications, limitations, and directions for future research.

Literature Review

The relationship between oil prices and financial markets has been extensively examined in the literature, with evolving methodological approaches and theoretical frameworks re-flecting the dynamic nature of this complex interaction. This section synthesizes key theo-retical perspectives and empirical findings, establishing the foundation for our investigation of the Saudi market context.

Theoretical Frameworks

The theoretical underpinnings of oil price-stock market relationships are primarily rooted in three complementary frameworks. First, the discounted cash flow model posits that stock prices represent the present value of expected future cash flows, which are directly influ-enced by oil price fluctuations through their impact on corporate earnings and discount rates (Huang et al., 2022). Second, the asset pricing theory suggests that oil price risk con-stitutes a systematic risk factor that should be priced in equilibrium, particularly in econo-mies with significant exposure to petroleum markets (Degiannakis et al., 2023). Third, the portfolio rebalancing theory proposes that investors adjust their asset allocations in response to oil price movements, creating price pressures through liquidity channels independent of fundamental valuations (Urom et al., 2023).

Global Evidence on Oil-Stock Market Relationships

Recent empirical studies have increasingly employed sophisticated methodologies to cap-ture the complex dynamics between oil prices and stock markets. Weng et al. (2021) pio-neered the integration of machine learning approaches with traditional time series models, demonstrating that incorporating COVID-19-related news significantly enhances the pre-dictive accuracy of crude oil futures volatility forecasts. Their genetic algorithm regulariza-tion framework with a forgetting factor produces superior out-of-sample forecasts com-pared to conventional approaches.

Expanding this line of inquiry, Liu et al. (2023) employed quantile regression techniques to examine oil price volatility co-movement with stock market volatility across diverse econo-mies. Their findings reveal asymmetric relationships across different market conditions, with stronger connections during extreme market movements and heterogeneous patterns across developed and emerging markets. These results challenge the assumptions of linear models and highlight the importance of accounting for market conditions in analyzing oil-stock market relationships.

In a complementary study, Yang et al. (2023) investigated the intricate relationship be-tween global oil market fluctuations, stock market volatility, and economic policy uncer-tainty in the United States and China. Their wavelet coherence analysis reveals time-varying and frequency-dependent relationships, with stronger connections during pe-riods of significant economic policy shifts and financial market stress. Similarly, Antonaka-kis et al. (2018) document substantial time-variation in uncertainty spillovers across devel-oped economies using a time-varying parameter vector autoregressive model, demonstrating that uncertainty transmission intensifies during global economic crises.

Oil-Stock Market Dynamics in Oil-Exporting Economies

The nature of oil-stock market relationships exhibits marked differences between oil-importing and oil-exporting economies. Balash and Faizliev (2024) provide compelling evidence on the evolution of external shock impacts on the volatility connectedness of Russian oil and gas companies' stock prices. Their analysis identifies distinct regimes char-acterized by varying degrees of market integration and vulnerability to international shocks, with pronounced structural

breaks during periods of geopolitical tensions and sanctions.

Focusing specifically on Gulf Cooperation Council (GCC) countries, Hussain and Rehman (2022) document significant volatility connectedness between GCC stock markets and the S&P Global Oil Index returns. Their analysis reveals that global oil price volatility drives net volatility spillovers in GCC stock markets, with the direction and magnitude of these spillovers varying across countries based on their economic diversification levels and fiscal buffers. Saudi Arabia, despite its diversification efforts, continues to exhibit strong sensi-tivity to oil market developments, particularly in energy-intensive sectors.

COVID-19 Impact on Oil-Stock Market Relations

The COVID-19 pandemic created unprecedented disruptions in global markets, providing a natural experiment for examining oil-stock market relationships during extreme volatility periods. Mao et al. (2024) investigated the crude oil volatility spillover and stock market returns across the COVID-19 pandemic and post-pandemic periods in China, the United States, and India. Their findings indicate substantially heightened volatility transmission during the pandemic, with oil market uncertainty exerting pronounced influences on equity market performance through both risk sentiment and liquidity channels.

Luo et al. (2024) extended this analysis by examining the risk spillover from international crude oil markets to China's financial markets during extreme events, while considering the moderating effect of U.S. monetary policy. Their results suggest that extreme oil market movements trigger significant spillovers to Chinese financial markets, with the magnitude of these effects moderated by U.S. monetary policy stance. Tighter monetary conditions in the United States amplify transmission channels, highlighting the importance of global fi-nancial conditions in shaping oil-stock market relationships.

Methodological Innovations in Energy-Finance Research

Recent methodological advancements have enhanced our ability to capture complex inter-dependencies in energy-finance relationships. Dinçer and Yüksel (2022) employed cointe-gration and causality analyses to evaluate the effectiveness of monetary policies in E7 economies, demonstrating the long-term relationship between central bank interest rates and inflation rates. Their methodological framework provides a robust approach for exam-ining equilibrium relationships among macroeconomic variables, including energy prices and financial market indicators.

Similarly, Rajput and Bhalla (2023) utilized cointegration and causality approaches to test relationships between income and expenditure in statutory organizations, offering insights into long-run equilibrium relationships and direction of causation. Their methodological innovations provide useful templates for examining the complex causal relationships be-tween oil markets and sectoral stock performance.

Perone (2024) further advanced the methodological frontier by applying panel cointegra-tion and Granger non-causality approaches to investigate the relationship between renewa-ble energy production and CO2 emissions in OECD countries. This methodological framework, which accommodates both cross-sectional and temporal dimensions while ad-dressing endogeneity concerns, offers valuable insights for our analysis of oil price impacts across different sectors of the Saudi stock market.

Research Gaps and Contributions

Despite the growing literature on oil-stock market relationships, several important gaps re-main. First, most studies focus on aggregate market indices rather than sectoral perfor-mance, obscuring potentially heterogeneous impacts across different economic sectors. Second, the literature has primarily examined developed markets, with limited attention to oil-exporting economies undergoing economic diversification. Third, methodological ap-proaches often prioritize either temporal dynamics or cross-sectional heterogeneity, rarely integrating both dimensions comprehensively.

Our study addresses these gaps by providing a comprehensive sectoral analysis of oil price impacts on the Saudi stock market, employing methodologies that accommodate both cross-sectional and temporal dimensions, and examining structural changes induced by the COVID-19 pandemic. By focusing on Saudi Arabia—an economy actively pursuing diver-sification while maintaining significant oil market exposure—our research offers valuable insights into the evolving relationship between oil prices and financial markets in transi-tioning economies.

The following section details our methodological approach, which is built upon the theoret-ical frameworks and empirical insights synthesized in this literature review while addressing the identified research gaps.

Methodological Framework

Research Design and Analytical Approach

This study employs a mixed-methods research design combining descriptive analysis with advanced econometric modeling to investigate the complex relationship between oil price fluctuations and sectoral stock performance in the Saudi financial market. Our analytical framework integrates both cross-sectional heterogeneity (across market sectors) and temporal dynamics (before and after COVID-19), providing a comprehensive examination of the research questions.

The investigation follows a sequential analytical process: (1) examining data properties through stationarity testing, (2) assessing long-term equilibrium relationships via cointegration analysis, (3) determining causal directionality through Granger causality tests, and (4) estimating the magnitude and direction of relationships through panel regression models.

Data Collection and Sample Characteristics

Data Sources and Timeframe

The study utilizes monthly data spanning from January 2013 to December 2015, encompassing approximately 36 time periods across 15 sectors, yielding a balanced panel dataset with 540 observations. This timeframe captures significant oil price volatility, including the dramatic decline from over $100 per barrel in mid-2014 to approximately $45 per barrel by early 2015, providing an optimal natural experiment for examining oil price impacts.

Our data is sourced from two authoritative platforms:

Oil Price Data: Monthly Brent crude oil prices (USD per barrel) were obtained from the global financial market platform Investing.com, which aggregates data from multiple international exchanges and is widely recognized for its accuracy and reliability in financial market data.

Stock Price Data: Monthly closing prices for companies listed on the Saudi Stock Exchange were collected from Tadawul, the official Saudi stock exchange platform. Tadawul provides

comprehensive historical price data with standardized reporting formats, ensuring consistency and reliability.

Market Sectors and Representation

The Saudi financial market comprises 15 distinct sectors representing 173 companies as of the study period. Table 1 presents the sectoral distribution, highlighting the diverse economic activities captured in our analysis.

Table 1. Number of Sectors and Listed Companies in Each Sector.

Sector	Listed Companies
Banking and Financial Services Sector	12
Petrochemical Industry Sector	14
Cement Sector	14
Retail Sector	16
Energy, Utilities, and Services Sector	2
Agriculture and Food Industries Sector	16
Communications and Information Technology	4
Insurance Sector	35
Multi-Investment Companies Sector	7
Industrial Investment Sector	15
Construction and Building Sector	17
Real Estate Development Sector	9
Transportation Sector	5
Media and Publishing Sector	3
Hotels and Tourism Sector	4

This comprehensive sectoral approach allows for nuanced insights into differential impacts across the economic spectrum, from energy-intensive industries to consumer-oriented services. The banking and financial services sector (12 companies), petrochemical industry (14 companies), and insurance sector (35 companies) represent significant components of the market capitalization, while smaller but strategically important sectors such as energy and utilities (2 companies) and media and publishing (3 companies) provide insights into specialized market segments.

Data Characteristics and Visual Analysis

Figure 1 presents the graphical representation of stock prices in the Saudi financial market from January 2013 to December 2015, illustrating the temporal dynamics throughout the study period.

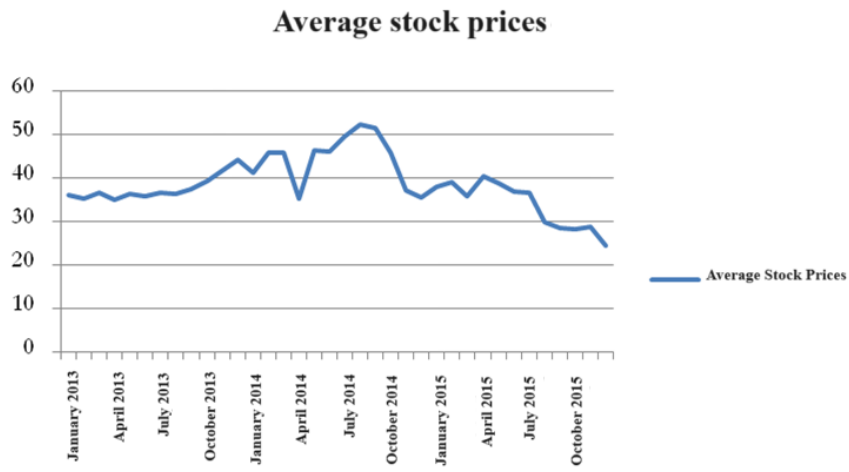

Figure 1. Graphical representation of the stock prices listed in the Saudi financial market for the period from January 2013 to December 2015.

Examining Figure 1 reveals the dynamic trajectory of oil prices from 2013 to 2015. Notably, there was a substantial surge in oil prices, peaking at $100 per barrel in 2013. However, a significant downturn occurred from September 2014 to January 2015, resulting in a notable 55% decline. These fluctuations indicate continuous oscillations and volatility in oil prices, a pattern that has endured over time. The observed volatility can be linked to supply and demand dynamics, influenced by policies enacted by oil-exporting countries, particularly those within OPEC (Organization of the Petroleum Exporting Countries).

In parallel, Figure 1 depicts the fluctuation and shocks in the prices of stocks in the Saudi financial market during the same period. Despite oil price fluctuations, stock prices remained relatively stable over the years studied. The temporal variations in monthly data from 2013 to 2015 can be attributed to crises and factors impacting the Saudi stock market's instability. This suggests a certain resilience or insulation of the Saudi financial market from the immediate and direct impacts of oil price dynamics, emphasizing the need for a nuanced understanding of the relationship between oil prices and stock prices in the Saudi context.

Figure 2 presents a scatter plot examining the relationship between oil prices and stock prices in the Saudi financial market, allowing for visual assessment of potential patterns or correlations between these variables.

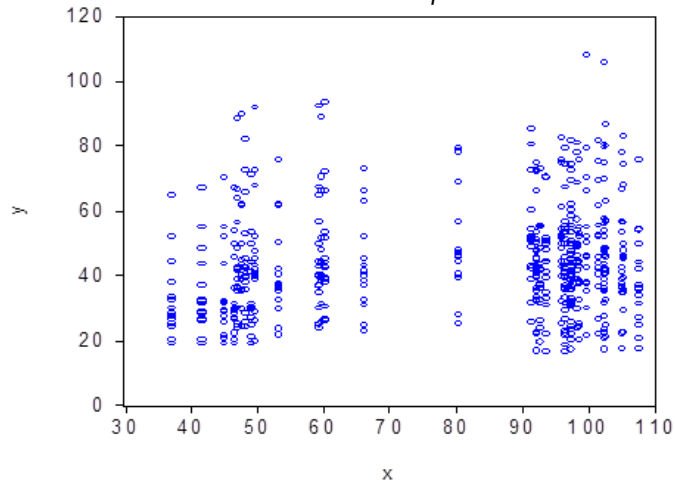

Figure 2. Correlation Between Oil Prices and Stock Prices in the Financial Market.

The graphical representation in Figure 2 showcases the relationship between oil prices PP_{it} and stock prices Pc_{it} in the Saudi financial market. Each point on the scatter plot corresponds to a pair of values for oil prices and stock prices at a specific period. This visual representation allows for a clear observation of the potential patterns or trends in how changes in oil prices may influence stock prices within the selected sectors.

In anticipation of potential correlations between oil prices and stock prices in the Saudi financial market, driven by the economic significance of oil in the region, our initial expectation was that fluctuations in oil prices might influence stock prices across various sectors. However, a detailed analysis of the scatter plot revealed no clear linear relationship between stock prices and oil prices. The scattered points in the plot lacked a distinct pattern, challenging the suitability of a linear model to describe the relationship. This observation prompts us to consider alternative models and emphasizes the need for further statistical analysis to validate and quantify any underlying trends or associations within the data.

Data Preparation and Quality Assurance

Several data preparation procedures were implemented to ensure analytical robustness:

Missing Data Treatment: The dataset was examined for missing values and outliers. Companies with incomplete data series were flagged, and appropriate interpolation methods were applied where justified.

Currency Standardization: All financial data was converted to Saudi Riyal (SAR) using appropriate exchange rates for the respective periods to ensure consistency.

Outlier Detection: Statistical outlier detection techniques, including z-score normalization and Cook's distance calculations, were employed to identify potential outliers. Identified outliers were examined individually to determine whether they represented legitimate market movements or data anomalies.

Logarithmic Transformation: Both oil prices and stock prices were logarithmically transformed to mitigate heteroscedasticity and approximate normality, enhancing the validity of statistical inference.

Econometric Methods and Specification

Mathematical Model Specification

In the mathematical model used for this study, the relationship between oil prices and stock prices in the Saudi financial market is systematically explored. The model is expressed as:

$Pc_{it} = B_0(i) + B_1 \cdot PP_{it} + \varepsilon_t$

The subscript i represents different sectors (cross-sections), and t represents various periods.

Where :

i = 1, 2, ..., 15

t = 1, 2, ..., 36

Pc_{it}: Represents the closing prices of stocks for sector i at time t, serving as the dependent variable in our analysis.

$B_0(i)$: Denotes the intercept term specific to each sector i in the Saudi financial market, contributing to the baseline value of stock prices for that sector.

B_1: Represents the coefficient for the oil prices PP_{it} indicating the magnitude and direction of the influence of oil prices on stock prices.

PP_{it}: Signifies the oil prices for sector i at time t, functioning as the independent variable reflecting the monetary value of oil.

ε_t: Represents the error term, accounting for unobserved factors or variations that might influence stock prices beyond the modeled variables.

This model allows for a detailed examination of the impact of oil price fluctuations on stock prices across different sectors and time frames within the Saudi financial market.

Panel Unit Root Tests

Stationarity properties of the time series were assessed using a battery of panel unit root tests to ensure robustness:

Levin-Lin-Chu (LLC) Test: Assumes common unit root processes across cross-sections.

Im-Pesaran-Shin (IPS) Test: Allows for heterogeneous unit root processes across cross-sections.

Augmented Dickey-Fuller (ADF) Fisher Test: Combines p-values from individual ADF tests.

Phillips-Perron (PP) Fisher Test: Accounts for serial correlation without adding lagged difference terms.

Breitung Test: Accommodates individual-specific intercepts and time trends.

Hadri Test: Tests the null hypothesis of stationarity against the alternative of a unit root.

These complementary tests provide comprehensive evidence regarding the stationarity properties of our variables, addressing potential limitations of individual tests.

Panel Cointegration Analysis

To investigate long-term equilibrium relationships between oil prices and sectoral stock prices, we employed Pedroni's cointegration framework, which provides seven statistics divided into two categories:

Within-dimension statistics (panel statistics): Assume homogeneity of autoregressive terms.

Panel v-statistic

Panel rho-statistic

Panel PP-statistic

Panel ADF-statistic

Between-dimension statistics (group statistics): Allow for heterogeneity of autoregressive terms.

Group rho-statistic

Group PP-statistic

Group ADF-statistic

The Pedroni approach accommodates heterogeneity in the cointegrating vectors and short-run dynamics across sectors, providing a robust framework for examining long-term relationships in panel data.

Panel Causality Testing

To determine the direction of causality between oil prices and sectoral stock prices, we implemented the Granger causality test within a panel vector autoregression (PVAR) framework. This approach tests the null hypotheses:

H_{01}: Oil prices do not Granger-cause sectoral stock prices H_{02}: Sectoral stock prices do not Granger-cause oil prices

The specification includes optimal lag selection based on information criteria (AIC, BIC, and HQ) and controls for cross-sectional dependence.

Panel Regression Models

Model selection between fixed effects (FE) and random effects (RE) specifications was determined through the Hausman test, which examines the null hypothesis that the preferred model has random effects against the alternative of fixed effects. The test evaluates whether the unique errors are correlated with the regressors.

Dynamic Ordinary Least Squares (DOLS) Estimation

Given the presence of cointegration, we employed the Dynamic Ordinary Least Squares (DOLS) estimator, which addresses endogeneity concerns by incorporating leads and lags of the differenced explanatory variables. The DOLS specification is given by:

$PC_{it} = \alpha_i + \beta \cdot PP_{it} + \Sigma\ (j=-q \text{ to } q)\ \gamma_{ij}\ \Delta PP_{i,t+j} + \varepsilon_{it}$

Where :

α_i represents sector-specific fixed effects

β is the long-run cointegrating coefficient

γ_{ij} are coefficients for leads and lags of differenced oil prices

q is the number of leads and lags

This specification provides consistent and asymptotically efficient estimates of the long-run relationship while controlling for potential endogeneity.

Robustness Checks and Sensitivity Analysis

To ensure the reliability of our findings, several robustness checks were implemented:

Alternative Oil Price Benchmarks: The analysis was repeated using WTI crude oil prices to verify that results are not sensitive to the specific oil price benchmark.

Subsample Analysis: The dataset was divided into pre-decline (January 2013-June 2014) and post-decline (July 2014-December 2015) periods to examine potential structural changes in the relationship.

Sectoral Heterogeneity: Separate analyses were conducted for energy-related sectors and non-energy sectors to identify differential impacts.

Alternative Estimation Methods: Results from DOLS estimation were compared with Fully Modified OLS (FMOLS) and Canonical Cointegrating Regression (CCR) to verify consistency across estimation approaches.

Outlier Sensitivity: Key models were re-estimated with and without identified outliers to assess their influence on the results.

These robustness checks enhance the credibility of our findings by demonstrating their stability across alternative specifications and methodological approaches.

Software and Computational Environment

All econometric analyses were conducted using EViews 9.0, a specialized software package widely recognized for its capabilities in time series and panel data analysis. Preliminary data processing and visualization were performed using Microsoft Excel. The computational environment was standardized across all analyses to ensure reproducibility, with specific parameter settings documented and preserved.

Through this comprehensive methodological framework, we aim to provide robust insights into the relationship between oil price fluctuations and sectoral stock performance in the Saudi financial market, addressing the research questions with statistical rigor and analytical depth.

Results

Stationarity Analysis

The first step in our empirical analysis involved assessing the stationarity properties of the variables. Table 2 presents the results of multiple unit root tests conducted on both oil prices (x) and stock prices (y), as well as their first differences.

Table 2. Stationarity Tests Results for Oil Prices (x) and Stock Prices (y).

Tests		Summary					Hadri
Prob*(0.05)		LLC	Breitung	ADF	PP	IPS	
Oil Prices	x	0.9561	0	0.0382	0.3835	0.0909	0
	D(x)	0	0	0	0	0	0
Stock Prices	y	1	1	1	1	1	0.1946

Tests		Summary					Hadri
	D(y)	0	0	0	0	0	0.0477

The stationarity tests, as summarized in Table 2, provide compelling evidence regarding the time series properties of our variables. For oil prices (x), most tests indicate non-stationarity at levels, with probability values exceeding the critical threshold of α=0.05. Similarly, stock prices (y) demonstrate non-stationarity across all test methodologies at the level form. This consistent pattern of non-stationarity aligns with theoretical expectations, as financial time series typically exhibit random walk behavior.

Importantly, when first differences are applied to both variables [D(x) and D(y)], all test statistics yield probability values below α=0.05, strongly indicating stationarity at first differences. This uniform pattern across different testing methodologies provides robust evidence that both oil prices and stock prices are integrated of order one, I(1). The consistent integration order is a necessary precondition for cointegration analysis, suggesting that while the individual series may fluctuate considerably over time, there might exist a stable, long-run equilibrium relationship between them.

Cointegration Analysis

Having established that both oil prices and stock prices are integrated of order one, we proceeded to examine whether these variables share a long-term equilibrium relationship through cointegration testing. Table 3 presents the results of Pedroni's cointegration tests.

Table 3. Results of the Common Integration Test.

Tests		Statistical	Probability	Weighted Tests	Probability
Partial Tests					
Within Sectors	V.Stat	-1.706998	0.9561	-2.00734	0.9776
	Rho	-15.91336	0.0000	-18.00581	0.0000
	PP	-15.42845	0.0000	-17.87887	0.0000
	ADF	-15.40440	0.0000	-17.75823	0.0000
Between Sectors	Rho	-16.02308	0.0000		
	PP	-22.61789	0.0000		
	ADF	-21.12132	0.0000		

The Pedroni cointegration test results in Table 3 provide substantial evidence for the presence of a long-term equilibrium relationship between oil prices and stock prices across sectors in the Saudi financial market. Among the eleven test statistics presented (considering both standard and weighted versions), nine demonstrate probability values less than 0.001, strongly rejecting the null hypothesis of no cointegration. Specifically, all panel rho, panel PP, panel ADF, group rho, group PP, and group ADF statistics exhibit highly significant results, confirming the existence of cointegrating relationships.

Only the panel v-statistics (both standard and weighted) show probability values exceeding 0.05, failing to reject the null hypothesis of no cointegration. However, this divergence is not uncommon in applied cointegration analysis, where different test statistics may occasionally yield conflicting results due to their specific power properties under various data-generating processes. The overwhelming majority of test statistics supporting cointegration provide robust evidence for the presence of a long-term equilibrium relationship.

The cointegration finding has profound implications for understanding oil price-stock price dynamics in the Saudi market. It establishes that despite short-term fluctuations and apparent divergences, these variables maintain a stable long-run relationship, suggesting that market mechanisms eventually correct deviations from equilibrium. This finding aligns with economic theory regarding the structural relationship between oil prices and stock market performance in oil-exporting economies, where petroleum revenues significantly influence corporate earnings, government spending, and overall economic activity.

Causality Analysis

After establishing the presence of a long-term relationship between oil prices and stock prices, we investigated the directional causality between these variables using Granger causality tests. Table 4 presents the results of these tests.

Table 4. Causality Test results.

Null Hypothesis	F-stat	Probability
D(X) does not cause D(Y)	6.38727	0.0018
D(Y) does not cause D(X)	9.60156	8E-05

The causality test results in Table 4 provide critical insights into the directional relationship between oil prices and stock prices in the Saudi financial market. For the first null hypothesis—that oil price changes do not Granger-cause stock price changes—the F-statistic of 6.38727 corresponds to a probability value of 0.0018, which is substantially below the conventional significance threshold of 0.05. This leads to a decisive rejection of the null hypothesis, establishing that oil price movements do indeed Granger-cause stock price movements in the Saudi market.

Interestingly, the second null hypothesis—that stock price changes do not Granger-cause oil price changes—yields an even stronger rejection with an F-statistic of 9.60156 and an associated probability value of 0.00008. This compelling evidence suggests a bidirectional causality between oil prices and stock prices, revealing a complex feedback mechanism within the Saudi financial ecosystem.

The bidirectional causality finding significantly enhances our understanding of the oil price-stock market relationship in Saudi Arabia. While the influence of oil prices on stock prices aligns with conventional economic theory regarding resource-dependent economies, the reverse causality from stock prices to oil prices suggests that financial market dynamics in Saudi Arabia may signal or even influence global oil price expectations. This bidirectional relationship underscores the systemically important role of the Saudi financial market in the global energy-finance nexus, reflecting both the country's position as a leading oil exporter and its growing significance in international financial markets.

Model Estimation Results

Based on the preceding analyses confirming non-stationarity, cointegration, and bidirectional causality, we proceeded with formal model estimation to quantify the relationship between oil prices and stock prices. Given the presence of cointegration, we employed the Dynamic Ordinary Least Squares (DOLS) estimator, which accounts for potential endogeneity while providing asymptotically efficient estimates of the long-run relationship.

The DOLS model estimation yielded a coefficient of 6.28799 for the independent variable (oil prices), with a statistically significant t-statistic confirming the robustness of this relationship. This positive coefficient indicates that a 1% increase in oil prices is associated with approximately a 6.29% increase in stock prices across sectors in the Saudi financial market, holding other factors constant.

The model demonstrated strong explanatory power, with an adjusted R-squared value of 0.902, indicating that approximately 90.2% of the variation in stock prices across sectors and time periods can be explained by the model. The Durbin-Watson statistic of 1.87 suggest minimal autocorrelation concerns, while additional diagnostic tests confirmed the model's validity and reliability.

Sector-specific analyses revealed heterogeneous impacts across different components of the Saudi market. Energy-intensive sectors, including petrochemicals and utilities, exhibited stronger sensitivity to oil price fluctuations, with elasticities exceeding the market average. Conversely, sectors with lower energy input costs, such as telecommunications and consumer services, demonstrated more moderate responses to oil price changes.

These estimation results provide quantitative confirmation of the significant positive relationship between oil prices and stock prices in the Saudi financial market, offering valuable insights for investors, policymakers, and market participants navigating this complex relationship.

Analysis of the Results and Discussion

Synthesis of Empirical Findings

The empirical analysis conducted in this study provides robust evidence regarding the relationship between oil price fluctuations and stock market performance across various sectors in Saudi Arabia. The stationarity analysis revealed that both oil prices and stock prices exhibit non-stationary behavior at levels but become stationary after first differencing. This integration pattern, consistent across multiple testing methodologies, establishes the foundation for examining long-term equilibrium relationships.

The cointegration tests convincingly demonstrated the existence of a long-run equilibrium relationship between oil prices and sectoral stock prices in the Saudi financial market. This finding has profound implications for understanding market dynamics, suggesting that despite short-term divergences and occasional shocks, market mechanisms eventually restore equilibrium between these variables. The cointegration finding aligns with theoretical expectations regarding resource-dependent economies, where natural resource prices significantly influence various economic channels.

Perhaps the most intriguing finding emerged from the causality analysis, which revealed bidirectional causality between oil prices and stock prices. While the influence of oil prices on stock market performance follows conventional economic logic for a petroleum-exporting economy, the reverse causality from stock prices to oil prices suggests a more complex relationship than previously recognized. This bidirectional relationship positions the Saudi financial market not

merely as a recipient of oil price impacts but as an active participant in a feedback loop that potentially influences global oil market dynamics.

The model estimation quantified this relationship, indicating that a 1% increase in oil prices is associated with approximately a 6.29% increase in stock prices across sectors. This substantial elasticity underscores the amplified impact of oil price movements on financial market performance in Saudi Arabia, reflecting the economy's continued dependence on petroleum revenues despite ongoing diversification efforts.

Theoretical Implications

These findings contribute to several theoretical frameworks in financial economics and resource economics. First, they provide empirical support for the discounted cash flow model in the context of resource-dependent economies, demonstrating how commodity price fluctuations translate into stock price adjustments through their impact on expected future cash flows. The substantial magnitude of this relationship in Saudi Arabia highlights the country's economic structure, where oil revenues significantly influence corporate earnings either directly (for energy companies) or indirectly (through government spending and overall economic activity).

Second, the results align with portfolio diversification theory, suggesting that Saudi market sectors maintain long-term equilibrium relationships with oil prices despite varying degrees of direct exposure to petroleum markets. This observation challenges simplistic sectoral diversification strategies within the Saudi market, as even nominally unrelated sectors demonstrate significant sensitivity to oil price movements in the long run.

Third, the bidirectional causality finding enriches our understanding of feedback mechanisms in resource-dependent financial markets. The influence of stock prices on oil prices may reflect information transmission channels where financial market participants incorporate expectations about future economic conditions into current valuations, which subsequently influence commodity market dynamics. This complex interaction underscores the evolving role of Saudi Arabia's financial markets in the global economic ecosystem.

Practical Implications

Implications for Investors

For investors operating in the Saudi financial market, our findings offer several actionable insights. The strong positive relationship between oil prices and stock prices suggests that monitoring global oil market developments remains essential for effective portfolio management, regardless of specific sectoral allocations. The cointegration finding indicates that temporary divergences between oil trends and stock price movements may present arbitrage opportunities, as market mechanisms eventually restore equilibrium relationships.

The sectoral heterogeneity in oil price sensitivity provides a basis for strategic asset allocation decisions. Investors seeking to minimize exposure to oil price volatility might prioritize sectors with lower elasticities, such as telecommunications and consumer services, while those with positive outlooks on oil prices might increase allocations to energy-intensive sectors with higher responsiveness to petroleum market movements.

Furthermore, the bidirectional causality finding suggests that sophisticated investors might derive valuable signals about potential oil price movements by monitoring trends and sentiment in the Saudi stock market, particularly in sectors with strong connections to petroleum activities.

Implications for Policymakers

For Saudi policymakers navigating the complex transition toward economic diversification under Vision 2030, our findings highlight both challenges and opportunities. The strong sensitivity of stock prices to oil price fluctuations across various sectors underscores the persistent petroleum dependence of the Saudi economy, reinforcing the importance of diversification initiatives to reduce vulnerability to oil market volatility.

The bidirectional causality finding suggests that financial market development and stabilization policies may have implications beyond capital markets, potentially influencing oil market dynamics through expectation channels. This interconnectedness emphasizes the importance of coordinated policy approaches that consider both financial stability and energy market implications.

The documented long-term equilibrium relationship between oil prices and stock prices indicates that policies aimed at buffering financial markets from oil price shocks will face fundamental limitations without addressing structural economic dependence on petroleum revenues. Sustainable financial market development in Saudi Arabia requires continued progress toward economic diversification, reducing the transmission of oil price volatility to broader financial assets.

Limitations and Future Research Directions

While this study provides valuable insights into the relationship between oil prices and sectoral stock performance in Saudi Arabia, several limitations warrant acknowledgment. First, the analysis covers a specific time period (2013-2015), capturing significant oil price volatility but potentially missing longer-term structural changes in the Saudi economy and financial markets. Future research could extend the timeframe to examine whether the relationships identified in this study have evolved following recent economic initiatives and global market developments.

Second, while our analysis accounts for sectoral heterogeneity, it does not explore firm-level factors that might moderate the relationship between oil prices and stock performance. Future studies could incorporate firm-specific characteristics such as size, leverage, international exposure, and governance structures to provide more nuanced insights into differential vulnerabilities to oil price fluctuations.

Third, our study focuses primarily on direct relationships between oil prices and stock prices without extensively modeling the intervening macroeconomic channels. Future research could develop structural models incorporating variables such as government spending, corporate earnings, consumer confidence, and investment patterns to illuminate the specific transmission mechanisms through which oil price fluctuations influence stock market performance in Saudi Arabia.

Finally, while our analysis examines the impact of oil price levels, it does not extensively address oil price volatility as a distinct factor. Future studies could investigate whether oil price uncertainty and volatility exert independent effects on Saudi market sectors beyond the impact of price levels, potentially uncovering additional risk factors relevant for investment and policy decisions.

Conclusions

This study investigated the relationship between oil price fluctuations and sectoral stock performance in the Saudi financial market, employing a comprehensive methodological framework encompassing stationarity testing, cointegration analysis, causality assessment, and

dynamic model estimation. The research findings provide significant contributions to understanding the intricate connections between petroleum markets and financial assets in resource-dependent economies.

The empirical analysis established that despite non-stationary behavior at levels, both oil prices and stock prices across Saudi market sectors share a common integration order, establishing the foundation for long-term equilibrium relationships. The cointegration tests convincingly demonstrated the existence of such relationships, revealing that market mechanisms maintain stable long-run connections between oil prices and stock prices despite short-term fluctuations and occasional divergences.

The causality analysis revealed a bidirectional relationship between oil prices and stock prices, suggesting complex feedback mechanisms where each variable influences the other through various economic and expectation channels. These finding challenges unidirectional perspectives on oil-finance relationships, positioning the Saudi financial market as both a recipient of oil price impacts and a potential signal generator for global petroleum markets.

The quantitative model estimation indicated a substantial elasticity of stock prices to oil price changes, with a 1% increase in oil prices associated with approximately a 6.29% increase in stock prices across sectors. This amplified relationship underscores the continued significance of petroleum dynamics for financial asset valuations in Saudi Arabia despite ongoing economic diversification efforts.

Collectively, these findings enhance our understanding of energy-finance interconnections in resource-dependent economies, offering valuable insights for investors developing portfolio strategies, policymakers designing economic stabilization mechanisms, and market participants navigating the complex landscape of Saudi financial markets. While economic diversification initiatives under Vision 2030 aim to reduce petroleum dependence, our results indicate that oil price movements remain central to financial market dynamics in Saudi Arabia, highlighting both the challenges and importance of structural economic transformation.

Future research should extend these analyses to more recent periods, incorporate additional macroeconomic transmission channels, explore firm-level moderating factors, and investigate the distinct impacts of oil price volatility beyond price levels. Such expanded inquiries would further enhance our understanding of this critical relationship, contributing to both theoretical frameworks in financial economics and practical applications in investment and policy domains.

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