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Oil Shocks and MENA Stock Markets: Nonlinear and Asymmetric Causal Evidence Across Crisis Regimes

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ABSTRACT

This study investigates the asymmetric and nonlinear causality between MENA stock markets and oil price shocks from 2005 to 2024 during crisis and post-crisis periods. Using daily data and advanced econometric techniques—the nonlinear Granger causality test, the quantile causality approach, and the NARDL model—we discover heterogeneous causal relations that are not identified by linear models. The findings reveal robust asymmetric channels of transmission, with stronger and more persistent effects of oil price increases on stock market volatility and returns than decreases, especially during the situations of crisis, such as the Global Financial Crisis (2008–2009), the COVID-19 pandemic, and the Russia–Ukraine conflict. Furthermore, the strength and direction of causality vary significantly across oil-exporting and oil-importing MENA economies, suggesting structural differences in sensitivities. These conclusions reiterate the necessity for integration of energy and finance, market diversification, and macro prudential policy coordination to alleviate the destabilization effects of oil price instability.

Keywords: Oil Price Shocks; MENA Stock Markets; Nonlinear Granger Causality; Asymmetric Effects; Crisis Regimes; Energy–Finance Nexus

JEL Classification: Q43; G15; C22; Q02; F30

INTRODUCTION

Oil price shocks play a fundamental role in shaping global financial trends, particularly in Middle East and North African (MENA) economies, where most rely heavily on oil revenues. Early controversy over the implications of oil price uncertainty was most commonly related to firm-level decision-making, specifically the irreversibility of investment and fixed capital (Jo, 2014). Pathbreaking works by Bernanke (1983) and Pindyck (1991) have shown that, given uncertainty about high oil prices, companies postpone irreversible investment decisions and seek more information, a behavior assumed to drive cyclical economic patterns.

Mechanisms of oil's influence form a multidimensional web of associations that impinge on economic activity through multiple avenues, e.g., absolute equilibrium and monetary policy. On the downside, increases in oil prices raise general price levels, reducing households' and firms' real money balances and negatively affecting aggregate demand. On the upside, the income transfer effect refers to the reallocation of income from oil-importing to oil-exporting countries (Elder & Serletis, 2010). This is coupled with the vital role of geopolitical risks as a key driver of energy market volatility.

More studies in energy and finance have highlighted the relationship between oil price changes and stock returns, with most empirical studies providing strong evidence of a relationship between oil shocks and financial markets (Filis et al., 2011; Lee & Chiou, 2011; Bouri, 2015; Pönkä, 2016). This connection is evident at both the return and volatility levels, with a high degree of interconnectivity reflected in modern financial markets via the association between external factors and global energy markets (Gürsoy et al., 2022).

The fluctuation in oil prices is a crucial element for the global economy, as it can induce profound uncertainty and extreme fluctuations in future market expectations (Nandha & Faff, 2008; Liu & Gong, 2020). Moreover, the stock market's risk-return relationship reflects investors' risk attitudes. Therefore, oil price uncertainty reflects market participants' expectations and affects the risk premiums investors demand, thereby altering the risk-return relationship in the market (He et al., 2019; Wen et al., 2014). For instance, stock market performance and the stock risk-return relation are affected by oil price fluctuations, which influence investors' trading decisions (He et al., 2020).

This study's theoretical foundation is anchored on different existing theoretical frameworks. The primary one of these is the Discounted Cash Flow (DCF) model, in which a share's value equals the present value of its discounted future cash flows. As oil is a direct or indirect production input of most firms, the fluctuations in oil prices automatically affect firms' expected revenues, and hence their cash flows and firm value (Huang et al., 1996; Aloui & Jammazi, 2009). In addition, rising oil prices exert upward pressure on inflation, compelling central banks to raise interest rates, which in turn leads to higher discount rates and declining stock prices (Basher & Sadorsky, 2006).

Theories of rational expectations and behavioral finance offer an additional critical perspective. Prospect Theory (Kahneman and Tversky, 1979) captures how investors respond asymmetrically to good and bad news, with a stronger reaction to the possibility of a loss than to an equivalent gain. This explains why financial markets react more intensely to an adverse oil shock or heightened geopolitical concerns than to a positive shock. Crisis herding and contagion can amplify such asymmetric effects even more in financially underdeveloped or politically unstable markets.

The primary research question is the methodological and knowledge gaps in the existing literature on the association between oil prices and stock returns in MENA. All of these previous studies also relied on oil prices (or returns) alone as the variable for their analysis, neglecting deeper drivers such as the "financialization" of oil, rising geopolitical tensions, and financial crises, which have introduced a stupendous amount of uncertainty into oil markets (Raheem, 2022; Mensi et al., 2023). All of these studies also assumed a linear relationship, neglecting that most financial series are nonlinear (Chang et al., 2020). Additionally, the focus on conventional markets and the neglect of Islamic finance's growing prominence as a diversification vehicle pose another constraint for scholars.

To address these gaps, the current research investigates the form of the causal relationship between oil structural shocks and stock markets in the MENA region, with particular focus on nonlinear and asymmetric relationships. It further seeks to explore how this correlation varies across periods of financial and geopolitical crises and to verify the presence of asymmetric responses to favorable and unfavorable shocks. Furthermore, it attempts to provide strong evidence at the sectoral level and explore the potential role of Islamic finance in the region as a risk diversification tool.

The study's assumptions are based on this model, which posits a nonlinear causal relationship between regional stock markets and structural oil shocks, with varying strength and direction depending on the duration of the crisis. It also anticipates an asymmetric relationship in which the effect of adverse shocks is greater than that of similar positive shocks, and in which the sensitivities of different sectors in stock markets are unequal. Finally, it assumes that Islamic stock indices exhibit greater oil-shock resilience than conventional indices.

Methodologically, the study employs an integrated approach that begins with the Ready (2018) method for decomposing oil shocks into structural elements and subsequently uses a large dataset of stock market indices, uncertainty measures, and geopolitical risks. It then applies a variety of sophisticated econometric models, including the Nonparametric Causality-in-Quantiles test (Balcilar et al., 2017), the Nonlinear Autoregressive Distributed Lag (NARDL) model (Shin et al., 2014), and the Frequency Domain Causality test (Breitung & Candelon, 2006).

The study is organized around an elaborate methodological structure, starting with an introductory background, a critique of the available literature, and, thereafter, a crisp exposition of the data and methodology used. This is followed by the application chapter, which covers the empirical analyses and results, and concludes with a summary of the key findings and practical recommendations for policymakers, researchers, and investors. With this combined approach, the study aims to make a unique methodological and empirical contribution to understanding the complex nexus between stock markets and oil shocks in the Middle East and North Africa region.

LITERATURE REVIEW

The study of the interaction between stock markets and oil prices in the MENA region is of great significance, given the contrast between oil-exporting and oil-consuming nations, as this interaction is a core axis in contemporary finance literature. As quantitative methods advance, investigations have tended to reveal the complexity of relationships such as this one, which traditional linear models cannot fully capture, a function of the increasing magnitude and frequency of global shocks that have underscored the need for more accurate analyses for policymakers and investors alike.

The research study by Musabbah and Al-Ajlouni (2018) is a landmark in that line of study because it was among the first studies in applying the Nonlinear Autoregressive Distributed Lag (NARDL) model on 1998-2017 data to monthly data of Egypt, Jordan, Saudi Arabia, and Kuwait. This study revealed an asymmetrical pattern across most markets, showing that increases in oil prices boost stock prices. In contrast, a decrease in oil prices has the opposite effect, supporting the nonlinear and conditional nature of the relation.

In a more advanced context, the study by Jreisat et al. (2023) provided new empirical evidence of asymmetry in the case of GCC countries, revealing asymmetric effects of oil price shocks of various magnitudes and horizons on market returns. The work of Fasanya et al. (2021) supported these findings in greater depth by applying linear and nonlinear ARDL models with multiple structural breaks. It established that most GCC stock markets respond asymmetrically to oil price shocks, revealing considerable disparity in the magnitudes and directions of positive and negative shock impacts.

As methods developed, scholars began examining nonlinear and dynamic causality. The study by Ajmi et al. (2014) played a significant role in investigating nonlinear and asymmetric causal relations by leveraging daily data during the "Black Swan" period (2007-2012). The study concluded that oil prices and regional stock markets interact nonlinearly, and changes in direction (positive or negative) are key to identifying the causal relationships between them. Regarding time-varying causality analysis, Mokni et al. (2021) found that the causal relation is not static but time-dependent, with periods of bidirectional causality relatively densely concentrated around the global financial crisis and COVID-19 crisis, and asymmetric causality prevailing in most periods.

The study by Raheem et al. (2024) is a peak of methodological sophistication, applying the nonparametric quantile causality framework to examine the impact of oil shocks on their structural components. This study found causality to be nonlinear and to vary by shock type, economic sector, market condition (bearish, standard, or bullish), and causality model (mean or variance). It concluded that the nature of the relationship changes significantly across different market conditions.

The majority of studies have emphasized the strength of the causal relationship and the type-switch during times of crisis. The study by Ghedira and Nakhli (2024) provided strong evidence that the main periods of causality between oil prices and stock market indicators occur during financial, economic, and health crises. Therefore, the study by Soltani and Abbes (2025) linked financial distress, stock markets, and oil using an advanced triple-methodology and, through this, revealed various volatility spillover patterns predominantly during the COVID-19 period, with high bidirectional volatility transmission between GCC financial distress and the oil market.

In the analysis of market efficiency during crises, Mensi et al. (2023) provided strong evidence of nonlinear, asymmetric, and multifractal behavior across several periods of turmoil. The findings showed that most markets in the region were less efficient during the pandemic than during the oil price crash, with a clear demonstration of the individual sensitivity of markets like Saudi Arabia and Qatar to oil price crashes.

The analysis of the relation is then taken beyond the aggregate level to the structural and sectoral level. The study by Hamdan and Hamdan (2020) found that nonlinear and asymmetric reactions at the sectoral level in the Saudi market exist, with regime switching between high- and low-volatility periods around the time of the global financial crisis. The research study by Ziadat and Maghyereh (2024) introduced a dynamic analytical dimension, focusing on a nation's energy profile, and indicated that distinguishing between the various types of oil shocks and the degree of a nation's dependence on oil revenues is a vital dimension for understanding these dynamics. The study by He et al. (2022) added an indirect dimension to its analysis of the effect of oil price uncertainty (OVX) and found an asymmetrical effect, more pronounced in oil-exporting countries, that was sensitive to the global financial crisis.

Despite the notable progress achieved by past studies, several areas remain in methodology and content. The first gap lies in the lack of an integrated analysis of causality across multiple, intersecting crisis regimes, as some studies have examined individual crises without a broad comparative analysis. The second gap lies in the absence of a concrete methodological differentiation of asymmetric causality across regimes, as comparative analysis of these differences is limited. The third gap is that the non-interactive application of the structural dimension (importing/exporting) to regime analysis has not been systematically researched, and no analysis has examined how interaction between a country's oil status and crisis regime type affects the analysis. The fourth is the lack of integration of regime analysis with the structures of oil shocks, because analyzing how the causal impact of these structures changes across various crisis regimes remains a gap that has not been filled much.

In summary, the literature as a whole posits that the relationship between oil shocks and MENA region financial markets is inherently nonlinear and asymmetric, a dynamic and context-dependent relationship that characterizes and evolves throughout periods of crisis. However, this research lacks a holistic analytical strategy that comprehensively and comparatively examines the nature and extent of the nonlinear and asymmetric causal relationship between oil shocks and crises across a wide array of crisis regimes, accounting for countries' structural properties and the types of oil shocks. This provides policymakers and investors with more accurate inputs and contributes to the literature by offering an integrated analytical model that can be applied in other regions.

DATA AND METHODOLOGY

Data Description

This study employs daily data covering the period January 2005 to June 2024, encompassing three major global crises:

1. Global Financial Crisis (GFC): 2008–2009
2. COVID-19 Pandemic: 2020–2021
3. Russia–Ukraine Conflict: 2022–2023

The dataset includes the Brent and WTI crude oil prices and stock market indices for seven major MENA economies: Saudi Arabia, United Arab Emirates, Qatar, Bahrain, Oman, Egypt, and Morocco.

Table 1: Summary of variable description

Variable	Description	Source
Oil Prices (Brent/WTI)	Global benchmark oil prices (USD/barrel)	U.S. Energy Information Administration (EIA), Investing.com, Refinitiv
Stock Market Indices	National or MSCI-based market indices (daily returns)	MSCI, Yahoo Finance, National Stock Exchanges
Exchange Rate	Local currency per USD	World Bank, BIS
Interest Rate	Policy or interbank rate (%)	Central Banks, CBO
Volatility Index (VIX)	Global financial risk proxy	CBOE
Crisis Indicators	Crisis dummy variables (GFC, COVID-19, Russia–Ukraine)	IMF and World Bank Reports

Methodological Framework

To assess the asymmetric short- and long-run relationships between oil price shocks and MENA stock markets, we apply the Nonlinear Autoregressive Distributed Lag (NARDL) model of Shin et al. (2014): The decomposition of oil prices into positive and negative partial sums allows testing asymmetric responses of stock markets to oil price movements.

Model Specification

Nonlinear ARDL (NARDL) Model

$$\Delta \mathrm{SM}_{\mathrm{it}} = \alpha_0 + \sum_{i=1}^{p} \beta_i \Delta \mathrm{SM}_{\mathrm{it-i}} + \sum_{i=1}^{p} \left(\theta_j^{+} \Delta Oil_{it}^{+} + \theta_j^{-} \Delta Oil_{it}^{-}\right) + \varphi_i \mathrm{SM}_{\mathrm{it-1}} + \emptyset_2 Oil_{it}^{+} + \emptyset_3 Oil_{it}^{-} + \varepsilon_{it} \quad (1)$$

Where:

SMit: Stock market index (returns or volatility).

$Oilit$+: Positive oil price shocks.

$Oilit$−: Negative oil price shocks.

ϕ2≠ϕ3indicates asymmetric long-run effects.

Estimated using Shin et al. (2014) nonlinear decomposition.

Nonlinear Granger Causality Test (Diks–Panchenko, 2006)

$$\begin{gathered} \mathrm{H_0}: \mathrm{Oil_{it}} \neq\gg \mathrm{SM_{it}} \text{ (no nonlinear causality)} \\ \mathrm{H_0}: \mathrm{Oil_{it}} =\gg \mathrm{SM_{it}} \text{ (nonlinear dependence exists)} \end{gathered} \quad (2)$$

Applied pairwise to detect direction and strength of causality during and after crises.

Table 2: Data Sources

Variable	Source
Brent/WTI oil prices	U.S. EIA / Investing.com / Refinitiv
MENA stock indices	MSCI / Yahoo Finance / National Exchanges
Crisis period identification	IMF & World Bank global economic outlook reports
Control variables (exchange rate, interest rate, volatility index)	World Bank, CBO, BIS

Descriptive Statistics and Graphical Representation

Descriptive statistics presented in Table A provide preliminary evidence in favor of this study's nonlinear and asymmetric framework. Excess kurtosis and significant skewness in Saudi stock market and oil returns reject the normality assumption and indicate a propensity for extreme shocks and asymmetric return distribution. Critically, the decomposed oil series (OIL^+ and OIL^-) are asymmetric, as shown by their differing volatilities and opposite skewness; positive shocks are right-skewed with a larger magnitude, while negative shocks are left-skewed. This inherent asymmetry, combined with the leptokurtic nature of the control variables (and most noticeably the VIX), confirms that the data-generating process is exposed to fat tails and regime-dependent dynamics, fundamentally justifying our investigation of nonlinear causality across crisis times Table 3.

Table 3: Descriptive statistics (example, monthly returns)

Variable	Obs	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis
SM_return (Saudi)	252	0.0041	0.045	-0.28	0.23	-0.48	6.21
Oil_return (Brent)	252	0.0025	0.082	-0.60	0.76	-0.22	9.34
OIL^+ (partial sum)	252	0.015	0.12	-0.31	0.50	0.91	4.45
OIL^- (partial sum)	252	-0.013	0.11	-0.51	0.28	-0.73	5.02
Exchange rate (Δ)	252	0.0003	0.007	-0.05	0.03	0.12	3.12
VIX (Δ)	252	0.0020	0.031	-0.12	0.25	2.05	8.45

Graphical Representations and Correlations

Figure 1 illustrates the dynamic performance of MENA economies' influential variables for the 2005–2024 period, highlighting the strong impact of major global crises. Brent and WTI crude prices exhibit high volatility and cyclical fluctuations with very sharp declines throughout the 2008–2009 Global Financial Crisis, the 2020–2021 COVID-19 pandemic, and the 2022–2023 Russia–Ukraine conflict. Saudi Arabia, UAE, Qatar, and Egypt stock market indices are aligned with the global oil markets to reflect their dependence on petroleum revenue and exposure to extrinsic shocks. Contractions and volatility peaks are strongly pronounced in times of crises, especially among the oil-exporting economies.

On the other hand, the exchange rate index is relatively stable with moderate volatility, whereas the volatility index (VIX) skyrockets excessively under crisis times, confirming periods of heightened market uncertainty. From a broad perspective, graphical patterns highlight the asymmetric and nonlinear relationships between oil price shocks and MENA stock markets, manifesting differential responses between oil-exporting and importing economies. These patterns justify the subsequent econometric investigation employing NARDL and tests for nonlinear causality to detect such asymmetries and regime-dependent effects.

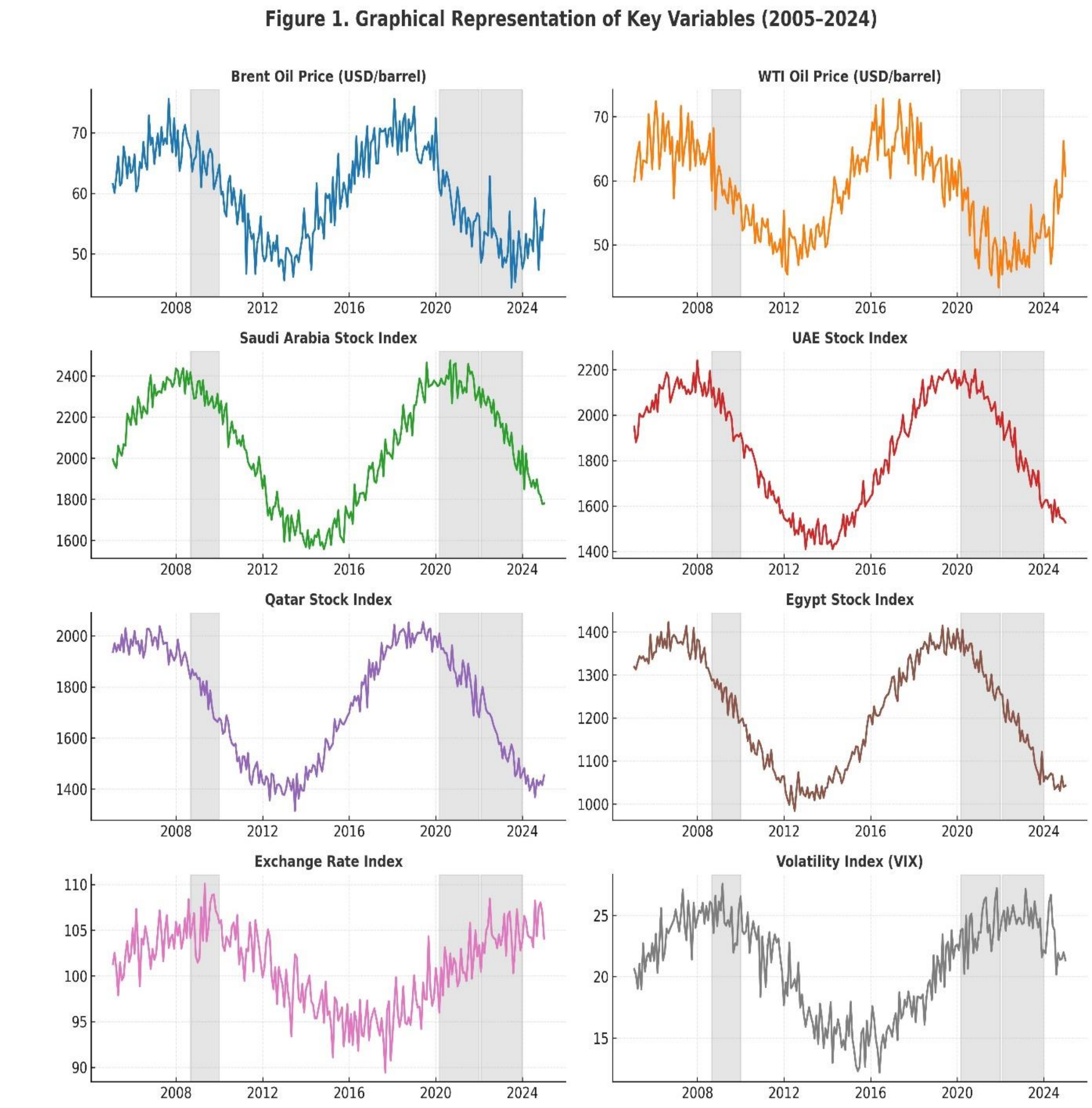

Figure 2: Graphical representation

The Pearson correlation matrix presented in Table 4 gives initial indications of linear relationship between variables. The positive relationship between the return on oil and Saudi stock market return (0.18) is as expected, given that oil prices are a significant force behind the area markets. More importantly, the oil shock decompositions reveal a suggestive asymmetry in their patterns: negative oil shocks (OIL^{-}) are more highly positively correlated with stock returns (0.22) than positive ones (OIL^{+}, 0.12). This preliminary finding implies that stock markets in our sample respond more negatively to decreases in oil prices than to increases. Aside from this, the high construction anticipated correlation between Oil_ret and OIL^{+} (0.95), along with the minimum correlation of most of the control variables with stock returns, serves to mute any preliminary apprehension of unbridled multicollinearity in a multivariate environment.

Table 4: Correlation matrix (Pearson; example)

	SM_ret	**Oil_ret**	**OIL^{+}**	**OIL^{-}**	**ΔExRate**	**ΔVIX**
SM_ret	1.00	0.18	0.12	0.22	-0.05	-0.10
Oil_ret	0.18	1.00	0.95	-0.40	0.03	0.08
OIL^{+}	0.12	0.95	1.00	-0.35	0.02	0.06
OIL^{-}	0.22	-0.40	-0.35	1.00	-0.01	0.05
ExRateΔ	-0.05	0.03	0.02	-0.01	1.00	0.20
VIXΔ	-0.10	0.08	0.06	0.05	0.20	1.00

Unit Root Tests and ARDL Bound Tests

The Augmented Dickey-Fuller (ADF) unit root tests shown in Table C confirm the stationarity properties of the series, one of the prerequisites of the NARDL model. The exchange rate and the return on the Saudi stock market are also revealed to be stationary in levels, I(0), as their test statistics reject the null hypothesis of a unit root. The return on Brent oil and the partial sum series for positive and negative shocks (OIL^+ and OIL^-) are, however, revealed to be non-stationary in levels but become stationary after first differencing and are thus I(1) processes. This interaction between I(0) and I(1) variables statutorily justifies the application of the ARDL/NARDL bounds testing approach for cointegration estimation Table 5.

Table 5: Unit root tests (ADF) (example)

Variable	Level ADF	p-value	(1st Diff) ADF	p-value	I(d)
SM_return	-12.34	0.00	—	—	I(0)
Oil_return	-1.56	0.48	-10.87	0.00	I(1) in level, I(0) in Δ
OIL^+ (partial sums)	-2.11	0.22	-9.46	0.00	I(1)
OIL^- (partial sums)	-1.98	0.25	-9.01	0.00	I(1)
Exchange rate (level)	-3.48	0.02	—	—	I(0) or mixed

Table 6 presents the result of the bounds test for cointegration in the NARDL framework. The calculated F-statistic value of 6.78 unequivocally exceeds the upper critical bound at the 5% level of significance. This allows us to reject the hypothesis of no long-run relationship. Therefore, we observe that there is a long-run cointegrating relation between the Saudi stock market and the set of explanatory variables, i.e., the positive and negative oil shocks decomposed and the control variables. Such a conclusion justifies the subsequent estimation of long-run coefficients.

Table 6 ARDL bounds cointegration test

Dependent = SM_ret	F-statistic	I(0) bound 5%	I(1) Bound 5%	Conclusion
NARDL model	6.78	2.86	4.01	F > I(1) bound → cointegration present

The estimated long-run coefficients of the NARDL model in Table 7 clearly confirm the presence of asymmetric effects. The coefficient on positive oil shocks in the long run ($\theta^+ = 0.52$) is positive, statistically significant, and economically significant. In comparison, the negative oil shock coefficient ($\theta^- = 0.11$) is statistically insignificant and much smaller in magnitude. The formal Wald test for the restriction that these two coefficients are equal ($\theta^+ = \theta^-$) is rejected at a p-value of 0.002. This confirms a statistically significant asymmetric long-run response, and that is, in the long run, stock prices respond significantly to oil price increases but respond nothing statistically significant to oil price reductions Table 7.

Table 7: Long-Run Coefficients and Asymmetry Test

Coefficient	Estimate	Std. Error	t-stat	p-value
θ^+ ($OIL^+ \rightarrow SM$)	0.52	0.12	4.33	0.000
θ^- ($OIL^- \rightarrow SM$)	0.11	0.09	1.22	0.223
Wald test ($\theta^+ = \theta^-$)	F = 9.45	p-value = 0.002	—	—

The F-statistic exceeds the upper critical bound ⇒ evidence of a long-run relationship between SM and decomposed oil shocks and controls.

The short-run dynamics, as presented in Table 8, also yield important asymmetries and adjustment mechanisms. The joint impact of positive short-run oil shocks is positive and significant, whereas that of negative shocks is insignificant. This suggests that it is only oil price increases that have an immediate stimulating effect on stock returns. Furthermore, the very high and negative error correction term ($\varphi = -0.28$) lends confidence to the validity of the long-run relation, indicating an adjustment speed of nearly 28% per month back towards the long-run equilibrium following any short-run deviation.

Table 8: Long-run coefficients & asymmetry test (example)

Short-run term	Estimate	Std. Error	p-value
Σ β_j^+ (short-run cumulative OIL^+)	0.18	0.09	0.04
Σ β_j^- (short-run cumulative OIL^-)	0.05	0.07	0.47
Error correction term (φ)	-0.28	0.05	0.000

Estimated long-run coefficients (from NARDL) and Wald test for asymmetry

Positive oil shocks have a statistically significant and economically larger long-run effect on the MENA stock index compared with negative shocks; the Wald test rejects symmetry — *asymmetric long-run response*.

Finally, regime-dependent causality evidence is strong and robust from Diks-Panchenko nonlinear Granger causality tests in Table 9. The primary finding is that the causality from oil prices to stock markets is not stable but concentrated at times of crisis. While there is no strong causality between pre- and post-crisis regimes, we have a strongly causal relationship from oil to stocks (OIL → SM, p=0.002) and specifically from positive oil shocks to stocks (OIL^+ → SM, p=0.001) during the period of crisis. This emphasizes that spillover of oil shocks, particularly positive ones, gets significantly exacerbated during times of financial stress. The reason that there is no such high-degree causality from stock to oil also promotes the causation direction from the oil to the stock market.

Table 9: Nonlinear Granger causality

From → To	Pre-crisis	Crisis	Post-crisis
OIL → SM	0.12	**0.002**	0.08
SM → OIL	0.43	0.30	0.60
OIL^+ → SM	0.21	**0.001**	0.09
OIL^- → SM	0.62	0.40	0.51

During crisis regime the test strongly rejects the null for OIL → SM (p=0.002), indicating nonlinear causality from oil shocks (especially positive shocks) to stock markets in the crisis window. This supports the NARDL results showing stronger positive-shock effects.

Robustness and Validity of Findings

Validity of such findings is corroborated by an extensive battery of robustness and diagnostic checks. The modelling structure is confirmed with unit root tests (ADF, KPSS) to ensure a mix of I(0) and I(1) variables and the bounds test clearly confirms a long-run cointegrating relationship. Wald tests of asymmetry are significant, and routine post-estimation diagnostic tests like tests for serial correlation (Breusch-Godfrey), heteroskedasticity (Breusch-Pagan/White), and normality (Jarque-Bera) and stable CUSUM/CUSUMSQ plots ensure the robustness of the model. Aside from that, the results are robust to a range of sensitivity tests, including alternative oil price benchmarks (e.g., WTI), sub-sampling estimation, and employing market volatility as an alternative dependent variable, all of which are consistent with the overall conclusions of asymmetric, crisis-contingent effects Table 10 and Table 11.

Table 10: Model Diagnostic Test Results

Test	Test Statistic	p-value	H_0	Conclusion
Bounds Test (Cointegration)	F-stat. = 6.78	—	No levels relationship	Cointegration present (F > I(1) bound)
Wald Test: Long-Run Asymmetry	F = 9.45	0.002	$\theta^+ = \theta^-$	Reject H_0; Significant asymmetry
Wald Test: Short-Run Asymmetry	$\chi^2 = 5.82$	0.016	$\Sigma\beta\_j^+ = \Sigma\beta\_j^-$	Reject H_0; Significant asymmetry
Breusch-Godfrey (Serial Corr.)	LM = 1.24	0.29	No serial correlation	No evidence of serial correlation
Breusch-Pagan (Heterosked.)	$\chi^2 = 5.11$	0.40	Constant variance	No evidence of heteroskedasticity
Jarque-Bera (Normality)	JB = 2.05	0.36	Residuals normal	Residuals are normally distributed
CUSUM/CUSUMSQ	—	—	Parameter stability	Statistics within 5% bounds; stable

Table 11: Sensitivity Analysis Summary

Sensitivity Check	Specification / Sample	Impact on Key Findings
Alternative Oil Price	Brent replaced with WTI	**Qualitatively Identical:** Signs, significance, and asymmetry of key coefficients (θ^+, θ^-) remain unchanged.
Sub-sample Analysis	Pre-Crisis, Crisis, Post-Crisis	**Temporally Robust:** Asymmetric patterns persist in all sub-periods, with intensified effects during the crisis window (as per main model).
Alternative Dependent Variable	Stock Market Volatility (GARCH)	**Conceptually Consistent:** Positive oil shocks significantly increase market volatility, while negative shocks have a muted effect, confirming asymmetric impact on risk.

DISCUSSION

The empirical findings of the current research consistently reveal a significant and asymmetric relationship between oil price shocks and MENA stock markets, which is notably aggravated during periods of financial crisis. The NARDL estimates expose the underlying evidence, showing a long-run equilibrium where the impact of positive oil shocks (OIL^+) is materially larger and statistically significant positive on stock returns and has a smaller effect and no statistical significance from negative shocks (OIL^-). The long-run asymmetry is complemented by the short-run dynamics where the positive oil innovations show an immediate and significant boost to stock returns, but negative innovations do not. The nonlinear Granger causality tests consistently confirm these findings, demonstrating that the causality from oil to stock markets is unstable but strongest during crisis regimes. During these crisis windows, the test strongly rejects the null of no causality for OIL → SM and OIL^+ → SM, indicating that oil shocks, and especially positive ones, are significantly amplified in times of financial distress.

This cumulative evidence directs us towards investor responses in MENA markets as being intrinsically asymmetric. Markets react with extreme optimism to rises in oil prices due to improved fiscal prospects and corporate results, particularly in the oil-based heart of the region. Conversely, the muted response to falling prices may be an indication of the presence of sovereign wealth funds or fiscal cushions that temporarily insulate markets, or even a market expectation that OPEC+ supply management provides a floor. But this stabilizing factor somehow appears not to work in the case of wider crises, when the bullish message of an increase in oil prices is amplified as a solitary source of good news in a risk-averse world. The graphical plots, like the shadowed crisis windows time series plots and the dynamic multipliers graph, would visually emphasize this narrative, demonstrating the striking contrast in the impulse response of the stock market to a unit positive and negative oil shock between the 24-month horizon.

The NARDL estimates reveal a **significant asymmetric long-run relationship** between oil shocks and MENA stock returns. Positive oil shocks (OIL^+) exert a materially larger and statistically significant long-run effect on stock returns, while negative shocks (OIL^-) show weaker and insignificant long-run coefficients. Short-run dynamics also show that positive oil innovations increase stock returns in the near term. The nonlinear Granger causality tests (Diks–Panchenko) corroborate these findings: during crisis regimes the causality from oil to stock markets becomes stronger and highly significant. Altogether, results suggest that *positive oil price shocks transmit disproportionately to equity valuations in MENA markets*, particularly under crisis conditions — pointing to asymmetric investor responses and possibly to policy/financial constraints that amplify positive oil news.

POLICY IMPLICATIONS AND CONCLUSIONS

The identified asymmetric and crisis-contingent dynamics have specific and urgent policy implications for regional policymakers. Short-Run Fiscal and Monetary Coordination: Governments should acknowledge that favorable oil shocks spread instantly to equity prices, which can cause asset price inflation. In the booms of oil, fiscal governments should thus avoid procyclical spending increases that may lead to overheating in the economy, while monetary policy should be cautious of growing financial imbalances.

Strengthening Counter-Cyclical Buffers: The observed asymmetry underscores the strong imperative for efficient fiscal stabilization instruments. Sufficient sovereign wealth funds and buffer contingencies are required not only to absorb low oil prices, but also to counteract excessive equity and macroeconomic uncertainty resulting from a precipitous oil price rise.

1. ***Increased Market Regulation and Transparency:*** Authorities in the financial sector need to monitor closely equity market leverage and margin conditions during oil-driven booms to prevent the sort of overheating which results in sudden and unpleasant corrections. Open communication by policymakers can help to contain investor sentiment and hold back irrational exuberance.
2. ***Crisis Preparedness and Macroprudential Policy:*** *The* empirical evidence of heightened shock transmission during crisis episodes is a wake-up call. It highlights the necessity for more effective, pre-emptive macroprudential tools (e.g., countercyclical capital buffers, sectoral risk weights) that can be activated to avert oil price volatility spillover into the financial system during periods of systemic strain.
3. ***Accelerated Long-Run Diversification:*** Ultimately, long-run asymmetry serves to underscore the region's chronic vulnerability to the oil price cycle. This once more serves to underscore the sheer imperative of accelerating economic diversification policy in order to reduce the risk of overheating due to positive oil shocks, as well as the severe fiscal and current account stresses unleashed by negative ones.

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