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Article

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Reinvestigating the Oil Dependency of the GCC Countries' Stock Market: A Regime-Switching Cointegration Approach

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ABSTRACT

This paper investigates the asymmetric impact of oil prices on Gulf Cooperation Council (GCC) stock markets using a regime-switching cointegration approach with data from April 2012 to April 2022. We postulate that investors consider ups and downs in the stock market index instead of price-earnings ratios in their decision-making process. Our results indicate that investors exhibit more optimism during economic upturns, corresponding to positive oil shocks, than pessimism during economic downturns. The study offers several contributions to the literature: (i) Diagnostic tests affirm that constructing the model based on stock market index movements rather than P/E ratios results in superior performance. (ii) As expected for oil-dependent nations, our model attributes more significant deterministic influence to the oil market and closely tracks the stock market. (iii) The results demonstrate that positive oil shocks exert a more pronounced long-term asymmetric influence on GCC stock markets than adverse shocks. (iv) Dynamic multiplier analysis reveals that oil shocks persist longer in Oman, Bahrain, and Qatar's markets than in the UAE, Saudi Arabia, and Kuwait. (v) The stock market in the United Arab Emirates exhibits greater independence from oil price fluctuations, responding modestly, while Qatar and Bahrain markets are more sensitive.

Keywords: Stock Market, Oil Market, GCC Countries, Regime-switching Cointegration, Asymmetry
JEL Classifications: G15, Q43, C12

1. INTRODUCTION

Despite an increase in renewable energy capacity, the expansion of the global economy still relies heavily on oil and other hydrocarbons, which will continue to be the most important sources of energy for the foreseeable future (Arezki et al., 2017; Kilian, 2008; Ahmed, 2004). Although no comprehensive theory exists yet to explain the complex nature of this relationship, most research focuses on the connection between the volatility of oil prices and the behavior of financial markets, finding that crude price fluctuations affect companies' revenue and, therefore, their stock returns.

We divide the associated literature into two distinct wings. While the first concentrates on net oil-importing countries (Fang and You, 2014; Mugaloglu et al., 2021; Park and Ratti, 2008; Silvapulle et al., 2017), the second research branch focuses on oil-exporting countries (Filis et al., 2011; Masih et al., 2011; Wang et al., 2013). As the first branch of research has attracted more attention than the second, the literature on oil-importing countries has grown considerably, leaving a need for more studies on the connections between stock prices and oil prices in oil-exporting nations.

Since the Gulf Cooperation Council (GCC) holds more than 45% of proven worldwide oil reserves (Ziadat et al., 2020; Hung, 2021), this study attempts to reduce this knowledge gap using a regime-switching cointegration approach. Considering that imperfect information and uncertainty surround equity markets and impact the stock market as a whole rather than specific shares, we revise the literature to focus on the stock market index rather than the P/E ratio and reinvestigate the stock market response to the oil market, postulating that the GCC's stock market behaves differently during oil market upturns and downturns.

We offer several contributions to the literature: (i) Diagnostic tests affirm that constructing the model based on stock market index movements rather than P/E ratios results in superior performance. (ii) In line with expectations for oil-dependent nations, our model attributes more significant deterministic influence to the oil market and closely tracks the stock market. (iii) It demonstrates that positive oil shocks exert a more pronounced long-term asymmetric influence on GCC stock markets than adverse shocks. (iv) Dynamic multiplier analysis reveals that oil shocks persist longer in Oman, Bahrain, and Qatar's markets than in the UAE, Saudi Arabia, and Kuwait. (v) The stock market in the United Arab Emirates exhibits greater independence from oil price fluctuations, responding modestly, while Qatar and Bahrain markets are more sensitive.

The remainder of the paper is organized as follows. Section 2 reviews the literature. Section 3 presents the model and methodology for this study. Section 4 presents the empirical results, while Section 5 concludes the study.

2. THE LITERATURE

This section provides insight into previous empirical studies documenting the relevance of oil price changes to stock markets in oil-importing countries in general and oil-exporting nations in particular, notably in the GCC states.

2.1. Oil Importers

Regarding oil-importing countries, Huong (2020) applied the generalized autoregressive conditional heteroskedasticity (GARCH) and vector autoregressive (VAR) models to explore the role of oil price fluctuations in Asian stock markets. The empirical results reveal a significant negative correlation between the Korean stock market and oil prices. Alamgir and Amin (2021) have also looked to see if there is an interlinkage between four South Asian stock market indexes, namely those of India, Pakistan, Sri Lanka, and Bangladesh. The nonlinear autoregressive distributed lag (NARDL) model suggests the existence of an asymmetric relationship.

Shabbir et al. (2019) have applied an autoregressive distributed lag (ARDL) approach to data samples from 1990 to 2017 to investigate the correlation between oil prices and the Pakistan stock market. The empirical test shows a negative interlinkage between oil prices and the stock market.

Similar approaches have been applied to other Asian markets. Bani and Ramli (2019) utilized the ARDL model on data samples for the period 2007-2016 for Malaysian stock prices. Results suggest that oil price fluctuations harm the equities market in the long run. Guliman and Bonifacio (2015) explored the dynamic relationship between Philippine stock prices (PSEi) and real oil prices. The VAR test, the Granger causality test, and the forecast error variance decomposition (FEVD) approach were applied to monthly samples from January 1996 to December 2014. However, the study revealed a lack of relationship between stock and oil prices.

Asteriou et al. (2013) investigated links between the behavior of oil prices and the stock markets of oil-importing and oil-exporting countries. Empirical tests, including the VAR, Granger causality, and error correction models, were applied to monthly data from January 1988 to December 2008. The results indicated two main findings. First, there is a more robust reaction between oil prices and stock markets than with interest rates over the short and long run. Second, oil market fluctuations have a more substantial impact on oil-importing countries.

Le et al. (2022) explored the impact of oil market structures on stock market growth, looking at the leading oil exporters and importers among 19 Asian countries. Integrated network analysis using the generalized sequential method of moments (SGMM) estimation technique was applied to data from 2008 to 2017. The results show that the stock markets of strong oil exporters experienced more positive growth, whereas net oil importers tended to have negative growth.

Khan et al. (2019) explored the interlinkage between oil prices and Shanghai stock returns. Their study implemented the ARDL model, showing that an increase in oil prices negatively impacts stock returns in the short and long run, while a decrease in prices tends to have a positive impact. In addition, a structural breaks test revealed a marked increase in demand for oil by Asian countries in 2005, the financial crisis in 2008, and several other geopolitical events that could have an enormous impact on oil price stability, which, as a result, will influence the stock market.

Benavides et al. (2020) applied the SAVAR-MGARCH method to an analysis of Mexico. The empirical results suggest that the volatility of oil prices has little impact on Mexican stock returns but also shows a negative and positive asymmetric influence in the short run.

A study by Altintas and Yacoub (2018) applied the NARDL and ARDL approaches to monthly data for Turkey's market prices, crude oil prices, and the money supply period from January 1988 to December 2014. The outcome suggests asymmetric responses for Turkish market prices and money supply shocks. Furthermore, Kumar et al. (2021) empirically reviewed the correlation between natural gas prices, crude oil prices, gold prices, and the Indian stock market. They utilized the NARDL model for weekly data from January 1997 to June 2019. The results indicate the presence of asymmetries in the short and long run among these asset classes.

2.2. Oil Exporters

Several studies have examined the connections between oil prices and stock market movements in oil-exporting countries. For example, Okere and Ndubuisi (2017) have investigated the effects of oil price shocks on the Nigerian economy. The results reveal that crude prices significantly influence the economy by directly impacting the stock market's performance. The authors advise the government to increase economic growth by correctly exploiting its natural resources. Gil-Alana and Yaya (2014) also suggest that monthly changes in oil prices influence the Nigerian stock market. Their empirical results show that the higher the oil price, the higher returns for the country.

Teulon and Guesmi (2014) have also explored the correlations between stock market returns and oil price fluctuations in several oil-exporting countries. Their study applies a variant of the GARCH-DCC model to reveal the existence of correlations between oil and stock markets in oil-exporting countries.

2.3. The GCC

In terms of the GCC, the literature is divided into two branches. The first emphasizes research that examines the impact of oil price volatility on GCC stock markets. This area of the literature provides valuable information for portfolio construction, risk management, and hedge funds. For example, a study by Rahman (2020) evaluates the association between oil price instability on the Saudi Stock Exchange (Tadawul). Data were obtained from the World Bank's database and Tadawul from 2000 to 2017. The VAR model suggests a long-run association between the two variables under study.

Echchabi and Azouzi's (2017) research explores the causal linkage between oil prices and the Omani stock index. The study applied a Granger non-causality test to the daily stock index from January 2003 to March 2016. The outcomes suggest that unidirectional causality from oil to stock index exists. Naifar and Al Dohaiman (2013) implemented Markov regime-switching to explore the correlation between GCC stock markets and oil price changes. Their study suggests that the relation is regime-dependent, except for Oman. Akoum et al. (2012) studied the short-run and long-run association between the stock price and the oil price using six GCC countries besides Egypt and Jordan. The empirical results reveal a change in the co-movements of oil and stock prices in the GCC countries in the long run. In the short run, the dependencies are weak.

The second branch of study focuses on asymmetricity among GCC countries' oil prices and stock markets considering the market trend. For example, Cheikh et al. (2018) applied the nonlinear smooth transition regression (STR) models to study the symmetricity of the effect of the oil market on the GCC's stock market. They found that while negative oil price changes have more influence than positive ones[1], only Kuwait's responses to the positive changes. Furthermore, negative oil changes do not affect Bahrain and Saudi Arabia. However, Buncic (2019) argued that the exponential function is "ill-suited as a regime weighting function in the smooth transition models" and requires a small transition function parameter. Otherwise, the exponential regime weighting function behaves like a dummy variable. The issue could cause Cheikh et al.'s (2018) inconsistent findings.[2]

In another attempt, Fasanya et al. (2021) examined whether the oil price contributes to the behavior of GCC stock markets. The study implemented the NARDL model to estimate the effect of oil prices on P/E ratios. However, their analysis overlooked diagnostic tests, as the LM and the Ramsey RESET tests confirm that serial correlation and misspecification exist in the model. Therefore, the empirical results obtained from the estimates are biased. Furthermore, the coefficient of variation clearly illustrates a low deterministic power of oil price in the model, which seems unrealistic as oil plays a crucial role in GCC countries.

In this paper, our primary focus is the actual trends of the oil and stock markets in the GCC countries rather than volatility using a cointegration approach. While many studies establish a negative relationship between oil prices and the stock market in advanced economies[3], we postulate that positive oil shocks boost GCC's stock market. However, while positive oil shocks direct more liquidity to the GCC stock market, adverse oil shocks have less impact as the GCC countries secure their economy through financial reserves.

Furthermore, our model provides forecasting opportunities for portfolio managers, investors, and policymakers, which has received less attention in previous studies. Since the GCC economies depend highly on oil, their stock market is more predictable than other advanced economies relying less on oil. Finally, the literature needs to investigate the dynamic multiplier to observe how long the oil shocks could last in GCC's stock markets and how fast the short-run adjustment toward the long-run equilibrium is.

3. DATA AND ESTIMATION STRATEGY

3.1. Data

The data spans from April 2012 to April 2022. Tables 1 and 2 summarize descriptive statistics of the study's variables (level and logarithm); Figure 1 provides the logarithm plot of the variables included in the model. The graphs indicate a sharp drop in the oil market in early 2020 (the COVID-19 pandemic) and reveal similarities in Kuwait's and Saudi Arabia's stock market trends at first glance.

3.2. Model and Methodology

Although the existence of a cointegration relationship between the oil market and the stock market is incongruous, as often stock market movements seem to be a random walk (in other words, they are unpredictable), the economies of GCC countries, including their stock market, rely heavily upon the international oil market.[4]

Therefore, we postulate a hypothetical cointegration relationship between oil prices and the stock market, as we expect other economic indicators in the GCC countries to respond to movements in the oil price. In other words, we anticipate a long-run equilibrium as the short-run adjustment arises from disequilibria.

As the long-run equilibrium moves over time due to structural changes and economic shifts (Lucas, 1976), we should apply a method to include it in the model. We consider the long-run cointegration as follows:

$$S_t=\theta_0+\theta_1 OP_t+\varepsilon_t \tag{1}$$

1 Nandha et al. (2011) and Youssef and Mokni (2019) found the same results for the GCC nations.

2 Cheikh et al. (2018) results (Table 6) report large transition function parameters. The parameter γ is greater than 5 in all cases except Saudi Arabia.

3 For instance, see Jones and Kaul (1996), Kilian (2008), Kilian and Park (2009), and Ciner (2013).

4 Iqbal and Fasano-Filho (2003).

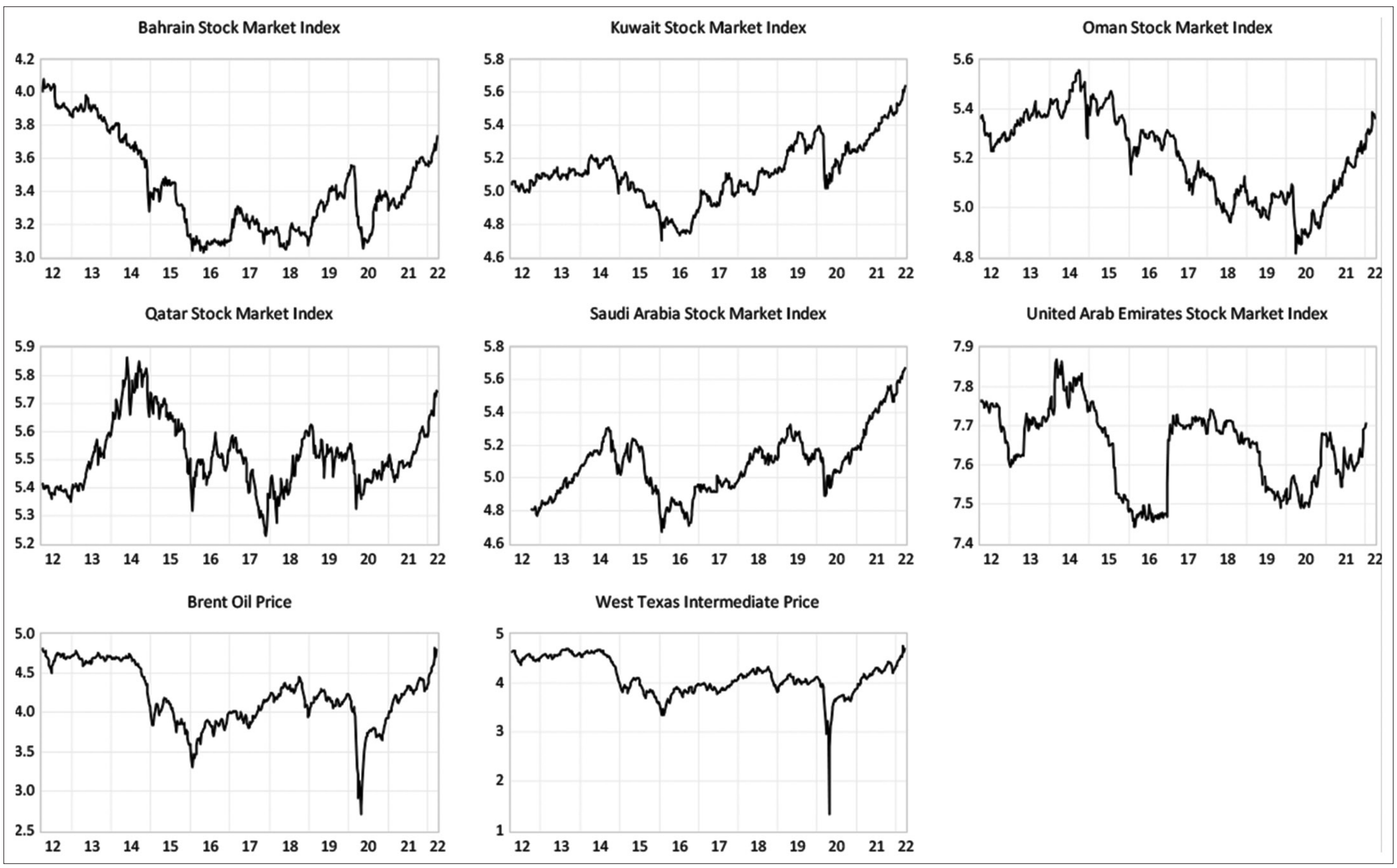
Table 1: Summary statistics for the variables (level) in the model

Statistic	Stock market index						Oil prices	
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE	Brent	WTI
Mean	31.2	158.3	647.2	69.7	521.4	11548.1	71.7	65.8
Median	27.6	159.5	651.9	68.3	519.2	11769.7	64.0	57.7
Maximum	52.8	216.5	892.6	96.7	703.2	18992.6	116.1	106.6
Minimum	20.9	114.3	461.1	51.1	367.8	5361.6	30.7	30.3
SD	9.7	23.6	116.2	9.2	78.6	2815.0	24.7	21.5

Table 2: Summary statistics for the variables (logarithm) in the model

Statistic	Stock market index						Oil prices	
	Bahrain	Kuwait	Oman	Qatar	Saudi Arabia	UAE	Brent	WTI
Mean	3.4	5.1	6.5	4.2	6.2	9.3	71.7	4.1
Median	3.3	5.1	6.5	4.2	6.3	9.4	64.0	4.1
Maximum	4.0	5.4	6.8	4.6	6.6	9.9	116.1	4.7
Minimum	3.0	4.7	6.1	3.9	5.9	8.6	30.7	3.4
SD	0.3	0.2	0.2	0.1	0.2	0.3	24.7	0.3

Figure 1: The plot of the variables in the model



Where S is the logarithm of the stock market index, and OP is the logarithm of the oil prices.[5] However, unlike the literature, we postulate that investors consider ups and downs in the stock market index instead of price-earnings ratios in their decision-making process as imperfect information and uncertainty surround equity markets and impact the stock market as a whole rather than specific shares.

We also hypothesize that positive oil shocks direct more liquidity to the GCC stock market, and adverse oil shocks have less impact as the GCC countries secure their economy through their financial reserves. Hence, we expect the stock market to behave differently during oil market upturns and downturns, which means the stock market is not a simple log-linear function of the oil market but a nonlinear one. Therefore, the model would be modified as follows:

$$S_t = \theta_0 + \mu_1 OP_t^+ + \mu_2 OP_t^- + \varepsilon_t \quad (2)$$

5 In our analysis, we consider WTI and Brent oil prices as the primary benchmarks for oil prices.

Where OP_t^+ and OP_t^- are partial sums of positive and negative changes in OP:

$$OP_t^+ = \sum_{i=1}^{t} \Delta OP_i^+ = \sum_{i=1}^{t} \max(\Delta OP_i, 0) \quad (3)$$

and

$$OP_t^- = \sum_{i=1}^{t} \Delta OP_i^- = \sum_{i=1}^{t} min(\Delta OP_i, 0) \quad (4)$$

We apply the nonlinear autoregressive distributed lags (NARDL) model proposed by Shin et al. (2014) to estimate:

$$\Delta S_t = \alpha + \delta_0 S_{t-1} + \delta_1 OP_{t-1}^+ + \delta_2 OP_{t-1}^- + \sum_{i=1}^{p} \gamma \Delta S_{t-i} + \sum_{i=0}^{q} \left(\vartheta_i^+ \Delta OP_{t-i}^+ + \vartheta_i^- \Delta OP_{t-i}^- \right) + \epsilon_t \quad (5)$$

In the model, p represents the dependent variable lags selected using the AIC, and q indicates the lag order for explanatory variables. Pesaran and Shin (1999) framed the NARDL equation using the autoregressive distributed lags (ARDL) method. The ARDL includes the past and current values of the explanatory variables (distributed lag) and the dependent variable's (autoregressive) past values as instrument variables in the model. It benefits from the dynamic mechanism, allowing short-run adjustment toward long-run equilibrium upon selecting optimal lags for the model's explanatory variables and the lagged dependent variable.

The key advantage of the ARDL approach is that while conventional cointegration methods such as vector autoregressive (VAR) and vector error correction (VECM) require the explanatory variables of the same order of integration, I(0) or I(1), the ARDL allows I(0), I(1), and mixed of I(0) and I(1). The second advantage is that, unlike conventional methods, the model has no requirement to include only exogenous regressors.

Since the oil market responds to the stock market and vice versa, one would assume bi-causality and endogeneity issues, which cause serial correlation, resulting in biased estimates and leading to unreliable hypothesis testing.

However, the ARDL approach resolves the problem, including lagged variables (Pesaran and Shin, 1999). The approach performs over methods such as dynamic ordinary least squares (DOLS), fully modified ordinary least squares (FMOLS), and maximum likelihood estimation (MLE) as it provides consistent estimates even in small samples using the OLS estimation method (Panopoulou and Pittis, 2004).

We postulate that besides the effect of excessive aggregation, sample-specific omitted variables, and measurement errors correlated with the regressors on the ARDL (Pesaran and Shin 1999), which creates economically implausible coefficients for specific groups, the nonlinear nature of the relationship is another reason behind that fact.

When we apply the ARDL approach to estimate the long-run oil price elasticity of the stock market (in equation 1), the system adjusts toward a unique equilibrium (a global attractor). However, since the Nonlinear ARDL approach assumes asymmetry, it decomposes negative (downturns) and positive (upturns) changes in oil prices, a regime-switching mechanism with the sign of decomposed variables as a regime transition.

In the model, while $\mu_1 = \frac{\delta_1}{\delta_0}$ and $\mu_2 = \frac{\delta_2}{\delta_0}$ denote the long-run impact of oil market upturns (OP_t^+) and oil market downturns $\left(OP_t^-\right)$, respectively, $\sum_{i=0}^{p} \vartheta_i^+$ and $\sum_{i=0}^{p} \vartheta_i^-$ capture the short-run dynamics of the effects of oil prices on the stock markets of the GCC countries.

The ARDL model[6] can be applied if the variables are I(1), I(0), or a mixture of both, but not I(2). We use the Dickey and Fuller (1979) stationary test to maintain the condition (Table 3). In addition, we utilize the Akaike information criterion (AIC) to determine the optimal lags in the model.

Using the dynamic multiplier, we examine the effect of positive and negative shocks in the oil market. The multipliers are defined as follows:

$$m_h^+ = \sum_{i=0}^{h} \frac{\partial c_{t+i}}{y_{t-1}^+}, \quad m_h^- = \sum_{i=0}^{h} \frac{\partial c_{t+i}}{y_{t-1}^-}, \quad n=0,1,2,\ldots \quad (6)$$

Notice that, by construction, as $h \to \infty$, $m_h^+ \to \mu_1$ and $m_h^- \to \mu_2$.

Since we postulate that the oil market inoculates more liquidity into the stock market, we expect $\mu_1>0$, $\mu_2>0$ for the stock market indexes in GCC countries. Although the core objective of the paper is to test the asymmetry of the long-run and short-run effects of oil market movements on GCC stock markets, we discuss the predictive power of the model, which is index-based rather than a price-earnings ratio.

4. EMPIRICAL RESULTS

According to the F-bounds test, the ARDL estimation for Bahrain releases no cointegration in the model between the stock market and the oil market using West Texas Intermediate (WTI) oil prices

6 Pesaran and Shin (1999) and Pesaran et al. (2001).

Table 3: ADF unit root test

Variables	Level	First difference
stock market index		
bahrain	−1.71	−21.84*
kuwait	0.14	−20.63*
oman	−1.40	−21.08*
qatar	−2.12	−22.40*
saudi arabia	−0.22	−20.93*
uae	−2.32	−19.84*
oil price		
brent-pos	2.90	−16.42*
brent-neg	0.05	−6.14*
wti-pos	1.05	−8.69*
wti-neg	0.65	−19.48*

Asterisk indicates the test statistic is significant at a 5% level

(Table 4). The oil price elasticity of the stock market index is approximately 0.57 and is significant.

The LM and Ramsey RESET tests show no sign of serial correlation and misspecification in the model. While a CUSUM test shows the model is stable during the study, a CUSUMQ test provides evidence of instability in the model.

When we apply the NARDL, there is a cointegration between the variables in the model as the F-bounds test is more than its critical value at a 5% significance level (Table 4). The oil price elasticity of the stock market in Bahrain during market upturns and downturns is 1.2 and 1, respectively. Despite the closeness of the coefficients, the Wald test confirms the long-run asymmetric effect of the oil market on the Bahrain Bourse. The result is against the literature claiming adverse oil shocks have a more pronounced impact than positive ones. The evidence supports our hypothesis that positive oil shocks direct more liquidity to the GCC stock market, and adverse oil shocks have less impact as the GCC countries secure their economy through their financial reserves.

Furthermore, the LM and Ramsey RESET tests confirm no serial correlation and misspecification in the model. The existence of nonlinearity in the model corrects the stability of the coefficients, as the CUSUMQ shows, together with the CUSUM test. The adjusted R^2 reveals that the oil market explains 40% of the variation in Bahrain stock prices. The dynamic multiplier indicates that despite a rapid response of the stock market to the oil shocks in the early stage, the full adjustment toward the new equilibrium is a prolonged process, as it takes 9 months to correct 50% of the disequilibrium (Figure 2).

When we use Brent oil prices as a proxy for oil market movements in the ARDL model, there is no cointegration as seen when the model conforms using WTI (Table 5). The elasticity of the stock market for Brent oil prices is close to WTI (0.61) and significant. The diagnostic tests reveal no evidence of serial correlation and misspecification in the model.

However, the NARDL results confirm a long-run relationship between variables in the model (Table 5). While the speed of adjustment has changed slightly using the NARDL approach, the elasticities have

Table 4: Full-information estimates of the linear and nonlinear models with WTI Oil Prices for Bahrain

Linear model			Nonlinear model		
Panel A: Short-run coefficient estimates					
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δop_t	0.23*	(0.00)	Δs_{t-1}	−0.16**	(0.08)
Δop_{t-1}	−0.01	(0.83)	Δop_t^+	−0.07	(0.41)
Δop_{t-2}	0.12*	(0.00)	Δop_{t-1}^+	−0.14	(0.15)
Δop_{t-3}	0.06	(0.12)	Δop_t^-	0.42*	(0.00)
			Δop_{t-1}^-	−0.09	(0.33)
			Δop_{t-2}^-	−0.05	(0.56)
			Δop_{t-3}^-	0.00	(0.99)
			Δop_{t-4}^-	−0.17*	(0.02)
			Δop_{t-5}^-	−0.07	(0.37)
			Δop_{t-6}^-	−0.10**	(0.09)
Panel B: long-run coefficient estimates					
Constant	1.04	(0.27)	Constant	3.63*	(0.00)
op	0.57*	(0.01)	op^+	1.20*	(0.00)
			op^-	1.00*	(0.00)
Panel C: Diagnostics					
F	1.95			5.37*	
ECM_{t-1}	−0.07*	(0.02)		−0.07*	(0.00)
LM	1.67	(0.19)		0.33	(0.72)
RESET	0.02	(0.89)		1.93	(0.17)
$\bar{R}^2$	0.29			0.40	
CUSUM	Stable			Stable	
CUSUMQ	Unstable			Stable	
Asymmetry test					
LR-Wald test				12.09*	(0.00)
SR-Wal test				0.63	(0.43)

a. Numbers inside the parentheses are P-values. b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively. c. The upper bound F-Statistic critical value at a 5% significance level for the linear and nonlinear models are 3.87 and 4.16

risen considerably. The oil market upturns and downturn coefficients are 0.85 and 0.69, respectively, and the Wald test denotes a long-run asymmetrical effect of Brent oil prices on Bahrain's stock market.

Although the CUSUM test proves the model is stable, the CUSUMQ reveals instability. Therefore, we test the model for probable breakpoints using the Quandt-Andrews unknown breakpoint test, which shows no breakpoints. According to the LM and Ramsey RESET tests, the model has no serial correlation or misspecification. The coefficient of determination based on the adjusted R^2 is about 41%, similar to the model's explanatory power when we use WTI oil prices. This means that two primary benchmarks for global oil prices have close deterministic power for Bahrain's stock market.

Figure 2: Dynamic Multiplier: WTI on Bahrain stock market shock evolution

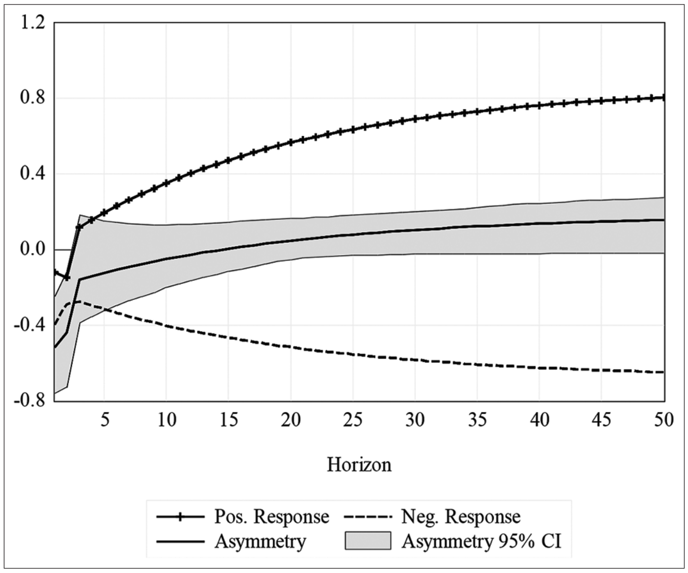


Figure 3: Dynamic multiplier: Brent on Bahrain shock market shock evolution

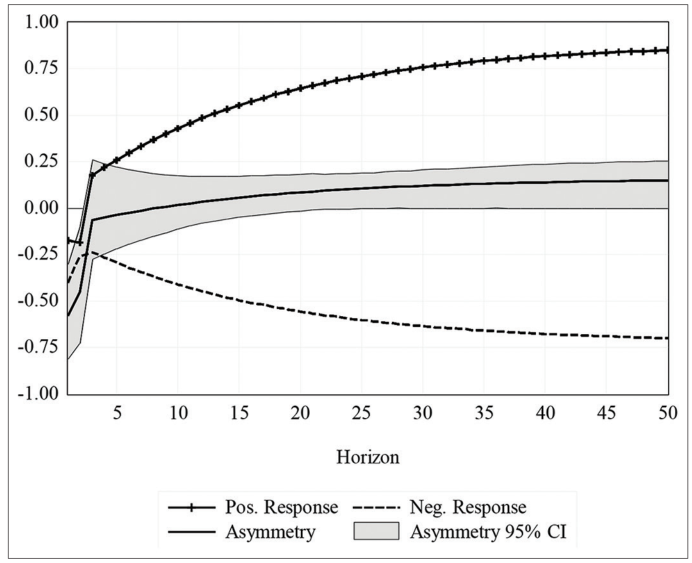


Table 5: Full-information estimates of the linear and nonlinear models with brent oil prices for Bahrain

Linear model			Nonlinear model		
		Panel A: short-run coefficient estimates			
Variable	Coefficient	P-value	Variable	Coefficient	P-value
Δop_t	0.23*	(0.00)	Δop_t^+	−0.15**	(0.08)
Δop_{t-1}	−0.05	(0.27)	Δop_{t-1}^+	−0.05	(0.53)
Δop_{t-2}	0.17*	(0.00)	Δop_{t-2}^+	0.27*	(0.00)
			Δop_t^-	0.40*	(0.00)
			Δop_{t-1}^-	−0.18*	(0.02)
		Panel B: long-run coefficient estimates			
Constant	0.82	(0.31)	Constant	3.65*	(0.00)
op	0.61*	(0.00)	op^+	0.85*	(0.00)
			op^-	0.69*	(0.00)
		Panel C: Diagnostics			
F	1.93			3.45**	
ECM_{t-1}	−0.07*	(0.02)		−0.06*	(0.00)
LM	1.67	(0.19)		1.99	(0.14)
RESET	0.02	(0.88)		0.20	(0.66)
$\bar{R}^2$	0.31			0.41	
CUSUM	Stable			Stable	
CUSUMQ	Unstable			Unstable	
Asymmetry Test					
LR-Wald Test				6.34*	(0.01)
SR-Wal Test				0.88	(0.35)

a. Numbers inside the parentheses are P-values. b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively. c. The upper bound F-Statistic critical value at a 5% significance level for the linear and nonlinear models are 3.87 and 4.16

Figure 4: The NARDL forecasting for Bahrain stock market (Model with WTI prices)

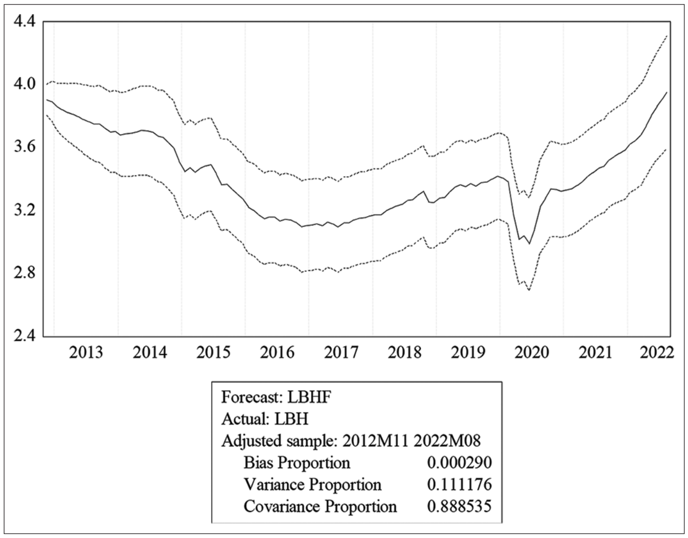


Figure 5: The NARDL forecasting for Bahrain stock market (Model with Brent oil prices)

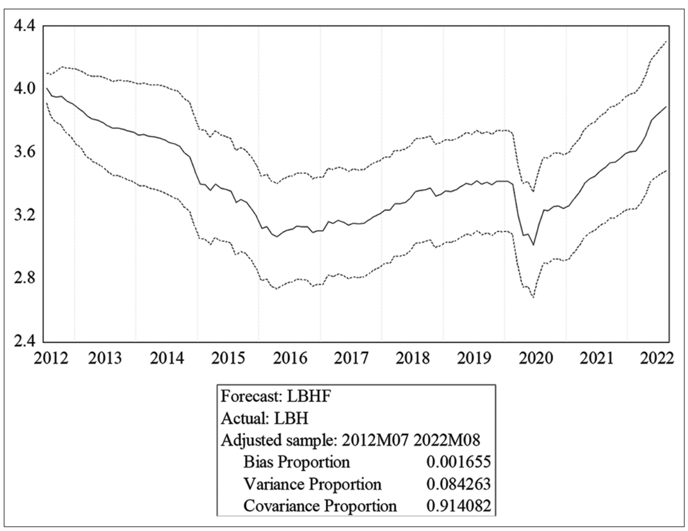


Figure 6: Dynamic Multiplier. WTI on Kuwait stock market shock evolution

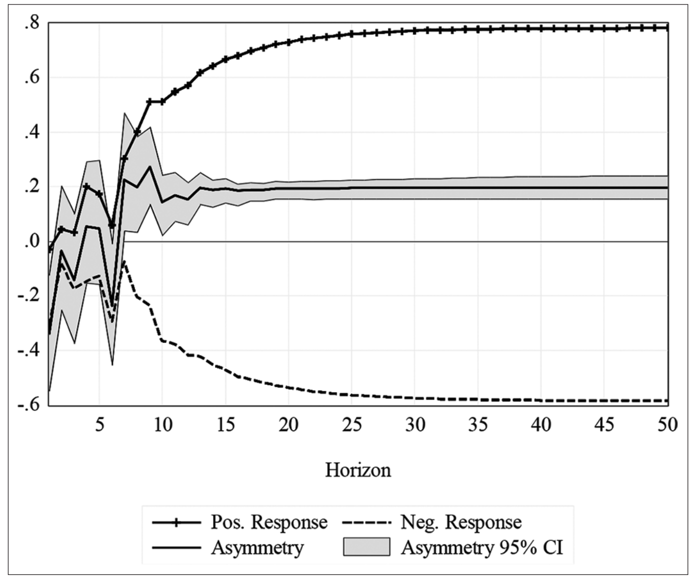
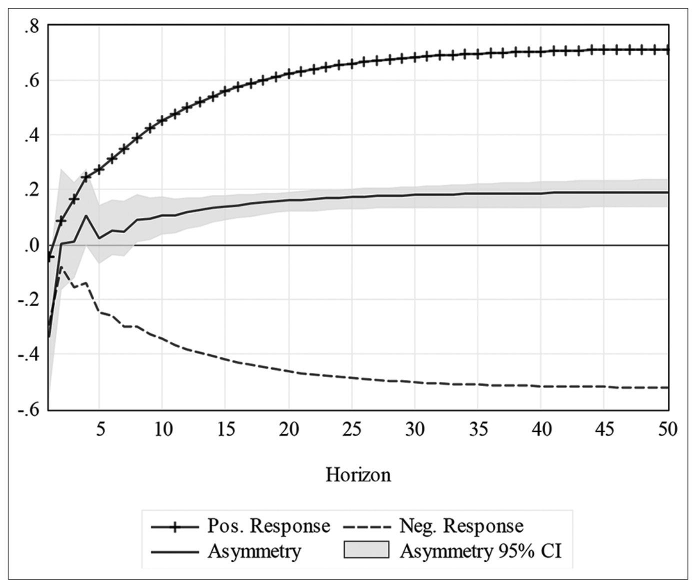


Figure 7: Dynamic Multiplier. brent on kuwait stock market shock evolution



In addition, the dynamic multiplier indicates that the Bahrain stock market responds rapidly to the oil shocks in the early stage but responds gradually afterward. It takes 11 months to achieve 50% of the adjustment toward equilibrium (Figure 3). Our model performs well in forecasting Bahrain’s stock market using the WTI and Brent oil prices, as the bias and variance proportions are small, which indicates the mean of the forecast is well tracking the mean of the stock market in Bahrain (Figure 4 and 5).[7]

The ARDL estimates for Kuwait show that considering WTI oil prices builds no cointegration as the F-bounds test is far below the lower bound critical values (Table 6). The elasticity of the Kuwait stock market for WTI is dramatically large but insignificant. However, when we apply the NARDL model, the F-bounds test reveals a strong cointegration between variables in the model (Table 6). We find that the stock market is asymmetrical (in the long run) and significantly responds to upturns and downturns in the oil market with elasticities of 0.78 and 0.58, respectively.

Furthermore, the diagnostics tests have no evidence of serial correlation or misspecification in the model, and the CUSUM test and the CUSUMQ confirm that the coefficients are stable. The adjusted illustrates that the oil market can explain 40% of Kuwait’s stock market variation, much like the Bahraini economy. However, Kuwait’s stock market adjusts faster toward equilibrium as the error correction coefficient is about −0.22. While 50% of the adjustment occurs in 3 months, the oil market impact is weaker for Kuwait’s stock market than for Bahrain. According to the dynamic multiplier, the stock market in Kuwait responds sharply

7 Pindyck and Rubinfeld (1998).

Table 6: Full-information estimates of the linear and nonlinear models with WTI Oil prices for Kuwait

Linear model			Nonlinear model		
Panel A: short-run coefficient estimates					
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δop_t	0.15*	(0.00)	Δs_{t-1}	−0.04	(0.62)
			Δs_{t-2}	0.06	(0.84)
			Δs_{t-3}	−0.23*	(0.02)
			Δop_t^+	−0.03	(0.69)
			Δop_{t-1}^+	−0.11	(0.24)
			Δop_{t-2}^+	−0.17*	(0.05)
			Δop_{t-3}^+	0.00	(0.98)
			Δop_{t-4}^+	−0.13	(0.12)
			Δop_{t-5}^+	−0.25*	(0.00)
			Δop_{t-6}^+	0.12**	(0.06)
			Δop_t^-	0.32*	(0.00)
			Δop_{t-1}^-	−0.28*	(0.00)
			Δop_{t-2}^-	−0.03	(0.71)
			Δop_{t-3}^-	−0.04	(0.67)
			Δop_{t-4}^-	−0.17*	(0.04)
			Δop_{t-5}^-	−0.28*	(0.00)
			Δop_{t-6}^-	−0.22*	(0.00)
Panel B: long-run coefficient estimates					
Constant	−2.74	(0.93)	Constant	5.14*	(0.00)
op	2.12	(0.81)	op^+	0.78*	(0.00)
			op^-	0.58*	(0.00)
Panel C: Diagnostics					
F	0.79			8.16*	
ECM_{t-1}	−0.005	(0.12)		−0.22*	(0.00)
LM	0.75	(0.47)		0.21	(0.81)
RESET	1.68	(0.20)		0.48	(0.49)
$\bar{R}^2$	0.14			0.40	
CUSUM	Unstable			Stable	
CUSUMQ	Unstable			Stable	
Asymmetry test					
LR-Wald test				27.34*	(0.00)
SR-Wal test				0.58	(0.45)

a. Numbers inside the parentheses are P-values. b. The asterisks indicate that the coefficients are significant at 5% and 10%, respectively. c. The upper bound F-Statistic critical value at a 5% significance level for the linear and nonlinear models are 3.87 and 4.16

in the first 7 months to the oil shocks, and the full adjustment is achieved relatively quickly (Figure 6).

When we replace WTI oil prices with Brent in the model and apply the ARDL approach, the result provides no evidence of a cointegration relationship, and the oil price coefficient is significant (Table 7). However, the NARDL method uncovers the relationship's nonlinear nature and illuminates the asymmetric long-run relationship (Table 7). Compared to the model with the WTI, the elasticities of the stock market for the upturns and downturns in the oil market change slightly (0.72 and 0.53); the same applies to the model's explanatory power and the adjustment speed (0.36 and −0.15, respectively). According to diagnostic tests, the model provides no evidence of serial correlation and misspecification, and the CUSUM and CUSUMQ tests indicate that the model is stable. The dynamic multiplier

Table 7: Full-information estimates of the linear and nonlinear models with Brent Oil Prices for Kuwait

Linear model			Nonlinear model		
		Panel A: short-run coefficient estimates			
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δs_{t-1}	−0.18**	(0.09)	Δs_{t-1}	−0.11	(0.23)
Δs_{t-2}	−0.04	(0.70)	Δs_{t-2}	−0.04	(0.64)
Δs_{t-3}	−0.29*	(0.00)	Δs_{t-3}	−0.26*	(0.00)
Δop_t	0.19*	(0.00)	Δop_t^+	−0.04	(0.51)
Δop_{t-1}	−0.03	(0.44)	Δop_t^-	0.29*	(0.00)
Δop_{t-2}	0.08*	(0.04)	Δop_{t-1}^-	−0.21*	(0.00)
Δop_{t-3}	0.06	(0.12)			
		Panel B: long-run coefficient estimates			
Constant	9.22	(0.36)	Constant	5.20*	(0.00)
op	−1.13	(0.67)	op^+	0.72*	(0.00)
			op^-	0.52*	(0.00)
		Panel C: Diagnostics			
F	1.82			9.10*	
ECM_{t-1}	0.01*	(0.02)		−0.15*	(0.00)
LM	1.10	(0.34)		0.11	(0.89)
RESET	1.49	(0.23)		0.01	(0.91)
$\bar{R}^2$	0.20			0.36	
CUSUM	Unstable			Stable	
CUSUMQ	Unstable			Stable	
Asymmetry Test					
LR-Wald Test				24.66*	(0.00)
SR-Wal Test				1.13	(0.29)

Figure 8: The NARDL Forecasting for Kuwait stock market (Model with WTI prices)

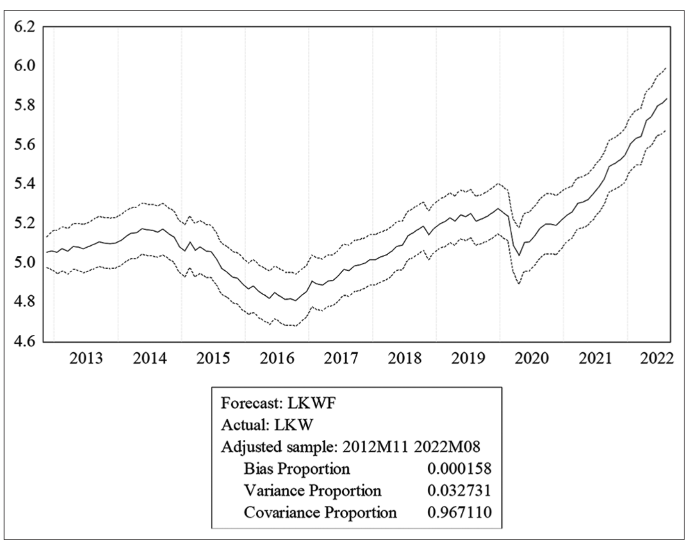
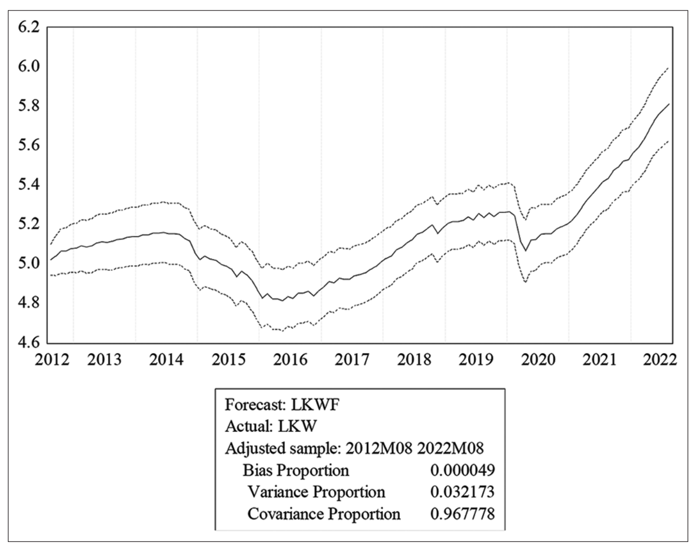


Figure 9: The NARDL Forecasting for Kuwait stock market (Model with Brent oil prices)



reveals the sharp effect of the oil shocks in the first 5 months, and the stock market achieves 50% of the adjustment in 4 months (Figure 7).

Our model provides great predictive power using the oil market to forecast the stock market movements in Kuwait, as the bias and variance proportion indicate (Figure 8 and 9).

Among the GCC countries, we find Oman to be a particular case as no asymmetry exists in the models (Tables 8 and 9). Although the bond test reveals no cointegration, the negative and significant error correction term provides evidence for a long-run relationship. [8]Since there is no asymmetry, when we apply the

8 Banerjee et al. (1998).

Table 8: Full-information estimates of the linear and nonlinear models with WTI Oil Prices for Oman

Linear model			Nonlinear model		
Panel A: short-run coefficient estimates					
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δs_{t-1}	−0.25*	(0.00)	Δs_{t-1}	−0.11	(0.23)
Δs_{t-2}	−0.09	(0.31)	Δs_{t-2}	−0.04	(0.64)
Δop_t	0.16*	(0.00)	Δop_t^-	−0.26*	(0.00)
Panel B: long-run coefficient estimates					
Constant	3.28*	(0.01)	Constant	6.97*	(0.00)
op	0.76*	(0.01)	op^+	2.12	(0.62)
			op^-	1.71	(0.61)
Panel C: Diagnostics					
F	2.67			3.15	
ECM_{t-1}	−0.05*	(0.00)		−0.02*	(0.00)
LM	0.49	(0.62)		1.14	(0.32)
RESET	0.98	(0.32)		3.03**	(0.08)
$\bar{R}^2$	0.20			0.22	
CUSUM	Stable			Unstable	
CUSUMQ	Stable			Stable	
Asymmetry Test					
LR-Wald Test				1.67	(0.11)
SR-Wal Test				1.13	(0.29)

Table 9: Full-information estimates of the linear and nonlinear models with Brent Oil Prices for Oman

Linear model			Nonlinear model		
Panel A: short-run coefficient estimates					
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δs_{t-1}	−0.26*	(0.00)	Δs_{t-1}	−0.31	(0.00)
Δop_t	0.18	(0.00)	Δs_{t-2}	−0.14	(0.13)
			Δop_t^+	0.12*	(0.02)
			Δop_t^-	0.21*	(0.00)
Panel B: long-run coefficient estimates					
Constant	3.41*	(0.03)	Constant	7.26*	(0.00)
op	0.76**	(0.05)	op^+	3.26	(0.75)
			op^-	2.65	(0.75)
Panel C: Diagnostics					
F	2.01			1.98	
ECM_{t-1}	−0.04*	(0.02)		−0.01*	(0.00)
LM	1.25	(0.29)		1.62	(0.20)
RESET	1.13	(0.29)		2.33	(0.13)
$\bar{R}^2$	0.22			0.22	
CUSUM	Stable			Unstable	
CUSUMQ	Stable			Stable	
Asymmetry test					
LR-Wald test				1.43	(0.16)
SR-Wal test				0.55	(0.46)

NARDL approach, the dynamic multiplier for Oman's stock market reveals an overshooting (overreacting) response to the oil market (Figures 10 and 11). Regarding forecasting, the model performance is weaker in tracking the stock market compared to other GCC countries (Figures 12 and 13). It is worth mentioning that Oman lacks economic diversification and has a high unemployment rate (more than 40%).[9]

9 Interestingly, Naifar and Dohaiman (2013) also found different results for Oman in their study.

Figure 10: Dynamic multiplier: WTI on Oman stock Market shock evolution

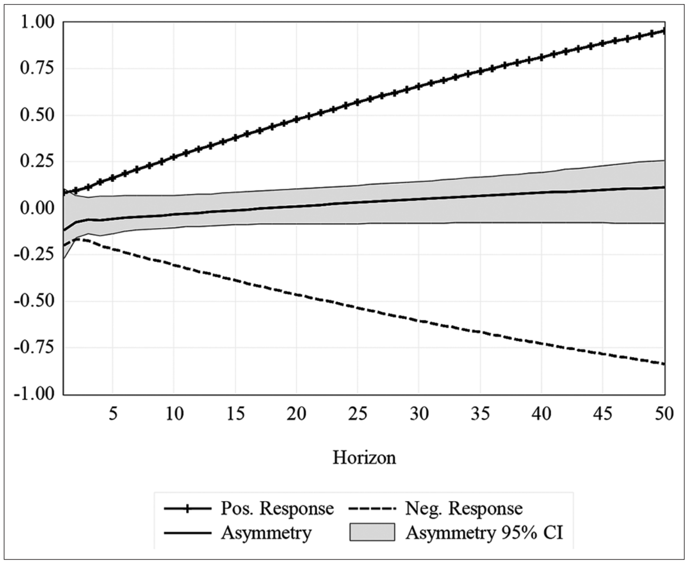


Figure 11: Dynamic multiplier: BRT on Oman stock Market shock evolution

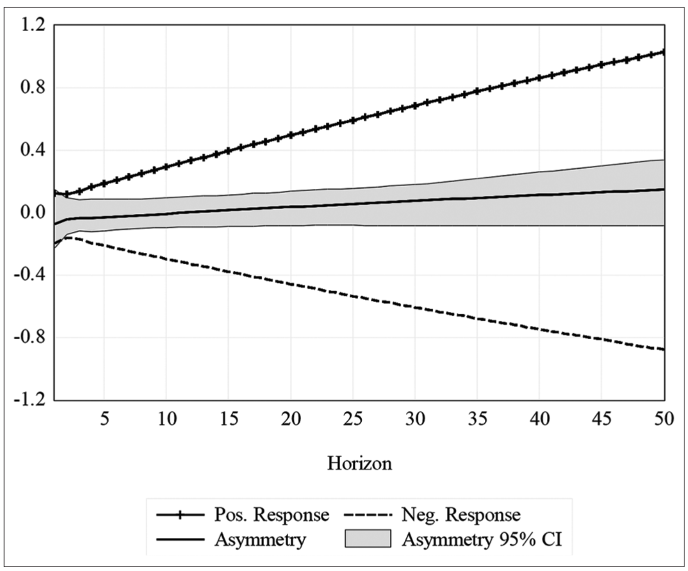


Figure 12: The NARDL forecasting for Oman stock Market (Model with WTI prices)

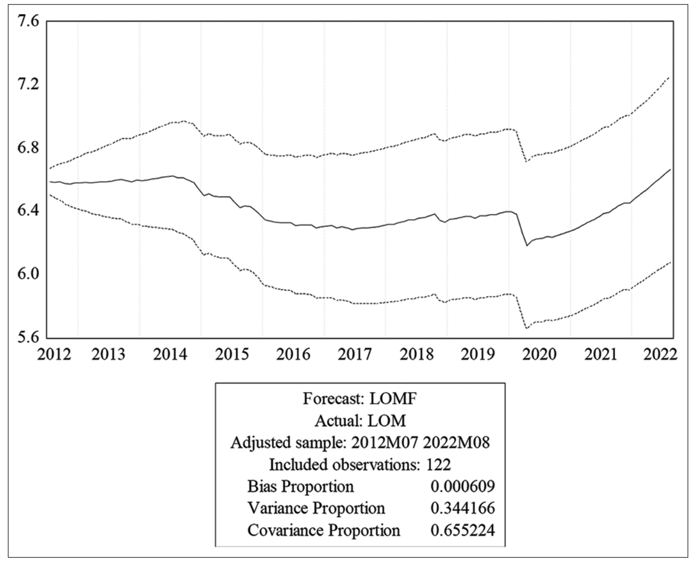
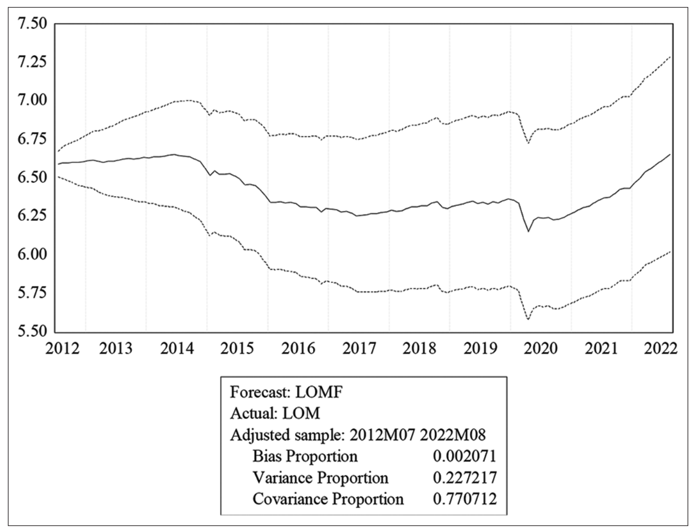


Figure 13: The NARDL forecasting for Oman stock Market (Model with Brent Oil prices)



For Qatar, the ARDL results confirm cointegration with no serial correlation or misspecification in the model. We observe that the elasticity of the stock market with a symmetric response to the oil market, considering WTI as a representative, is significant and about 0.78 (Table 10). However, when we apply the NARDL approach (Table 10), the long-run asymmetrical responses of the stock market to the upturns and downturns in the oil market are observed and well pronounced as the coefficients are 1.04 and 0.95, respectively. While the model has no serial correlation and misspecification, both CUSUM and CUSUMQ tests confirm that the coefficients are unstable during the study period. Therefore, we apply the Quandt-Andrews unknown breakpoint test[10], which reveals August 2014 as a breakpoint. However, when we include a stability dummy in the model, it carries an insignificant coefficient, and other coefficients have changed slightly, which confirms that the break has a negligible effect on the estimates in the model.[11]

Furthermore, the speed of adjustment is about −0.06, and 50% of the adjustment toward equilibrium is achieved in 10 months. The dynamic multiplier reveals a close pattern in the response of the Qatari stock market to oil market shocks and the Bahrain stock market. However, the Qatar stock market responds slightly at the early stages of the shock (Figure 14). Regarding the deterministic power, the oil market explains only 22% of the variations in Qatar's stock market (half of the explanatory power in Bahrain and Kuwait), which signals the importance of the other determinants, such as natural gas, in Qatar's economy.[12]

While changing the oil market representative from WTI to Brent

10 Donald and Ploberger (1994).

11 Results are available upon request.

12 Qatar ranks 3rd in the world in terms of proven natural gas reserves.

Table 10: Full-information estimates of the linear and nonlinear models with WTI Oil Prices for Qatar

Linear model			Nonlinear model		
Panel A: Short-run coefficient estimates					
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δs_{t-1}	−0.31*	(0.00)	Δs_{t-1}	−0.31*	(0.00)
Δs_{t-2}	−0.19*	(0.03)	Δs_{t-2}	−0.21*	(0.02)
Δop_t	0.14*	(0.00)	Δop_t^-	0.21*	(0.00)
			Δop_{t-1}^-	−0.14*	(0.02)
Panel B: Long-run coefficient estimates					
Constant	1.08*	(0.59)	Constant	4.63*	(0.00)
op	0.78	(0.12)	op^+	1.04**	(0.09)
			op^-	0.95**	(0.09)
Panel C: Diagnostics					
F	4.81*			5.35*	
ECM_{t-1}	−0.07*	(0.00)		−0.07*	(0.00)
LM	0.27	(0.76)		0.05	(0.95)
RESET	0.16	(0.69)		0.17	(0.68)
$\bar{R}^2$	0.21			0.24	
CUSUM	Stable			Unstable	
CUSUMQ	Unstable			Unstable	
Asymmetry test					
LR-Wald test				4.19*	(0.04)
SR-Wal test					

Table 11: Full-information estimates of the linear and nonlinear models with Brent Oil Prices for Qatar

Linear model			Nonlinear model		
Panel A: short-run coefficient estimates					
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δs_{t-1}	−0.31*	(0.00)	Δs_{t-1}	−0.31*	(0.00)
Δs_{t-2}	−0.18*	(0.04)	Δs_{t-2}	−0.19*	(0.04)
Δop_t	0.15*	(0.00)	Δop_t^-	0.22*	(0.00)
			Δop_{t-1}^-	−0.13*	(0.03)
Panel B: long-run coefficient estimates					
Constant	1.05	(0.66)	Constant	4.74*	(0.00)
op	0.78	(0.18)	op^+	1.08	(0.19)
			op^-	0.97	(0.17)
Panel C: Diagnostics					
F	4.19*			4.58*	
ECM_{t-1}	−0.06*	(0.00)		−0.06*	(0.00)
LM	0.38	(0.69)		0.18	(0.83)
RESET	0.15	(0.71)		0.18	(0.67)
$\bar{R}^2$	0.19			0.24	
CUSUM	Stable			Stable	
CUSUMQ	Unstable			Unstable	
Asymmetry test					
LR-Wald test				3.74**	(0.06)
SR-Wal test					

slightly affects the long-run response of Qatar's stock market to the ups and downs in the oil market (1.08 and 0.97, respectively), it makes the coefficients insignificant (Table 11). However, the dynamic multiplier reveals the same fashion and 50% of the adjustment occurs in 12 months (Figure 15). Our model performs well in tracking Qatar's stock market despite having insignificant long-run coefficients in the model (Figures 16 and 17).

In the case of Saudi Arabia, the ARDL model (Table 12) shows no cointegration in the model, and the elasticity coefficient

Figure 14: Dynamic multiplier: WTI on Qatar stock Market stock evolution

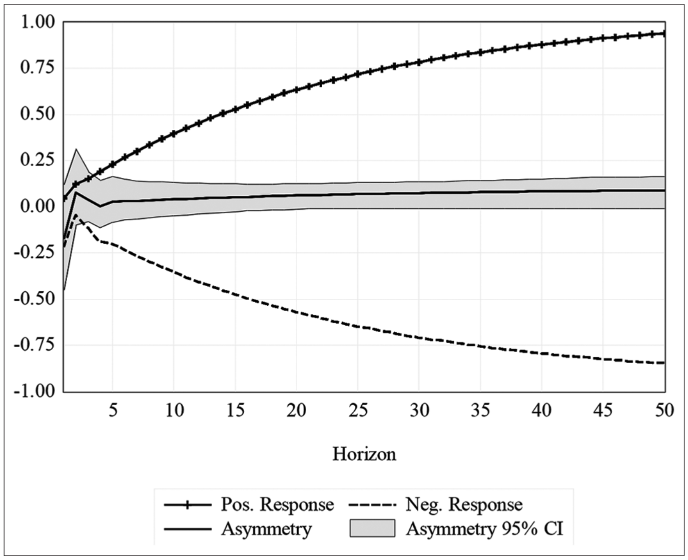
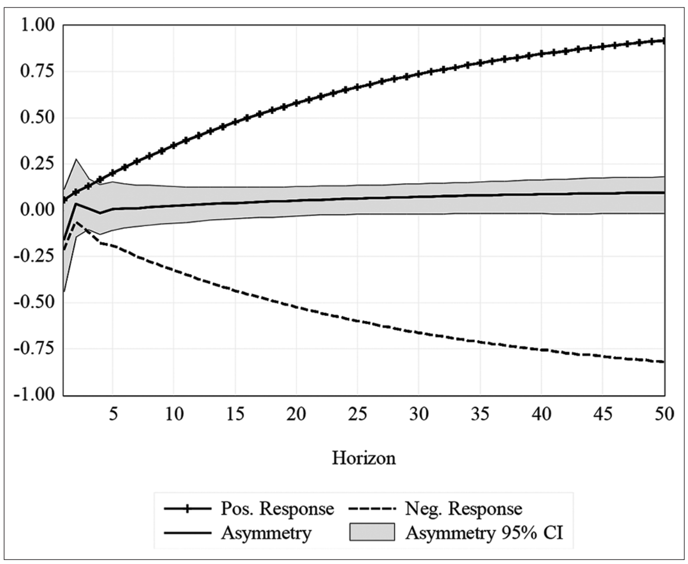


Figure 15: Dynamic multiplier: BRT on Qatar stock Market shock evolution



is insignificant (0.67). However, when we apply the NARDL approach (Table 12), the results demonstrate that nonlinearity exists in the model as we build a cointegration with significant coefficients for the long-run asymmetric response of the stock market to the upturns and downturns in the oil market (0.68 and 0.53, respectively). The coefficients are close to the results obtained for the stock market in Kuwait and illustrate a higher degree of independence of the Saudi stock market from the oil market.

Our diagnostic tests denote no evidence of serial correlation and misspecification, and the CUSUM and CUSUMQ tests confirm that the model is stable. Interestingly, the dynamic multiplier has the same pattern as Kuwait except for the early stages, with a slight difference in the speed of adjustment. The result provides evidence for similarities in these economies as Saudi Arabia achieves 50%

Figure 16: The NARDL forecasting for Qatar stock market (Model with WTI prices)q

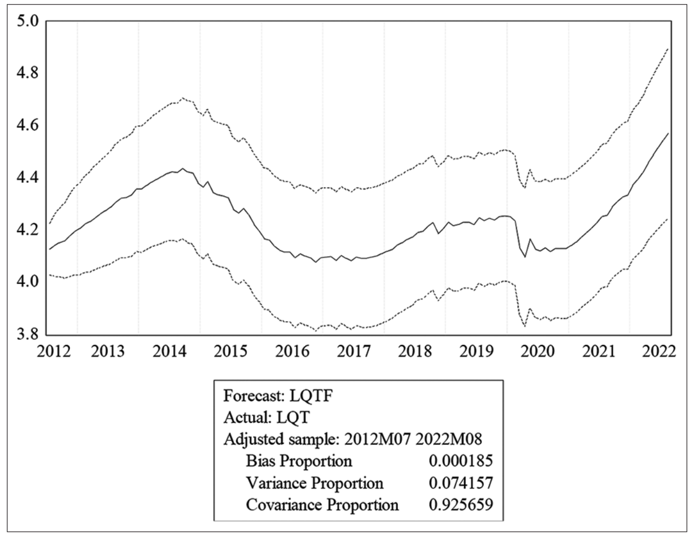


Figure 17: The NARDL Forecasting for Qatar stock Market (Model with Brent oil prices)

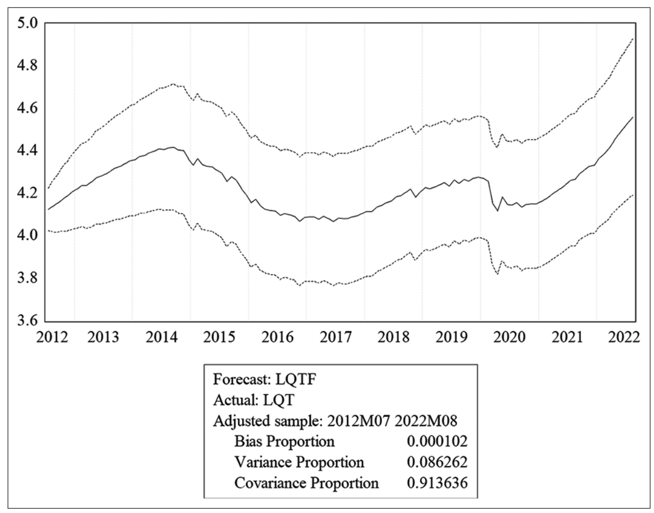


Figure 18: Dynamic multiplier: WTI on Saudi Arabia stock Market shock evolution

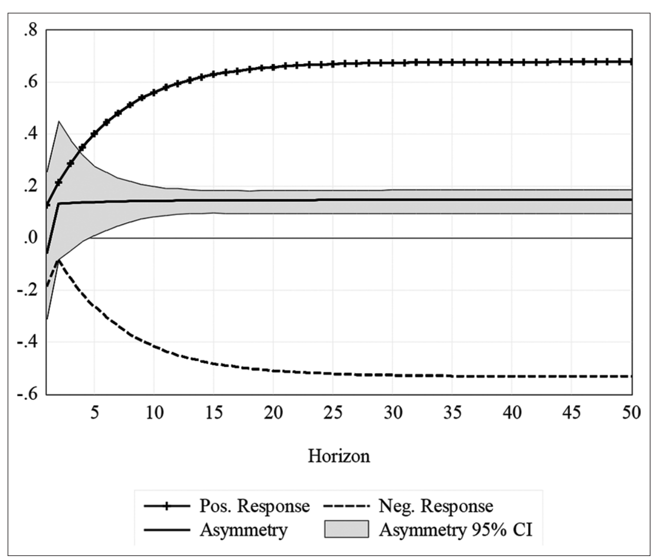


Table 12: Full-information estimates of the linear and nonlinear models with WTI Oil Prices for Saudi Arabia

Linear model			Nonlinear model		
			Panel A: short-run coefficient estimates		
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δop_t	0.14*	(0.00)	Δop_t^-	0.19*	(0.00)
			Δop_{t-1}^-	−0.17*	(0.00)
			Panel B: long-run coefficient estimates		
Constant	3.80	(0.18)	Constant	6.34*	(0.00)
op	0.67	(0.36)	op^+	0.68*	(0.00)
			op^-	0.53*	(0.00)
			Panel C: Diagnostics		
F	1.09			5.42*	
ECM_{t-1}	−0.03**	(0.07)		−0.16*	(0.00)
LM	0.58	(0.56)		0.38	(0.69)
RESET	2.07	(0.15)		0.00	(0.99)
$\bar{R}^2$	0.09			0.20	
CUSUM	Stable			Stable	
CUSUMQ	Stable			Stable	
Asymmetry test					
LR-Wald test				14.23*	(0.00)
SR-Wal test					

Table 13: Full-information estimates of the linear and nonlinear models with Brent Oil prices for Saudi Arabia

Linear model			Nonlinear model		
			Panel A: short-run coefficient estimates		
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δop_t	0.19*	(0.00)	Δop_t^-	0.23*	(0.00)
Δop_{t-1}	−0.08**	(0.09)	Δop_{t-1}^-	−0.24*	(0.02)
Δop_{t-2}	0.10*	(0.03)	Δop_{t-2}^-	0.13**	(0.07)
			Δop_{t-3}^-	−0.14*	(0.04)
			Panel B: long-run coefficient estimates		
Constant	4.32**	(0.07)	Constant	6.39*	(0.00)
op	0.53	(0.38)	op^+	0.68*	(0.00)
			op^-	0.53*	(0.00)
			Panel C: Diagnostics		
F	1.16			4.94*	
ECM_{t-1}	−0.03**	(0.06)		−0.14*	(0.00)
LM	0.37	(0.69)		0.33	(0.72)
RESET	2.18	(0.14)		0.04	(0.85)
$\bar{R}^2$	0.14			0.23	
CUSUM	Stable			Stable	
CUSUMQ	Stable			Stable	
Asymmetry test					
LR-Wald test				13.49*	(0.00)
SR-Wal test					

of the adjustment toward equilibrium in 4 months (Figure 18). In addition, the coefficient of determination (adjusted R^2) shows that the oil market has less explanatory power (20%) in Saudi Arabia.

When we replace the WTI with Brent oil prices in the model for Saudi Arabia, the results remained unchanged for the long-run asymmetric response of the stock market to the upturns and downturns in the oil market (Table 13) and 50% of the adjustment toward equilibrium occurs in 4 months which is similar to Kuwait stock market (Figure 19). Our model introduces reliable forecasting of the stock market in Saudi Arabia using oil prices (Figures 20 and 21).

The stock market in the United Arab Emirates (UAE) provides evidence of cointegration with the oil market (WTI as a

Figure 19: Dynamic multiplier: BRT on Saudi Arabia stock Market shock evolution

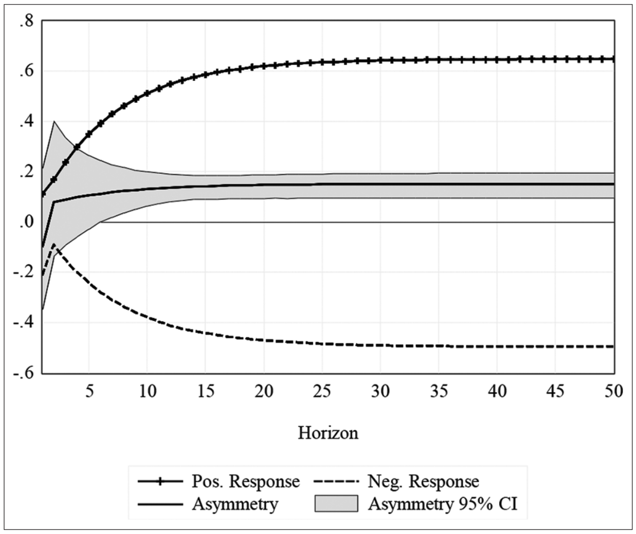


Figure 20: The NARDL forecasting for Saudi Arabia stock market (Model with WTI prices)

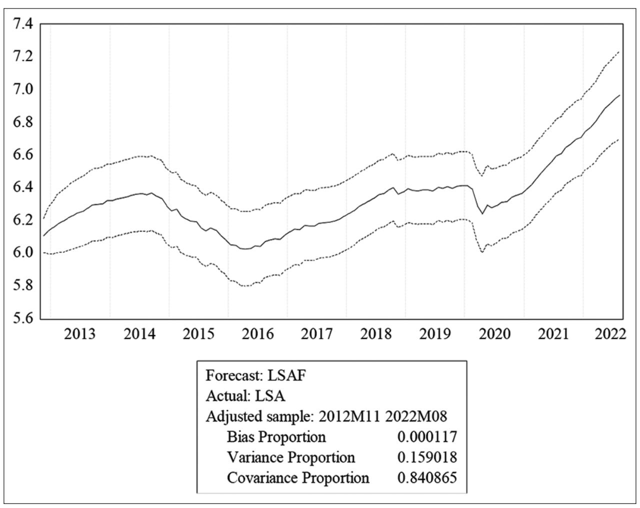


Figure 21: The NARDL forecasting for Saudi Arabia stock market (Model with Brent oil prices)

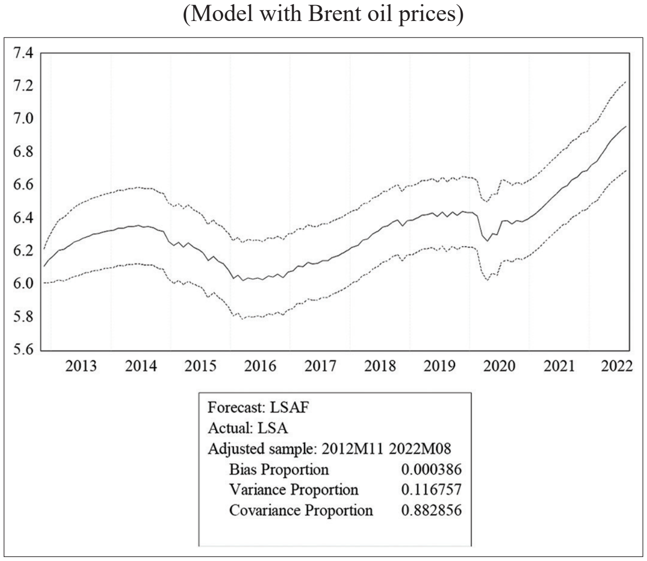


Figure 22: Dynamic multiplier: WTI on UAE stock market shock evolution

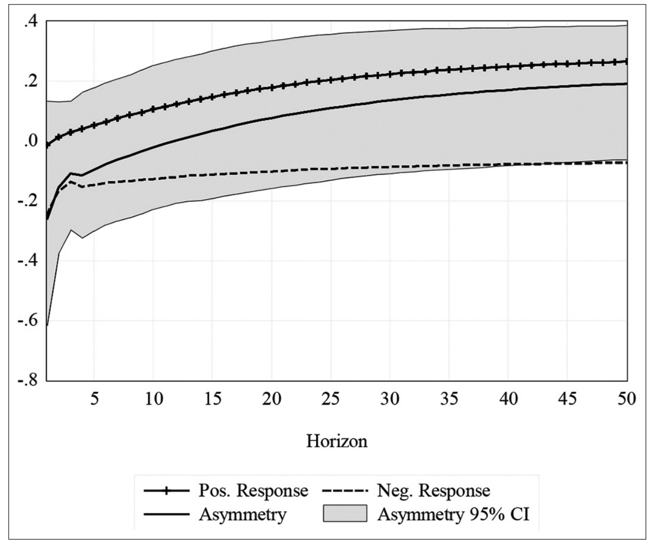


Figure 23: Dynamic multiplier: BRT on UAE stock market shock evolution

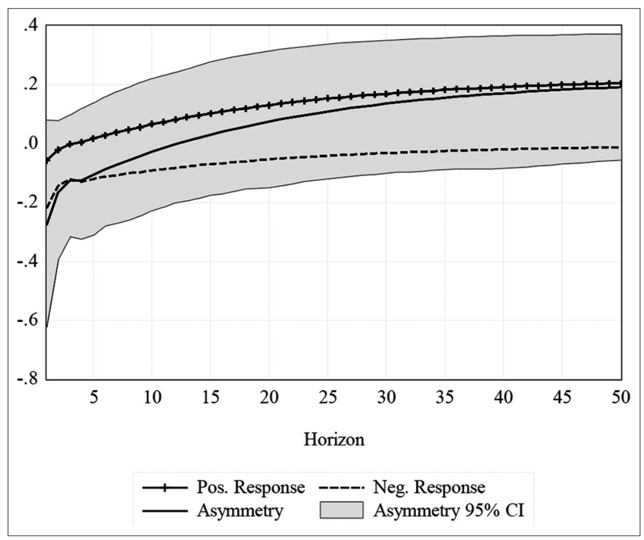


Figure 24: The NARDL forecasting for the United Arab Emirates stock market (Model with Brent oil prices)

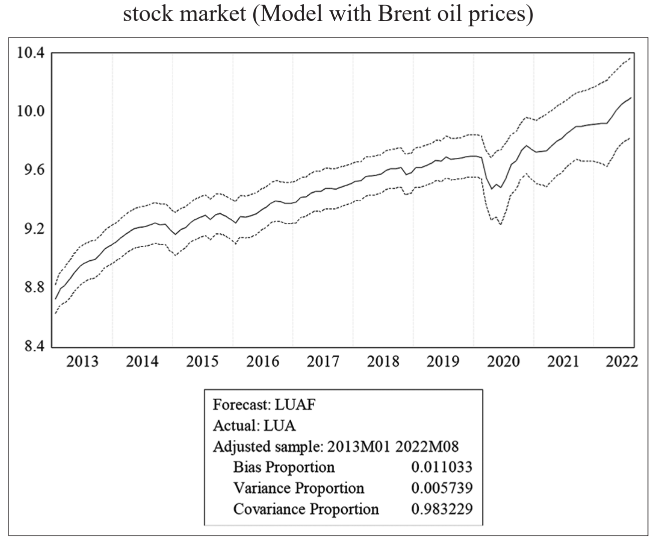


Table 14: Full-information estimates of the linear and nonlinear models with WTI Oil Prices for the United Arab Emirates

Linear model			Nonlinear model		
Panel A: short-run coefficient estimates					
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δs_{t-1}	−0.28*	(0.01)	Δs_{t-1}	−0.31*	(0.02)
Δs_{t-2}	−0.16	(0.15)	Δs_{t-2}	−0.25**	(0.06)
Δop_t	0.16*	(0.00)	Δs_{t-3}	0.07	(0.60)
			Δop_t^+	−0.30**	(0.09)
			Δop_{t-1}^+	−0.04	(0.80)
			Δop_{t-2}^+	0.23	(0.17)
			Δop_{t-3}^+	0.17	(0.29)
			Δop_{t-4}^+	−0.22	(0.18)
			Δop_{t-5}^+	−0.15	(0.36)
			Δop_{t-6}^+	0.18	(0.26)
			Δop_t^-	0.41*	(0.00)
			Δop_{t-1}^-	−0.09	(0.48)
			Δop_{t-2}^-	−0.14	(0.28)
			Δop_{t-3}^-	−0.16	(0.21)
			Δop_{t-4}^-	−0.06	(0.63)
			Δop_{t-5}^-	0.02	(0.89)
			Δop_{t-6}^-	−0.03	(0.81)
Panel B: long-run coefficient estimates					
Constant	8.22*	(0.00)	Constant	9.15*	(0.00)
op	0.42	(0.56)	op^+	0.40*	(0.00)
			op^-	0.16	(0.21)
Panel C: Diagnostics					
F	6.95*			4.76*	
ECM_{t-1}	−0.03*	(0.00)		−0.27*	(0.00)
LM	0.43	(0.65)		0.64	(0.53)
RESET	0.07	(0.78)		0.07	(0.79)
$\bar{R}^2$	0.13			0.31	
CUSUM	Stable			Stable	
CUSUMQ	Unstable			Unstable	
Asymmetry test					
LR-Wald test				11.55*	(0.00)
SR-Wal test				0.23	(0.63)

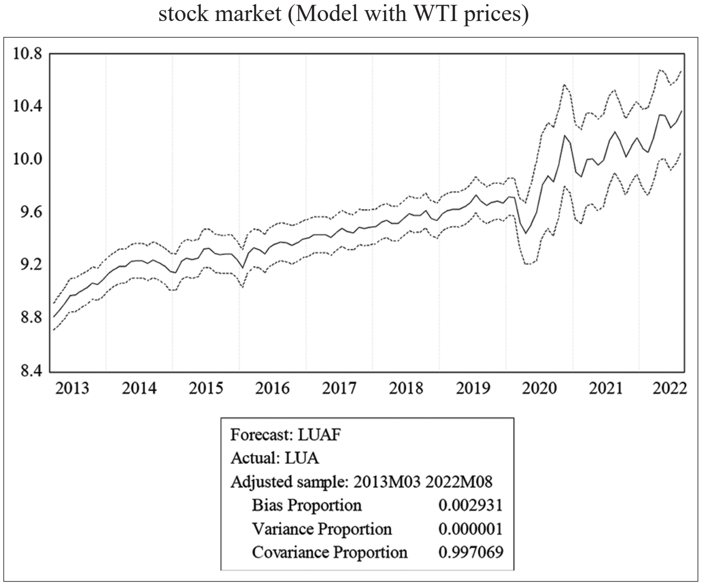
representative) when the ARDL and NARDL methods are used to estimate the model (Table 14). While the Wald test confirms the long-run asymmetric effect of the oil market's upturns and downturns (0.40 and 0.16, respectively), downturns in the oil market have an insignificant impact on the UAE stock market.

Compared with other GCC countries, the stock market in the UAE is the most independent, which is reasonable as its economy is more diversified and less dependent on oil and gas than most other nations in the region. Although positive shocks in the oil market might pump more liquidity into the stock

Table 15: Full-information estimates of the linear and nonlinear models with Brent Oil Prices for the United Arab Emirates

Linear model			Nonlinear model		
Panel A: short-run coefficient estimates					
Variable	**Coefficient**	**P-value**	**Variable**	**Coefficient**	**P-value**
Δs_{t-1}	−0.24*	(0.03)	Δs_{t-1}	−0.28*	(0.01)
Δop_t	0.13*	(0.02)	Δs_{t-2}	−0.26*	(0.02)
			Δs_{t-3}	−0.13	(0.26)
			Δs_{t-4}	−0.19**	(0.09)
			Δs_{t-5}	−0.12	(0.29)
			Δs_{t-6}	−0.19**	(0.09)
			Δs_{t-7}	−0.18	(0.12)
			Δs_{t-8}	−0.24*	(0.03)
			Δop^{+}_{t-1}	0.17	(0.14)
			Δop^{-}_{t}	−0.14	(0.21)
			$\bar{R}^2$	0.31*	(0.00)
Panel B: long-run coefficient estimates					
Constant	8.42*	(0.00)	Constant	9.46*	(0.00)
op	0.36	(0.63)	op^{+}	0.29*	(0.03)
			op^{-}	0.09	(0.46)
Panel C: Diagnostics					
F	6.48*			9.14*	
ECM_{t-1}	−0.03*	(0.00)		−0.18*	(0.00)
LM	0.95	(0.39)		0.45	(0.64)
RESET	0.00	(0.95)		0.05	(0.83)
	0.11			0.27	
CUSUM	Stable			Stable	
CUSUMQ	Unstable			Unstable	
Asymmetry test					
LR-Wald test				0.98	(0.33)
SR-Wal test				0.05	(0.83)

Figure 25: The NARDL forecasting for the United Arab Emirates stock market (Model with WTI prices)



market, downturns do not tend to disturb the stock market to the same extent. The dynamic multiplier reveals that the UAE stock market has the highest degree of independence from the oil market among GCC countries. It has the fastest adjustment toward equilibrium, as 50% of the adjustment occurs just in 2 months (Figure 22).

Although the CUSUM test shows the model is stable, the CUSUMQ provides evidence of instability in January 2020. Hence, we include a stability dummy in the model and find that despite having a significant coefficient for the dummy variable, the other coefficients experience a slight change. In addition, the oil market explains 31% of the variations in the stock market.

When we replace oil market prices with Brent, the results show a slight change, as the effect of the oil market upturns on the stock market in the UAE declines to 0.29 (Table 15). The dynamic multiplier indicates the same fashion and 50% of the adjustment toward equilibrium occurs in 3 months (Figure 23). Moreover, our model provides a good forecast for the stock market in the United Arab Emirates using WTI as it does for Brent oil prices (Figures 24 and 25).

5. CONCLUSION AND POLICY IMPLICATIONS

Although the literature investigates the response of the price-to-earnings ratio (P/E) to various oil shocks, this paper suggests using the stock market price index as a gauge. We hypothesize that in economic upturns and downturns, people tend to trade shares pessimistically, ignoring the P/E, or optimistically, considering that a low P/E will rise substantially.

We also postulate that positive oil shocks direct more liquidity to the GCC stock market, and adverse oil shocks have less impact as the GCC countries secure their economy through their financial reserves. Hence, we expect the stock market to behave differently during oil market upturns and downturns, which means the stock market is not a simple log-linear function of the oil market but a nonlinear one. Our model reveals results that confirm the hypotheses and provide evidence for the importance of the oil market in the GCC economies.

While the existence of a cointegration relationship between the oil market and the stock market is incongruous, as stock market movements often seem to be a random walk (unpredictable), the stock markets of GCC countries reveal a convincing cointegration. The results are reasonable as GCC economies depend highly on oil, and the stock market is no exception.

Our diagnostic tests also confirm that the model performs better when we build it based on the movements of the stock market index rather than on P/E ratios. In addition, as expected in oil-dependent nations, our model specifies more deterministic power to the oil market and tracks the stock market to a great extent.

Although the literature claims that adverse oil shocks have a more pronounced impact on the GCC country's stock markets than positive ones, our results confirm the opposite with asymmetries in the long run but not in the short run, which supports our hypothesis regarding the positive and negative oil shocks.

We illustrate that the stock market in the United Arab Emirates is the most independent from the oil market, responding only slightly to oil price movements. However, Bahrain and Qatar's stock markets are the most sensitive to the oil market.

Furthermore, the dynamic multiplier reveals that the oil shocks last longer in Oman, Bahrain, and Qatar's stock markets than in the United Arab Emirates, Saudi Arabia, and Kuwait's stock markets. Regarding the response to the oil shocks, Kuwait and Saudi Arabia's stock markets have similar behavior. The same applies to the Bahrain and Qatar stock markets.

Oman's stock market is an exception among the GCC nations, as no asymmetry exists in the models. Hence, we apply the NARDL approach; the dynamic multiplier reveals an overshooting response to the oil shocks. It is worth mentioning that Oman lacks economic diversification and has the highest unemployment rate (more than 40%) among GCC nations.

The findings suggest that diverse economic activities make the stock market more independent from the oil market (such as in the United Arab Emirates). The idea has led other GCC countries, such as Saudi Arabia and Qatar, to expand and diversify their economic activities. However, wealth accumulation and concentration effects on GCC stock markets require further research to point out sustainable growth paths with reduced oil market dependency. Our analysis is fruitful for portfolio managers, investors, and policymakers as it sheds new light on GCC's stock markets and helps explain their differences and similarities in response to the oil market.

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