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The Dynamics of Oil Prices and Stock Markets in Selected Arab Countries: Evidence from the Fourier-Shin Co-integration Test



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Abstract

This study uses the Fourier-Shin (F-Shin) cointegration test to examine the long-term interaction between Brent crude oil prices and the equity markets of selected Arab countries, using data from January 2010 to December 2024. The findings reveal a long-term co-integration relationship between oil and stock prices in Jordan, Kuwait, Lebanon, Morocco, Qatar, and Tunisia. However, the DOLS estimator indicates no significant effect of oil prices on stock prices in Jordan, Morocco, Qatar, or Tunisia. This indicates that other macroeconomic or regional factors besides oil prices have a more dominant effect in these countries. It also indicates that sensitivity to energy prices may be limited. This study emphasises the importance of understanding the long-term effects of structural changes and external shocks, such as oil price fluctuations, on stock market dynamics in selected Arab countries.

Keywords

Stock prices • Fourier-Shin cointegration test • Oil prices

Jel Codes

Q43, C22, E44



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In the context of global economics, it is essential to understand the oil market-driven effects on financial markets to ensure that the domestic economy remains stable and balanced. Rising oil prices drive up input costs, leading to inflation. In order to fight inflationary pressure, central banks usually raise interest rates, leading to a relationship between monetary policy tightening and lower stock prices (Bjørnland, 2009; Filis & Chatziantoniou, 2014; Liu et al., 2019). A surge in crude oil prices has the potential to contribute to economic growth by increasing income levels and positively affecting stock market returns, especially for net oil exporting countries (Bagirov & Mateus, 2024; Horobet et al., 2019; Lee et al., 2015). Conversely, this may cause both investors and policymakers to anticipate a rise in inflation rates. Consequently, prompting an increase in discount rates and exerting a contradictory influence on the stock market, engendering fragility within financial markets. In this context, the significance of oil price fluctuations for macroeconomic indicators is emphasised, particularly in oil-dependent exporting countries (Arouri & Rault, 2012; Bein & Aga, 2016; Lou et al., 2024).

The level of oil dependence is the primary factor determining how countries react to oil price movements. Degiannakis (2018) reported that higher oil prices lead to wealth transfer and exert a positive effect on stock prices, compared with a negative effect on oil-dependent stock markets. Additionally, Wang et al. (2013) emphasise that changes in oil prices are primarily driven by shifts in supply or aggregate demand. Apart from this, several other studies argue that the asymmetric dynamics of stock markets reflect underlying changes in country-specific situations, such as market depth, legal regulations, and risk profiles (Lee et al., 2017). For example, oil-related impulses on financial markets across Arab countries vary in terms of their level of energy dependence and how much of their economic output comes from oil and other natural resources (Salameh et al., 2012). Some Arab countries, especially oil exporters, benefit from higher oil prices because their budgets depend on energy revenues. Others, with less access to oil revenues, are vulnerable to such price shocks. (Bouri, 2015). The market responses to oil price shifts vary significantly across Arab countries, indicating that a homogeneous response is not evident. In this context, the magnitude of volatility in price movements is as important as the upward or downward trend in crude oil prices. By comparing oil-driven effects on these countries, we can provide a valuable context for understanding the long-term co-integration between energy and equity markets. (Boldanov et al., 2016; Degiannakis et al., 2018). Given the predominance of the Gulf Cooperation Council for the Arab States (GCC) in global oil supply, the inclusion of these countries is imperative.¹ However, to enhance the validity and comparability of the findings, it would be more appropriate to extend the study to encompass the entire Arab geography, rather than confining it to this specific sub-region.

The principal aim of this research is to empirically analyse the long-term interplay between the energy and financial markets of Arab countries. Recent studies have predominantly employed traditional or sudden and sharp breaks, potentially overlooking gradual and smooth transitions (see Table 1). In contrast, stock markets react gradually to tax reforms, regulations, or slowly rising inflation. This is also a significant gap in the literature. In this study, time series analysis is conducted using the F-Shin (2016) approach, developed to better address structural complexities in time series data. The F-Shin approach enriches the traditional time

¹The GCC includes Bahrain, Saudi Arabia, the UAE, Oman, Qatar, and Kuwait.

series framework by Fourier transformation to identify long-term dependencies between non-stationary series. One of its distinguishing advantages lies in the ability to accommodate unknown structural breaks with a high degree of flexibility, thereby ensuring the reliability of the cointegration results obtained without the necessity of prior specification of the time of these breaks. From this approach, the F-Shin test (2016) provides robust inference and a flexible framework for analysing the long-term relationships between financial markets and oil prices.

This research contributes to the existing literature in three main ways. Firstly, it is a rare study that investigating oil-financial market interdependencies within the framework of co-integration in the Arab region. This includes countries with a high level of dependence on energy exports as well as countries with a more limited level of dependence. In this respect, this study fills an important gap in the literature on the region. Secondly, the F-Shin cointegration method, utilised in the analysis, offers a flexible approach to modelling breaks in time series through the sinusoidal Fourier transform, obviating the necessity to define the form of structural breaks in advance. This approach provides more realistic and reliable results than traditional methods. Third, the study analyses how the effects of this heterogeneous structure on financial markets differ, considering the different levels of dependence on oil revenues among Arab countries. Thus, it provides findings that will contribute to the development of region-specific, differentiated strategies for policymakers. In conclusion, the study aims to provide a unique and comprehensive analysis to help shape investor strategies and macroeconomic stabilisation policies in Arab countries where the impact of oil prices on financial markets is structurally differentiated.

The structure of the study unfolds as follows: Section 2 includes a literature overview. Section 3 describes the data and methodological approach. Section 4 analyses the empirical results of the study. Finally, Section 5 presents concluding insights.

Literature Review

The impact of oil prices on equity markets has attracted increased attention in recent years, particularly considering the increasing fluctuations observed. Initial studies focused on indicators such as growth, inflation, and employment (Baumeister & Kilian, 2016; Hamilton, 1983); however, over time, the reflection of these effects on financial markets has also come under scrutiny (Elian & Kisswani, 2018; Fasanya et al., 2021; Lögün, 2025; Rafailidis & Katrakilidis, 2014; Zwak-Cantori, 2024). Stock markets have been recognised as a means to monitor general and sectoral trends in the economy, in addition to providing insights into investor expectations. Empirical studies conducted in this context predominantly use long-term relationships to inform their analyses through the utilisation of co-integration and causality analyses. For instance, Salamah et al. Al (2012) analysed Arab countries across three distinct groups: oil exporters, importers, and mixed countries. Their findings indicated significant long-term relationships between oil prices and stock market indices within all three groups. However, the analysis reveals that country-specific differences should also be considered. [Table 1](#) summarises the empirical findings on the interdependence of oil and equity markets in Arab countries.

Table 1*Review of Relevant Literature*

Study	Region / Country(ies)	Method and Period	Findings
Lou et al. (2024)	GCC	Econometric analysis, 2003–2022	A stable association between oil and equity returns is identified. Changes in tax policies and oil prices affect certain sectors.
Fasanya et al. (2021)	GCC	Symmetric & Nonlinear ARDL, Bai-Perron test, 1992–2016	The analysis encompasses both asymmetric effects and structural breaks. Significant short- and long-term effects are observed.
Alqahtani et al. (2020)	GCC	GARCH, J. cointegration, Granger, 2004–2018	The Johansen test shows a long-term co-integration between energy and equity assets and a two-way relationship in the short term.
Fayyad & Daly (2011)	Kuwait, Oman, UAE, Bahrain, Qatar, UK, and USA	VAR, DCV, & Impulse-Response analysis, September 2005–February 2010.	The long-term integration of oil and equity markets is strong. During the global financial crisis, oil price increases predicted higher stock returns. Qatar, the UAE, and the UK were more sensitive to oil shocks.
Arouri et al. (2011)	GCC	VAR–GARCH model, 2005–2010	VAR–GARCH analyses show that oil benchmarks and GCC equity market indices are closely linked, especially in crises.
Jouini (2013)	GCC	Panel techniques, June 2005–October 2008	Co-integration analyses demonstrate the long-term interdependence of oil and GCC equity markets. This is more pronounced in Bahrain and Oman. This underscores the significance of global factors in stock market movements.
Arouri & Rault (2012)	GCC	Bootstrap panel cointegration, SUR, 1996–2007	The findings indicate long-term co-integration of oil benchmarks and GCC equity markets, but the effect varies across countries.
Maghyreh & Al-Kandari (2007)	GCC	Nonlinear cointegration, Breitung's test, 1996–2003	A non-linear co-integration relationship has been identified between the prices of oil and stock market indices. This non-linear relationship offers investors enhanced predictability.
Hammoudeh & Choi (2006)	GCC	VEC model, 1994–2004	GCC stock markets and WTI prices are cointegrated over the long term, along with other global factors.
Benbachir et al. (2022)	MENA countries	Event study, 2002–2020	Oil shocks' impact on markets varies by country.
Bouri (2015a)	Lebanon, Jordan, Tunisia, and Morocco	ARMAX–GARCH, 2003–2013	A weak relationship is observed in Lebanon, whereas a strong post-crisis relationship is evident in Jordan.
Ajmi et al. (2014)	11 MENA countries	Nonlinear causality, 2007–2012	Non-linear causality has been observed during crisis periods.
Salameh et al. (2012)	MENA (oil exporting/importing)	Panel unit root, Granger, J., 2007–2009	The study finds long-term integration between energy and equity sectors, but not in oil-importing countries.
Alrabadi (2024)	Jordan	VAR, Granger, Johansen cointegration, 2013–2022	A strong co-integration relationship is observed between oil returns and the Amman Stock Exchange (ASE) indices over the long term. Significant positive effects are observed in the short term.

Study	Region / Country(ies)	Method and Period	Findings
Muhtaseb et al. (2016)	Jordan	Asymmetric cointegration, TAR, MTAR, 2000–2015	Oil price increases significantly impact equity returns. The analysis of co-integration is asymmetric.
Dagher & El Hariri (2013)	Lebanon	VAR, IRF, and variance decomposition, 2013–2015	Short-term positive effects are detected, but no co-integration is found. The oil effect was found to be limited.
Elian & Kisswani (2018)	Kuwait	ARDL, DOLS, Toda-Yamamoto, 2000–2015	The results of the ARDL and DOLS tests prove that long-term Brent and WTI are linked to returns. Further tests show bidirectional and unidirectional causality.
Cretì et al. (2014)	Oil exporting/ importing countries	Evolutionary Co-spectral Analysis, 2000–2010	Co-integration analysis shows the long-term impact of oil shocks on importing countries. Long-term co-integration exists between energy and equity assets in Kuwait but not in Dubai.
Daradkah et al. (2021)	Egypt, Morocco, and Jordan	VAR, Granger, Impulse Response, 2005–2018	Oil and equity markets are causally and dynamically related.

As summarised in [Table 1](#), the empirical literature on the relationship between crude oil price and equity markets reveals contradictory findings, ranging from robust positive associations to statistically insignificant results in Arab countries. These observed divergences are primarily attributed to the inherent heterogeneity in economic structures (e.g., net importer vs. exporter positions) and the limitations of the econometric methodologies employed in earlier studies. Specifically, traditional linear methods assume that parameters remain constant over time, failing to capture dynamic market behaviours. Although some studies employ co-integration tests with structural breaks to mitigate this, they predominantly consider regime switching as a sharp, instantaneous shift. However, financial markets often exhibit gradual adjustments to shocks. Arai & Kurozomi (2007) emphasise that the presence of structural breaks affects the results of cointegration tests, potentially leading to incorrect conclusions about the presence or absence of cointegration. In this context, it is advantageous to use Fourier functions, which are not affected by the shape or position of the number of structural breaks. Therefore, to address these methodological gaps, the present study aims to assess the cointegrating links between oil price and equity markets in detail within the framework of the F-Shin cointegration test, which is uniquely capable of modelling smooth structural transitions.

Data and Methodology

Data

The dataset employed in this study, which covers the period from 2010:M01 to 2024:M12, comprises stock prices of 11 selected Arab countries and BRENT crude oil prices². Data were sourced from the databases of Morgan Stanley Capital International and Federal Reserve Bank of St. Louis. Each variable has been transformed using the natural logarithm. [Table 2](#) presents summary information on the oil price and stock prices of 11 selected Arab countries.

²This period was selected as it reflects the restructuring of stability in the oil and equity markets of Arab League countries following the severe financial downturn initiated in 2008. Moreover, the significant fluctuations in oil prices and the notable shifts in regional economic dynamics observed after 2010 provide a suitable framework for the analysis.



Table 2
Summary of variables

Variables	Symbol	Data Interval
Oil Price		
BRENT	$\ln oil$	2010:01–2024:12
Stock Price		
Bahrain	$\ln s^{BH}$	2010:01–2024:12
Egypt	$\ln s^{EG}$	2010:01–2024:12
Jordan	$\ln s^{JO}$	2010:01–2024:12
Kuwait	$\ln s^{KW}$	2010:01–2024:12
Lebanon	$\ln s^{LB}$	2010:01–2024:12
Morocco	$\ln s^{MA}$	2010:01–2024:12
Oman	$\ln s^{OM}$	2010:01–2024:12
Qatar	$\ln s^{QA}$	2010:01–2024:12
Saudi Arabia	$\ln s^{SA}$	2014:08–2024:12
Tunisia	$\ln s^{TN}$	2010:01–2024:12
United Arab Emirates	$\ln s^{AE}$	2010:01–2024:12

Table 3 presents the descriptive data characteristics of the employed variables. The findings indicate that stock prices exhibit a high degree of volatility and that returns tend to deviate significantly from the assumption of normal distribution. Notably, the stock markets of certain countries, such as Lebanon and Jordan, display greater fluctuations than others. In addition, oil prices also show substantial volatility, with sudden and sharp declines occurring more frequently.

Table 3
Summary of descriptive statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	J. B.	Obs.
$\Delta \ln s^{BH}$	−0.407	−0.510	19.145	−31.879	5.793	−1.053	9.088	309.528	179
$\Delta \ln s^{EG}$	−0.455	−0.763	25.409	−40.824	9.004	−1.015	7.119	157.264	179
$\Delta \ln s^{JO}$	−0.513	−0.565	23.459	−45.988	5.618	−2.334	27.254	4549.817	179
$\Delta \ln s^{KW}$	0.242	0.676	19.080	−27.935	4.936	−0.783	8.883	276.444	179
$\Delta \ln s^{LB}$	0.549	−0.471	180.198	−156.296	19.954	1.367	59.473	23841.430	179
$\Delta \ln s^{MA}$	−0.196	0.050	10.066	−29.308	4.730	−1.322	9.722	389.072	179
$\Delta \ln s^{OM}$	−0.108	0.117	10.078	−24.673	4.383	−1.227	8.403	262.677	179
$\Delta \ln s^{QA}$	0.154	0.684	13.752	−24.653	5.112	−0.833	5.735	76.488	179
$\Delta \ln s^{SA}$	0.093	0.627	15.670	−16.335	5.763	−0.407	3.355	4.081*	124
$\Delta \ln s^{TN}$	−0.263	−0.342	16.324	−11.272	4.386	0.237	3.872	7.350*	179
$\Delta \ln s^{AE}$	0.439	0.299	21.554	−31.048	6.902	−0.567	6.144	83.320	179
$\Delta \ln oil$	−0.017	1.107	46.905	−55.479	10.697	−1.127	11.769	611.410	179

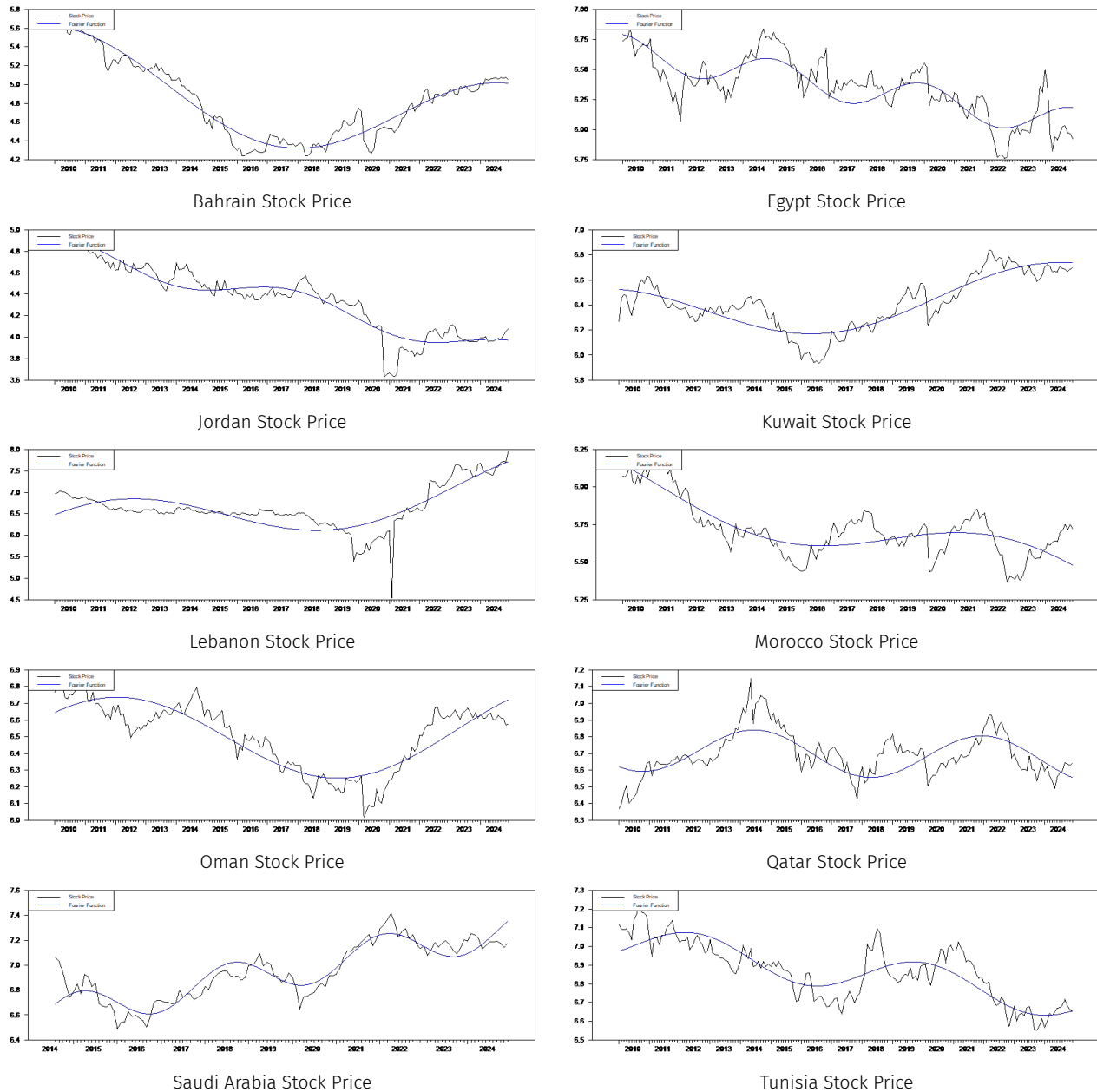
Note: * Significant at the 1% level.

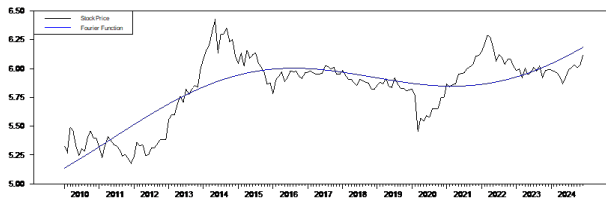
³In the graph, the black lines represent the raw data, whereas the blue lines indicate the trend component. This distinction allows for a clearer observation of both the fluctuations in stock and oil prices over time and their overall trends.

Figure 1 displays the time series graphs of oil and stock prices.³ It is particularly observed that in oil-exporting countries such as Saudi Arabia, the UAE, Kuwait, and Qatar, stock prices tend to move in the same direction as Brent crude oil prices. These parallel trends show that oil price dynamics are significant predictors of equity markets in these countries. In contrast, in oil-importing countries such as Egypt and Tunisia, this relationship appears to be weaker.

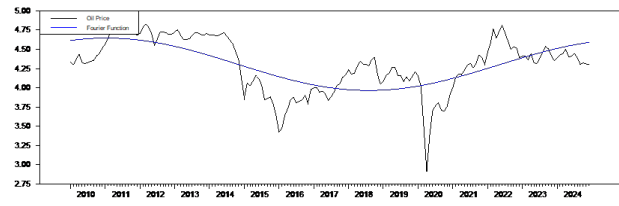
Figure 1

Temporal Dynamics of Variables





United Arab Emirates Stock Price



BRENT Oil Price

Econometric Methodology

Failure to account for structural breaks in the cointegrated vector representing the cointegrated relationship can result in unreliable outcomes in traditional co-integration tests. When structural breaks exist in a long-term relationship, traditional co-integration tests tend to yield results that fail to reject the null hypothesis that there is no co-integration. Oil and energy prices in Arab countries exhibit structural breaks, geopolitical shocks, and cyclical fluctuations. For this reason, classical approaches may ignore these fluctuations. The Fourier approach eliminates the need to specify break dates in advance by modelling smooth and periodic breaks in the time series. This study is based on the assumption that there exists an enduring integration pattern between stock prices and crude oil prices in a selected group of 11 Arab countries. Accordingly, the F-Shin co-integration test was employed to examine the presence of such a long-term co-integration relationship. Developed by Tsong et al. (2016), the F-Shin cointegration test allows for a more flexible analysis of long-term relationships by assuming that structural breaks occur in a nonlinear, continuous, and gradual manner. This method offers an important advantage in that there is no need to specify the number, form, or timing of structural breaks in advance when investigating co-integration relationships among time series. Essentially, it represents an extended version of the co-integration test based on the Fourier function initially proposed by Shin (1994) and is therefore referred to as the F-Shin test. The regression models used in this test to examine the cointegrated relationship are presented below:

$$y_t = \alpha + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \theta x'_t + \sum_{i=-l}^l \psi_i \Delta x'_{t-i} + \varepsilon_t \quad (1)$$

$$y_t = \alpha + \beta t + \gamma_1 \sin\left(\frac{2\pi kt}{T}\right) + \gamma_2 \cos\left(\frac{2\pi kt}{T}\right) + \theta x'_t + \sum_{i=-l}^l \psi_i \Delta x'_{t-i} + \varepsilon_t \quad (2)$$

In models (1) and (2), k denotes the number of frequencies, T represents the total number of data points, t is the deterministic trend, and π is the mathematical constant expressed as 3.14. The terms $-l$ and l refer to the lag lengths of the past and future periods, respectively. $\sin$ and $\cos$ are the trigonometric functions, which serve as additional deterministic components in the regressions.

The F-Shin co-integration test is a two-stage approach. The first step involves estimating models (1) or (2) using the dynamic ordinary least squares method, and the appropriate number of frequencies is determined. The second step consists of subjecting the residuals obtained from the model-estimated with the selected number of frequencies to the Shin (1994) cointegration test. The hypotheses used to test for the existence of co-integration are as follows:

$H_0 : (\sigma_u^2 = 0) \rightarrow$ There is a co-integration relationship.

$H_1 : (\sigma_u^2 > 0) \rightarrow$ There is no cointegration relationship.

The test value to test this hypothesis is given in Equation (3):

$$CI_f^0, CI_f^1 = \frac{1}{T^2} \frac{\sum_{t=1}^T \tilde{S}_t(k)^2}{\tilde{\sigma}^2} \quad (3)$$

In equation (3), CI_f^0 denotes the test statistic obtained when the model with constant term is considered and CI_f^1 denotes the test statistic obtained when the model with constant term and trend is considered. $\tilde{S}_t(k)$ is the sum of residual squares of the model estimated in the first stage by considering the appropriate number of frequencies k , T is the number of observations and $\tilde{\sigma}^2$ is the long-term variance. If the CI_f^0 or CI_f^1 test statistic fails to surpass the decision boundary values calculated by Tsong et al. (2016), the assumption of no long-term linkage could not be invalidated. In contrast, if the test value is greater than the critical values, statistical results lead to the rejection of the null (H_0) and the opposing hypothesis (H_1) of no co-integration is accepted. In this analytical framework, once the existence of a cointegrated linkage between time series is established, it is necessary to test whether the γ_1 and γ_2 parameters of the trigonometric terms in models (1) or (2) are statistically significant. The hypotheses are tested using the test called $F^m(k^*)$ based on the constraints. Accordingly, the null hypothesis states that the parameter estimates of the trigonometric terms are statistically insignificant ($H_0 : \gamma_1 = \gamma_2 = 0$), while the opposing hypothesis states that a minimum of one among the trigonometric coefficients is statistically significant ($H_1 : \gamma_1 \neq \gamma_2 \neq 0$). To interpret the test results, if the calculated $F^m(k^*)$ test statistic is greater than the rejection criteria drawn from Tsong et al. (2016), the null hypothesis is rejected, and at least one of the coefficients of the trigonometric terms is statistically significant. This result implies that the cointegrated relationship identified by Tsong et al. (2016) between the time series can be reported. However, if the $F^m(k^*)$ test statistic is smaller than the critical values, the null hypothesis cannot be rejected, implying that the parameter estimates for the Fourier components are statistically insignificant. In this case, it is determined that the result of the existence of a cointegrated relationship cannot be reported according to the Tsong et al. (2016) test, and the test that should be used is the Shin (1994) cointegration test.

Empirical Results

This study employs traditional unit root tests alongside a Fourier-based approach, which allows for the detection of structural breaks in the series when analysing their stationarity properties. The results of the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, which belong to the traditional approaches, are shown in Table 4.

Table 4
Traditional Unit Root Test Results

Dependent Variable	ADF		PP	
	c	$c + t$	c	$c + t$
$\ln s^{BH}$	-2.3380	-1.2410	-2.3336	-1.1355
$\Delta \ln s^{BH}$	-11.5242^a	-11.9169^a	-11.4181^a	-11.9870^a
$\ln s^{EG}$	-2.4116	-3.5673^b	-2.3259	-3.5604^b
$\Delta \ln s^{EG}$	-14.2586^a	-14.2182^a	-14.6115^a	-14.5638^a
$\ln s^{JO}$	-1.8949	-2.7917	-1.8948	-2.8853
$\Delta \ln s^{JO}$	-13.5740^a	-13.5756^a	-13.5739^a	-13.5755^a
$\ln s^{KW}$	-1.3300	-1.7000	-1.4010	-1.7709
$\Delta \ln s^{KW}$	-13.0052^a	-13.0147^a	-13.0651^a	-13.1098^a
$\ln s^{LB}$	-0.3958	-0.8035	-1.1647	-1.4761

Dependent Variable	ADF		PP	
	<i>c</i>	<i>c + t</i>	<i>c</i>	<i>c + t</i>
$\Delta \ln s^{LB}$	-14.0450^a	-14.3217^a	-21.6104^a	-23.2529^a
$\ln s^{MA}$	-2.2278	-2.0253	-2.2460	-2.1023
$\Delta \ln s^{MA}$	-12.2545^a	-12.2823^a	-12.2495^a	-12.2680^a
$\ln s^{OM}$	-1.7419	-1.4592	-1.6322	-1.2802
$\Delta \ln s^{OM}$	-15.1950^a	-15.2702^a	-15.2405^a	-15.3400^a
$\ln s^{QA}$	-3.1556^b	-3.1391	-3.0494^b	-3.0135
$\Delta \ln s^{QA}$	-15.4399^a	-15.4793^a	-15.5643^a	-15.6131^a
$\ln s^{SA}$	-1.2988	-3.4096	-1.3160	-3.4263
$\Delta \ln s^{SA}$	-10.9541^a	-10.9716^a	-10.9613^a	-10.9819^a
$\ln s^{TN}$	-1.9827	-2.7944	-1.9682	-2.9074
$\Delta \ln s^{TN}$	-12.6011^a	-12.5650^a	-12.6300^a	-12.5882^a
$\ln s^{AE}$	-1.8794	-2.0385	-1.7940	-1.9438
$\Delta \ln s^{AE}$	-15.3038^a	-15.2857^a	-15.2863^a	-15.2678^a
Independent Variable				
$\ln oil$	-2.1074	-2.1539	-2.1893	-2.2632
$\Delta \ln oil$	-10.4154^a	-10.3860^a	-9.8619^a	-9.8183^a

Note: *c* and *c + t* refer to constant and trend, respectively. a = 1%, b = 5% significance levels.

Table 4 indicates that, except for Qatar and Egypt, all series have a unit root at the level and are non-stationary. However, they become stationary after first differencing, indicating that the majority of the series follow an I(1) process. On the other hand, Table 5 presents the results of the Fourier Augmented Dickey-Fuller (FADF) unit root test, which incorporates the effects of structural breaks through the use of Fourier functions.

Table 5
Results of the Unit Root Test Based on Fourier Functions

Variables	<i>c</i>			<i>c + t</i>		
	Freq	F(k)	FADF	Freq	F(k)	FADF
Dependent Variable						
$\ln s^{BH}$	1	557.2634	-3.2384	1	1016.6838	-3.9849
$\ln s^{EG}$	1	57.76327	-3.54074	3	37.7108	-4.1796^b
$\ln s^{JO}$	1	102.6566	-2.8546	2	44.3971	-3.6081
$\ln s^{KW}$	1	246.1410	-3.3618	1	204.5589	-3.4120
$\ln s^{LB}$	1	65.52851	-1.9280	1	140.4769	-3.3108
$\ln s^{MA}$	2	52.7193	-2.7050	1	62.1864	-2.7837
$\ln s^{OM}$	1	263.0402	-2.9211	1	209.1840	-2.9486
$\ln s^{QA}$	2	69.0353	-3.8145^b	2	74.3439	-3.9959
$\ln s^{SA}$	1	115.8962	-2.2935	3	72.0168	-4.8494^a
$\ln s^{TN}$	2	68.1686	-3.0543	2	57.6973	-4.0861
$\ln s^{AE}$	2	90.3755	-2.3899	1	71.0815	-2.3422

Variables	c			$c + t$		
	Freq	F(k)	FADF	Freq	F(k)	FADF
Independent Variable						
$\ln oil$	1	77.6780	-3.8482	1	66.7407	-3.8624
Critical Values						
	c (Christopoulos & León-Ledesma, 2010)			$c + t$ (Hepsağ, 2022)		
Frequency	5%	1%		5%	1%	
k=1	-3.85	-4.43		-4.46	-5.11	
k=2	-3.28	-3.95		-4.16	-4.83	
k=3	-	-		-3.83	-4.50	
F(k)	4.929	6.730		4.972	6.873	

Note: c and $c + t$ refer to constant and trend, respectively. $a = 1\%$, $b = 5\%$ significance levels.

An analysis of Table 5 reveals that, for $k = 1, 2, 3$, the absolute values of the FADF test statistics are lower than the critical values at the 5% and 1% significance levels. As a result, the null hypothesis of a unit root can not be rejected, suggesting that the series are non-stationary at levels (with the exception of Qatar in the model with a constant and Egypt and Saudi Arabia in the model with both a constant and a trend). On the other hand, in cases where the series are stationary, the explanatory power of the trigonometric terms was tested using the F-test. Since the F-values obtained exceed the critical values for both the model with only a constant and the one with constant and trend, this implies that the trigonometric terms are significant from a statistical perspective.

The F-Shin co-integration test was implemented to assess the long-term statistical connection between variables. Given that the trend is an important component of the time series in modelling (Mert & Çağlar, 2023), the cointegration test was applied only to the model that includes both a constant and a trend. This is because the trend component can influence long-term dynamics. In line with this, based on the FADF test results, the long-term interaction between the variables was tested for all countries, except Egypt and Saudi Arabia, which are non-stationary at level values and in the trend model. The findings of the F-Shin co-integration test are presented in Table 6.

Table 6

Results of the F-Shin Co-integration Test

Country	Freq	F(k)	Min SSR	Test Statistic
Bahrain	1	10.3176	0.3820	0.0656
Jordan	3	6.8261	0.4878	0.0854*
Kuwait	1	8.3507	0.2834	0.0388*
Lebanon	2	39.3351	4.7661	0.1444*
Morocco	1	4.6512	0.3654	0.0322*
Oman	2	9.2246	0.2339	0.2101
Qatar	1	7.0320	0.3760	0.0606*
Tunisia	1	6.9066	0.2813	0.0379*
United Arab Emirates	1	6.9543	0.5851	0.1404

Frequency	Critical Values	
	5%	1%
k=1	0.048	0.063
k=2	0.099	0.163
k=3	0.114	0.170
F(k)	4.019	5.860

Note: The superscript * indicates that co-integration is statistically significant at the 1% and 5% significance levels.

Table 6 shows that the test statistics for Jordan, Kuwait, Lebanon, Morocco, Qatar, and Tunisia fall below the critical values, suggesting a long-term cointegration between stock prices and oil prices in these countries. According to the results of the F-test, which assesses the importance of the sine-cosine terms for these countries, the computed F-test statistics exceed the critical value, suggesting that at least one of the trigonometric terms is non-zero. This implies that the results of the F-Shin co-integration test are reliable. The study's findings partially align with previous literature. For instance, Hammoudeh & Choi (2006), Alqahtani et al. (2020), Jouini (2013), Maghyereh & Al-Kandari (2007), and Arouri & Rault (2012) identified long-term relationships between variables in GCC countries. In this regard, the results for Kuwait and Qatar are consistent with those in the literature, whereas the findings for Bahrain, Oman, and the UAE diverge. This heterogeneity is expected, given the structural differences among these economies. While GCC countries such as Kuwait and Qatar are highly dependent on oil and have financial markets that are more sensitive to fluctuations in oil revenues, the economic diversification process pursued by Bahrain and the UAE has weakened the relationship between oil and stock prices (Cheikh et al., 2021). Similarly, the outcomes related to Kuwait and Qatar are in line with those of Salameh et al. (2012), whereas different results emerge for the UAE, Oman, Bahrain, Jordan, Tunisia, and Morocco. Additionally, the results for Jordan are supported by the findings of Muhtaseb & Al-Assaf (2016) and Alrabadi (2024), who also reported a long-term relationship. In contrast, Dagher & El Hariri (2013) found no co-integration in the case of Lebanon, which contradicts the findings of this study. The inconsistency observed for Lebanon may stem from differences in the sample periods, as this study incorporates more recent structural events (e.g., political and financial shocks) that could have reshaped the oil-stock market interaction (Snaije, 2022). Regarding Kuwait, Elia & Kiswani (2018) and Cretì et al. (2014) identified a structurally embedded relationship connecting petroleum prices and capital market dynamics, which is consistent with this study's results. Furthermore, the absence of a significant relationship in Dubai, as reported by Cretì et al. (2014), aligns with the findings obtained for the UAE. Overall, the cross-country heterogeneity indicates that the transmission of oil price shocks varies depending on market openness, regional political events, the degree of economic diversification, and reliance on oil revenues (Arouri & Fouquau, 2009). These structural factors help explain why some countries exhibit a strong long-term connection while others do not.

After determining a persistent integration pattern, the DOLS estimator, which includes Fourier functions, was used to identify the long-term effects of oil prices on the stock prices of these countries. The estimation results are presented in Table 7.

Table 7*Long-term coefficients: DOLS estimation results*

	Coef.	S.E.	t-stat.	Coef.	S.E.	t-stat.	Coef.	S.E.	t-stat.
	Jordan			Kuwait			Lebanon		
<i>c</i>	5.4231 ^a	0.5151	10.527	5.1636 ^a	0.4004	12.894	1.4759 ^a	0.4015	3.676
<i>trend</i>	-0.0062 ^a	0.0006	-9.400	0.0005	0.0006	0.843	0.0020 ^a	0.0006	3.423
$\Delta \ln oil$	-0.1184	0.1125	-1.053	0.2789^a	0.0904	3.086	1.1532^a	0.0888	12.986
<i>sin</i>	-0.1100 ^b	0.0481	-2.285	-0.1590 ^a	0.0480	-3.313	-0.3320 ^a	0.0386	-8.589
<i>cos</i>	-0.0135	0.0469	-0.288	0.1470 ^a	0.0389	3.778	0.3749 ^a	0.0387	9.667
	Morocco			Qatar			Tunisia		
<i>c</i>	5.7749 ^a	0.6564	8.797	5.6645 ^a	0.8699	6.511	6.9935 ^a	0.5147	13.587
<i>trend</i>	-0.0043 ^a	0.0011	-3.898	0.0008	0.0014	0.570	-0.0043 ^a	0.0008	-4.957
$\Delta \ln oil$	0.0756	0.1481	0.510	0.2226	0.1963	1.134	0.0615	0.1162	0.530
<i>sin</i>	-0.1767 ^b	0.0786	-2.246	0.0436	0.1042	0.419	-0.1797 ^a	0.0616	-2.914
<i>cos</i>	0.0543	0.0637	0.852	-0.1040	0.0845	-1.231	0.0125	0.0500	0.252

Note: a = 1% and b = 5% significance levels.

Table 7 reveals that oil prices drive stock price increases in a statistically meaningful manner in Morocco, Qatar, and Tunisia but negatively affect those in Jordan. However, this effect does not appear to be statistically significant. This indicates that, in these countries, in addition to oil prices, other factors have a stronger influence on stock prices. Therefore, it can be argued that oil prices are not sufficiently influential on stock prices in these countries. This model implies that in oil-importing or less oil-dependent economies, such as Morocco and Tunisia, oil price shocks may affect stock markets through indirect channels, including production costs and inflationary pressures. Indeed, Filis & Chatziantoniou (2014) demonstrated that in net oil-importing countries, increases in oil prices exert negative effects on stock markets via cost and inflation channels.

In contrast, it has been concluded that oil prices trigger a statistically credible increase in the stock market performance of Kuwait and Lebanon. Specifically, a 1% increase in oil prices raised the stock prices of Kuwait and Lebanon by 0.27% and 1.15%, respectively. The stronger responses observed in these countries underscore the significance of oil revenues for financial conditions, investor expectations, and liquidity channels (IMF, 2023). Lebanon's fragile economic structure and high dependence on energy imports make the country highly vulnerable to external shocks. Consequently, fluctuations in oil prices may have more pronounced effects on Lebanese markets than many other countries (Bouri, 2015b).

These findings indicate that the relationship between oil prices and stock markets varies across countries. This diversity stems from the pronounced structural, institutional, and political differences among the economies in the sample. Accordingly, our results provide important country-specific insights into how energy price shocks are transmitted to financial markets.

Conclusion and Discussion

This study investigates the long-term effects of Brent oil price levels on stock market valuations in selected Arab countries using monthly data spanning the period from January 2010 to December 2024. The analysis employs the F-Shin co-integration test to account for potential structural breaks and nonlinearities in the data. The empirical results reveal that the long-term association between crude oil valuations and stock market trends varies across countries. Specifically, the test statistics indicate the existence of a long-term co-integration relationship for Jordan, Tunisia, Kuwait, Morocco, Lebanon, and Qatar. Moreover, the F-test results, assessing the significance of the sine and cosine specifications, support the robustness and reliability of the F-Shin co-integration approach. This is consistent with previous findings in the literature, such as those of Hammoudeh & Choi (2006), Alqahtani et al. (2020), Jouini (2013), Maghyereh & Al-Kandari (2007), and Aroui & Rault (2012), which also report long-term relationships in GCC countries. In contrast, no long-term relationship was detected for Bahrain, Oman, and the UAE. This outcome indicates the necessity for policymakers in countries highly dependent on energy imports or exports to reassess existing monetary and fiscal policy frameworks. In countries highly dependent on oil, such as Kuwait and Qatar, policymakers may prioritise mechanisms that enhance the economy's resilience to sudden oil price fluctuations. In contrast, in countries like Bahrain and the UAE, where economic diversification reduces sensitivity to oil prices, policy priorities may focus on sustaining diversification strategies and strengthening the financial markets' capacity to withstand external shocks. Policy recommendations developed within this framework provide more concrete insights that are directly linked to the countries' levels of oil dependence, exposure to global financial integration, and macroeconomic vulnerabilities. In this context, it is crucial for policymakers to build a more resilient macroeconomic structure capable of withstanding oil price fluctuations.

Furthermore, the DOLS estimator was applied to quantify the long-term effects. The results indicate that oil prices are a significant positive determinant of stock prices in Kuwait and Lebanon. The strong impact of oil price fluctuations on the financial markets of these two countries highlights the importance of policy mechanisms aimed at stabilising liquidity flows dependent on oil revenues. Accordingly, policymakers should design fiscal and financial policies that reinforce protective measures against oil price shocks. Conversely, in Morocco, Qatar, Tunisia, and Jordan, no significant statistical correlation was observed. This finding implies that these countries may have a lower sensitivity to energy prices and that other macroeconomic or regional factors could play a more prominent role in determining stock price movements. For example, in Morocco and Tunisia, the impact of oil price fluctuations on stock markets may materialise through indirect macroeconomic channels, such as production costs and inflationary pressures. Accordingly, it would be more rational for investors to consider sectors sensitive to energy prices and those resilient to macroeconomic shocks when constructing their portfolios. In economies that are highly sensitive to oil prices, enhancing sectoral diversification could mitigate uncertainties related to energy costs. Additionally, directing investments towards financial markets with lower integration with oil markets could offer effective hedging opportunities. Such a strategy would enable investors to better manage regional and sector-specific risks.

Overall, the findings highlight that crude oil price fluctuations and stock market movements are shaped by cross-country differences in economic structure and the degree of dependence on energy resources. Therefore, the study provides an analytical insight indicating that investment strategies should be evaluated in accordance with countries' levels of energy dependence, financial market integration, and macroeconomic vulnerability. Nevertheless, one of the main limitations of this study is the exclusive focus on oil prices in

the analysis. Future research would benefit from incorporating additional fundamental economic indicators, including interest rate and exchange rate volatility, to develop more comprehensive models and yield deeper insights.



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