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Oil and gold return spillover and stock market elasticity during COVID-19 pandemic: A comparative study between the stock markets of oil-exporting and oil-importing countries in the Middle East

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ABSTRACT

This article aimed to study the return spillover effect of oil and gold on the elasticity of financial markets in a group of countries in the Middle East. The results showed a heterogeneous impact of oil and gold returns on the stock market’s elasticity. In contrast, oil returns significantly affected elasticity in most oil-exporting countries. Additionally, the elasticity of financial markets in oil-importing countries showed a slight impact on the movement of oil returns. The impact of oil and gold returns also varied among short, medium, and long-term periods; gold returns were greater for Kuwait, Bahrain, Saudi Arabia, and Jordan. The impact of oil was more in Qatar, Bahrain, and Egypt, whereas the effect of gold and oil was equal in Turkey. Last, the effect of the COVID-19 pandemic on the elasticity of financial markets was significant.

Author statement

Omar Bani-Khalaf: Conceptualization, Software, Validation, Formal analysis, Writing - Original Draft, Investigation, Visualization. Nigar Taspinar: Writing - Review & Editing, Supervision.

1. Introduction

Beginning in Wuhan, China, in December 2019, and ending with its last mutation, “Omicron,” COVID-19 has affected all aspects of life, including the stock markets. Since the World Health Organization (WHO) declared the virus a worldwide pandemic on January 30, 2020, financial markets have suffered from many crises that have caused panic among investors. For instance, oil futures contracts fell to unprecedented levels. On March 9, 2020, oil prices dropped by more than 25% in a single day. Different causes explain this variation in oil prices during COVID-19, which raised several concerns among investors because of its societal effect (high infection rate, significant death rates, and accompanying health service obstructions). On the one hand, the global crisis resulted in a worldwide reduction of activity, which largely affected the transportation sector and, as a result, the oil demand. On the other hand, the failure of early oil supply discussions between the Organization of the Petroleum Exporting Countries (OPEC) and Russia prompted international suppliers to initiate a price war. Therefore, worldwide uncertainty caused oil prices and returns to fluctuate. The yellow metal was not immune to this uncertainty and played its traditional role as a hedging tool effectively. Gold is seen as a protective asset among investors facing unpredicted price changes in financial markets and inflation. Increased uncertainty and financial risk worldwide led investors to invest in gold to protect their portfolio returns. Increases in demand for gold as a protective asset during COVID-19 caused gold prices to increase. According to Atri et al. (2011, 2021), COVID-19 has had a positive effect on gold prices.

The uncertainties caused by COVID-19 have also affected stock markets. Many investors resorted to transferring their liquid assets to safer long-term investments in light of the pandemic (Li et al., 2021). Investors incurred significant losses in a short time because of the rapid and unexpected spread of the virus, which led to a decrease in the general liquidity of the market (Zhang et al., 2020). Changes in the general liquidity of stock markets led to changes in the stock market’s elasticity, with investors increasing their trading volumes because of price changes to hedge against probable losses in the stock markets.

In light of the above discussion, the aim of this study is to examine the nexus between gold-oil returns and stock market elasticity in oil-importing and oil exporting countries in the Middle East. We examined return spillovers among oil-gold returns and stock market elasticity.
using Diebold and Yilmaz’s (2012) and Barunik and Krehlik’s (2018) methods. We also investigated the coherence among oil-gold returns and stock market elasticity by adopting bivariate and partial wavelet approach. Diebold and Yilmaz’s (2012) method allowed us to investigate return spillovers among our variables in a directional way, and Barunik and Krehlik’s (2018) novel method allowed us to investigate directional return spillovers among our variables under different investment horizons (short term, medium term, and long term). These methods helped us observe directional return spillovers among oil-gold returns and stock market elasticity and compare their behaviors under different investment horizons. Additionally, we used wavelet coherence method to determine and visualize coherence among our variables in a time-frequency domain. After determining possible co-movements among oil-gold returns and stock market elasticity, we applied partial wavelet coherence (PWC) method to investigate the possible impact of the COVID-19 pandemic on these co-movements. The advantage of adopting the PWC method is that it excludes the impact of a common factor on the co-movements between two variables. That is why this method has superior properties compared to the bivariate wavelet coherence (BWC) method.

We chose the Middle East as our sample because, according to OPEC reports, the Middle East has 64.5% of OPEC’s oil reserves (OPEC, 2021). However, the stock markets in these countries are still inefficient, and the demand for stock investments is low compared to other investment alternatives. We excluded countries that did not provide sufficient data. For instance, we removed Iraq from our sample because it did not provide enough information regarding market capitalization or trading volume. Moreover, we excluded Oman because its overall market size is small. To obtain a geographically homogenous sample, we chose the most oil-importing countries with sufficient data, Jordan, Egypt, and Turkey. We excluded Syria and Lebanon because they lacked data regarding stock markets.

This study contributes to the literature in the following ways: (1) Most previous studies in the literature investigated the effect of volatility in gold and oil returns on the closing prices or liquidity of stock markets, which they measured by turnover ratio. We examined co-movements and correlations between oil and gold return spillover, on the one hand, and stock market elasticity, on the other. (2) We, to our best knowledge, compared co-movements among oil-gold returns and stock market elasticity and the impact of the COVID-19 pandemic on these co-movements for the first time in the literature among homogenous geographical countries in the Middle East, depending on whether the country was an exporter or importer of oil. (3) And we employed the latest econometrics approaches to compare empirical results for robustness.

The following sections will be as follows: In the second section, we summarized related literature that dealt with the topic. In the third section, we discussed the sample and the methodology used in the study. In the fourth section, we present and discuss the study’s results for each country in detail. Finally, we presented our findings and recommendations in the fifth section.

2. Literature review

For decades, researchers Hamilton (1983) and Sadorsky (1999) have tried to study the relationship between oil prices and financial markets. These studies have shown a significant impact of oil on financial markets. Especially in the last few years, researchers have continually investigated this delicate interaction. For example, Shabbir et al. (2020) used the autoregressive distributed lag model (ARDL) to test the impact of gold, oil prices, and the exchange rate on the stock market. They concluded that oil and gold prices affected stock prices. Further, they stressed the need to invest in gold in light of the world’s current high inflation rates. Other researchers used a quantile regression approach to examine the relationship between oil and gold prices and an emerging market’s stock market volatility (Ali et al., 2020). Their results suggest that exchange rate and gold price volatility negatively affect stock market performance. Civeci and Akcoc (2021) used the nonlinear ARDL (NARDL) method to test the relationship between oil return volatility and the stock market. They found that the effect of oil return shocks is limited in the short term, whereas in the long term, its effect is feeble. Rafiuddin et al. (2021) investigated the relationship among gold, oil, and stock markets for Gulf countries’ stock markets using the wavelet approach. They concluded that there is no impact of fluctuations in oil and gold revenues on the stock market in Gulf countries in the long run. They also concluded that oil returns affected the Kuwait stock market more than the Gulf markets. Mishra et al. (2022) used the asymmetric causality test to estimate the movement between spot and future prices of oil and gold. The results showed negative and positive shocks in oil prices Granger cause gold prices, and vice versa. Likewise, Kumar et al. (2020) used the NARDL to examine the causality between oil, gold, exchange rate, and stock market return. They concluded that oil affects the Indian stock market, whereas the stock market affects gold. Mohanty et al. (2011) and Hamdi et al. (2019) they studied the oil price spillover among GCC country. They concluded that oil price has a long-term effect on the elasticity of the Qatari stock market.

However, after the emergence of the coronavirus pandemic and the changes it caused in the financial market, the need to study the consequences of this unusual event on the financial market became clear to researchers. Albulescu et al. (2021) used wavelet coherence test to examine changes in correlation between crude oil and the US stock market in light of the COVID-19 outbreak. Their main finding was that the pandemic boosted the spread of oil shocks in the stock market. Wei et al. (2021) found that the pandemic had a significant effect on the long-run volatility of the correlation of gold and oil market prices. Later, Ali et al. (2022) used the wavelet coherency method to compare spillover and nonlinear causality between oil shocks and stock market volatility. Their findings revealed that the pandemic caused a change in relations in some markets (e.g., Russia) and amplified shocks in other oil-importing markets (e.g., the United States). Haroon and Rizvi (2020) and Zaremba et al. (2021) used panel regression to test the impact of COVID-19 on market liquidity, which proxied with turnover ratio. Their findings showed that an increase in the number of confirmed cases leads to financial liquidity drying up in the markets.

Moreover, the pandemic has raised questions among researchers about the effectiveness of gold in hedging against risks. Wang et al. (2021) used the multistage approach (e.g., wavelet coherence and GARCH-EVT-VaR model) to investigate the nonlinear oil-gold connection, concluding that gold is still a safe haven against stock market volatility. Tissiaux et al. (2021) used wavelet coherency approach to examine the effect of COVI-19 on the liquidity of Saudi stock market. They concluded that the direction of the relationship between oil return and stock market liquidity varies during the pandemic outbreak.

However, most of these studies were concerned about stock market returns, volatility, and stock market liquidity. They also said nothing about the disparities in the usefulness of gold as a substitute for oil in the stock markets of oil-exporting and importing countries.

3. Data and methodology

We selected a sample of eight countries in the Middle East, five of which are oil exporters (Bahrain, United Arab Emirates [UAE], Kuwait, Qatar, and Saudi Arabia) and three are importers (Jordan, Egypt, and Turkey). We chose this sample for two main reasons: first, to compare significant oil-exporting and importing countries located in the same geographical area where there may be homogeneity in general political and economic conditions. Second, because we relied on published data about the financial markets of these countries, we excluded countries whose financial markets did not provide sufficient data to calculate the variables. Daily data were collected from January 2020 to November 2021. We chose this period to include the beginning of the pandemic’s outbreak and the economic breakthrough until the last SARS-COVID
Table 1: Variables, their abbreviations, and sources.

| Short name | Long name                              | Source           |
|------------|----------------------------------------|------------------|
| Elasticity | Coefficient of trading elasticity      | Calculated       |
| Oil        | Return of future contract of WTI       | DataStream       |
| Gold       | Return of future gold contract         | DataStream       |
| COVID      | Logarithm of cumulative COVID-19       | WHO              |

3.1. Elasticity

In calculating elasticity, we followed Wanzala (2018) and used the model Datar (2000) proposed. According to this model, the trading elasticity coefficient (TEC) is the percentage change in trading volume ($\%\Delta T \cdot V$) to percentage change in price at time $t$ ($\%\Delta P$), with a wide range of possible values, from minus infinity to positive infinity ($\infty$, $\infty$) (Eq. (1)):

$$ TEC = \frac{\%\Delta T \cdot V}{\%\Delta P} \text{ where } TEC = (-\infty, \infty) \quad (1) $$

$$ \%\Delta T \cdot V = \frac{T \cdot V_t - T \cdot V_{t-1}}{T \cdot V_{t-1}} \quad (2) $$

$$ \%\Delta P = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (3) $$

A high TEC means a large volume of transactions follow price movements. When major transactions occur with minimal price movement, the value of TEC approaches infinity and, therefore, high elasticity. For instance, if TEC is more than one and prices are rising, greater prices are attracting even bigger volumes, which is good news. However, if TEC is one and prices are rising, trading volume is rising at the same level. If TEC is less than one and prices are rising, then they are rising on a lower level of demand. This rise may be speculative, and the market may be considered to be inelastic.

3.2. Model specification

The main goal of this study is to test the co-movements between stock market elasticity and oil and gold returns. Therefore, we started by testing the following models:

$$ TEC_{country} = f(Oil, Gold) \quad (4) $$

$$ TEC_{country} = f(Oil, Gold, COVID) \quad (5) $$

The first model, Eq. (4), assumes that oil and gold returns drive TEC, whereas the second model, Eq. (5) tests this relationship after adjusting for the impact of COVID-19. We reviewed the literature (Adekoya et al., 2021; Asadi et al., 2022; Umar et al., 2019) to choose the methodology that could best achieve the main goals of this study. We adopted Diebold and Yilmaz’s (2012) frequency domain spillover method, and we reposted the results by visualizing them using wavelet coherence. Finally, we used PWC to exclude the effect of COVID-19 on the relationship between variables.

3.2.1 Diebold and Yilmaz (2012)

The fundamental goal of this research was to provide additional information on the oscillations in the returns of oil and gold and their impact on the oscillations of stock market elasticity for a sample of Middle Eastern oil-importing and oil-exporting countries. We used Diebold and Yilmaz’s (2012) technique to achieve this goal. This technique is based on the VAR system and generalized variance decomposition (GVD) and offers a simple and straightforward way to measure the system’s volatility connectedness. GVD aims to separate forecast error variance of one asset from parts other assets have affected. GVD helps overcome any disturbance induced, which is attributed to ordering other variables. In the middle of the GVD version, the past distribution of errors is utilized, creating the correlated shocks (Diebold and Yilmaz, 2012). Additionally, the GVD is efficacious in curbing the degree of connectedness among financial assets. As a result, the GVD model aids in eliminating any disruption caused by the ordering of other variables. The previous distribution of mistakes is used in the middle of the GVD version, causing the associated shocks (Diebold and Yilmaz, 2012). The GVD effectively reduces the degree of interconnectedness between financial assets. The nth order for VAR model can be formulated by the following equation:

$$ \theta = \sum_{n=1}^{N} \sigma_i b_{n} + \epsilon_i \quad (6) $$

where $\sigma_i$ is a $(\sigma_1, \sigma_2, \sigma_3)$ random vector, $\epsilon_i$ is a vector of error terms, and $\sigma_i$ is the function of a $3 \times 3$ matrix. After we assumed that the var system was covariance stationary, we represented the moving average representation in the following equation:

$$ \gamma_i = \sum_{j=1}^{m} A_j \epsilon_{i-j} \quad \text{where } A_j = \sum_{n=1}^{N} \sigma_i A_{i-n} \quad (7) $$

where $A_0$ is the N $\times$ N identity matrix, and $A_0$ is equivalent to zero. The moving average was based on the GVD model and was used to assess overall spillover, paired spillover, and directional spillover among stock market elasticity, oil return, and gold return. The GVD matrix, which represents the n-step-ahead error forecast, is calculated by using the following equation:

$$ b_j(n) = \frac{V_{-1} \sum_{n=1}^{n} \epsilon_i p_i \prod p_i \epsilon_i}{\sum_{i=0}^{\infty} \epsilon_i} \quad (8) $$

where $\epsilon_i$ is vector of $i^{th}$ (0,1) elements, whereas $p_i$ is the coefficient matrix multiplied by n-lagged vector shock. $\prod$ is the variance matrix of the error vector $\epsilon$. Moreover, $V_{-1}$ is the $i^{th}$ diagonal element of $\prod$. The inputs in b(n) matrix were transformed to be normal to ensure the sum of forecast error variance was 1.

3.2.2. Barunik and Krehlik (2018) frequency domain spillover method

After we tested volatility using Diebold and Yilmaz (2012), we used Barunik and Krehlik (2018) to determine the frequency domain of spillovers. This allowed us to conduct an in-depth analysis. Our study provides readers with comprehensive knowledge of selected assets. Furthermore, we intend to examine which frequency spillover is larger than others to provide additional information regarding the effect of fluctuating oil and gold returns on the elasticity of financial markets. This approach, which Barunik and Krehlik introduced in 2018, breaks down the original Diebold and Yilmaz spillover at specific frequencies. Specifically, the model is used as a formulation based on a spectral formation of deconstructing variance use. We used the function of frequency response:

$$ \theta(z, \omega) = \sum_{k=1}^{n} \gamma^z \omega^\delta \theta \quad (9) $$

Equation (6) was obtained from the $\theta$ coefficient’s Fourier information, with $\omega = \sqrt{-1}$. The general causality spectrum across frequencies, with $\theta \in (-n, n)$, was calculated as follows:

$$ f(\theta) = \omega^{1-i} \theta^{(1-i) \sum_{i,n}^{i,n} \iota} \theta^{|\sum_{\theta^{(1-i)} \sum_{\theta^{(1-i)}} \iota} |} \quad (10) $$
where $\theta (\tau F) = \sum_{m} e^{-i \omega_m \theta_m}$ denotes the Fourier modification in the impulse response $\theta$. However, the $f(\theta)_n$ displays the component of the spectrum of the $i^{th}$ variable at frequency $\theta$, taking into consideration shocks in the $n^{th}$ variable. Eq. (7) was used to quantify within-frequency causality depending on the spectrum of the $i^{th}$ variable with frequency $\theta$. Finally, we measured the pairwise connectedness from $Y$ to $X$ at frequency $F$ using the following equation:

$$\rho_{XY} (F) = \frac{\rho_{XY} (F) - \sum_{m} \rho_{XY} (F)}{\sum_{m} \rho_{XY} (F)}$$

(11)

To estimate the generalized forecast error variance decompositions on frequency band $B = (K, L) : K, L \in ( - N, N)$, $K < L$, we used the following equation:

$$C^F = \frac{\sum_{i=1}^{L} \rho_{XY} (B) - \sum_{i=1}^{L} \rho_{XY} (B)}{\sum_{i=1}^{L} \rho_{XY} (B)}$$

(13)

The total directional connectedness from and to between variables $E$ and $G$ was estimated using the following formulas respectively:

$$C^E_{i,j} = \sum_{i=1}^{L} \rho_{XY} (B)$$

(14)

$$C^F_{i,j} = \sum_{i=1}^{L} \rho_{XY} (B)$$

(15)

Using equations (11) and (12), we can estimate the directional connectedness from oil and gold returns to elasticity in the short, medium, and long term (and vice versa) during the time domain. For instance, the short term represents high frequency. It is located between 1 and 4 days, the medium term represents the medium frequency, and the period of 10 to 30 days represents the long term and low frequency (Barunik and Kreidlík, 2018). However, studying different frequencies gives us a better understanding of the variance (shock) interaction between variables during different periods.

### 3.2.3. Bivariate and partial wavelet coherency

To visualize the results of previous methods and to investigate co-movements among variables during time, we used BWC, which Torrence and Compo (1998) proposed and Grinsted et al. (2004) developed. This method is used to obtain information about frequency and time together. It provides effective periodic signal detection and separation by balancing over time and frequency localization. Furthermore, it allows a better trade-off between identifying cycles and peaks or discontinuities (Frimpong et al., 2021). Wavelet coherence uses a filter window “mother wavelet” to explain the information during the time which can be calculated using the following equation:

$$\psi_{\alpha, \beta} = \psi \left( \frac{t - \beta}{\alpha} \right), \alpha, \beta \in R \ and \ \alpha \neq 0$$

(16)

where ($\alpha$ and $\beta$) are respectively the scaling and translation coefficient belonging to a real number, and $\psi$ is the length of the mother wavelet ranging from $-1$ to $1$. To express the BWC ($q^2_{XY}$) between response variable $Y$ and predictor variable $X$, we used Hu et al.’s (2017) equation notation:

$$q^2_{XY} = \frac{\leftrightarrow Y, X_{(\alpha, \beta)} \leftrightarrow X, Y_{(\alpha, \beta)}}{\leftrightarrow Y, X_{(\alpha, \beta)} \leftrightarrow X, Y_{(\alpha, \beta)}}$$

(17)

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$$\psi_{\alpha, \beta} = \frac{1}{\sqrt{\alpha}} \psi \left( \frac{t - \beta}{\alpha} \right), \alpha, \beta \in R \ and \ \alpha \neq 0$$

(16)

where ($\alpha$ and $\beta$) are respectively the scaling and translation coefficient belonging to a real number, and $\psi$ is the length of the mother wavelet ranging from $-1$ to $1$. To express the BWC ($q^2_{XY}$) between response variable $Y$ and predictor variable $X$, we used Hu et al.’s (2017) equation notation:

$$q^2_{XY} = \frac{\leftrightarrow Y, X_{(\alpha, \beta)} \leftrightarrow X, Y_{(\alpha, \beta)}}{\leftrightarrow Y, X_{(\alpha, \beta)} \leftrightarrow X, Y_{(\alpha, \beta)}}$$

(17)

where ($\leftrightarrow Y, X_{(\alpha, \beta)} \leftrightarrow X, Y_{(\alpha, \beta)}$) are bivariate matrices of the smoothed cross-wavelet predator between variables $Y$ and $X$. The wavelet point between response and impulse variable $Y$ and $X$ was determined by the following:

$$\psi_{\alpha, \beta} = \frac{\psi \left( \frac{t - \beta}{\alpha} \right)}{\psi \left( \frac{t - \beta}{\alpha} \right)}$$

(18)

where (im) was the imaginary part of $\psi \left( \frac{t - \beta}{\alpha} \right)$, and (re) was the real part. As we mentioned earlier, our goal was to measure conditional co-movements among studies’ variables. In other words, we wanted to measure the impact of COVID-19 on stock market elasticity and on the relationship between variables. Hence, we used an improved version of PWC (Hu and Si, 2021), which is an extension of Koopmans’ (1974). Koopmans changed the scale domain to location-scale domain. The PWC ($\rho$) between $X$ and $Y$ after removing the effect of $Z$ at scale $\alpha$ and location $\beta$ is presented in equation (19). The symbol (.) means that we excluded the variable $Z$.

$$\rho_{XY} = \sqrt{\frac{1 - q^2_{XY} Z_{(\alpha, \beta)}}{1 - q^2_{XY} Z_{(\alpha, \beta)}}}$$

(19)

Finally, the conical shape shown in gray is the significance interval. The rows inside this cone were considered to represent a significant movement (relationships) among variables.

### 4. Empirical results

We started by reporting the primary descriptive statistic and the results in Table 2. The Jordanian stock market has the highest average market elasticity, whereas the Saudi market has the lowest. According to the kurtosis values, the elasticity curves follow a leptokurtic distribution in most markets because they have a thick tail. Additionally, the stock market elasticity is homogenous, where the standard deviation values are relative to each other.

Then, we presented the test results for each country separately to achieve a better comparison among the financial markets of those countries.

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**Table 2**

Descriptive statistic.

| Index | Mean | Median | Max | Min | SD | Skewness | Kurtosis |
|-------|------|--------|-----|-----|----|----------|----------|
| Elasticity | 98.12 | 98.83 | 98.66 | 0.70 | 0.30 | 0.08 | 1.20 |
| Oil return | 0.41 | 0.50 | 1.25 | 0.45 | 0.30 | 0.13 | 1.20 |
| Gold return | 1.25 | 0.50 | 1.41 | 0.30 | 0.30 | 0.05 | 1.41 |
| TCI | 0.55 | 0.50 | 1.41 | 0.45 | 0.45 | 0.00 | 1.41 |

**Table 3**

Diebold and Yilmaz’s test for return spillover connectedness in the Jordanian stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM |
|-----------|------------|------------|-------------|------|
| Elasticity | 98.12 | 0.08 | 1.20 | 0.63 |
| Oil return | 0.41 | 98.83 | 0.70 | 0.30 |
| Gold return | 1.25 | 0.50 | 0.45 | 0.45 |
| TCI | 0.55 | 0.50 | 1.41 | 1.46 |
5

Table 4: Barunik and Krehlik test of frequency domain spillover for the Jordanian stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM_ABS | FROM_WTH |
|-----------|------------|------------|-------------|----------|----------|
| The spillover table for band 3.14 to 0.79 roughly corresponds to 1 day to 4 days. | | | | |
| Elasticity | 74.08 | 0.65 | 0.77 | 0.47 | 0.62 |
| Oil return | 0.28 | 70.69 | 0.55 | 0.28 | 0.37 |
| Gold return | 1.07 | 0.10 | 78.45 | 0.39 | 0.52 |
| To_ABS | 0.45 | 0.25 | 0.44 | TCI = 1.14 |
| To_WTH | 0.60 | 0.33 | 0.58 | TCI = 1.51 |

The spillover table for band 0.79 to 0.31 roughly corresponds to 4 days-10 days.

| Elasticity | 15.34 | 0.03 | 0.28 | 0.10 | 0.66 |
| Oil return | 0.08 | 17.47 | 0.12 | 0.07 | 0.43 |
| Gold return | 0.13 | 0.01 | 13.17 | 0.04 | 0.28 |
| To_ABS | 0.07 | 0.01 | 0.13 | TCI = 0.21 |
| To_WTH | 0.44 | 0.07 | 0.86 | TCI = 1.37 |

The spillover table for band 0.31 to 0.00 roughly corresponds to 10 days to Inf days.

| Elasticity | 8.70 | 0.00 | 0.15 | 0.05 | 0.59 |
| Oil return | 0.05 | 10.68 | 0.09 | 0.05 | 0.52 |
| Gold return | 0.04 | 0.00 | 7.03 | 0.01 | 0.14 |
| To_ABS | 0.03 | 0.00 | 0.08 | TCI = 0.11 |
| To_WTH | 0.34 | 0.01 | 0.90 | TCI = 1.25 |

4.1. Jordanian stock market

Table 3 shows Diebold and Yılmaz’s (2012) test results. According to Table 3, gold and oil returns affect the Jordanian stock market’s elasticity by 1.24% and 0.41%, respectively. This finding represents variations in gold returns that contribute to variations in Jordanian stock market elasticity more than variations in oil returns. In comparison, Table 3 indicates that gold and oil returns affect the Jordanian stock market, oil returns, and gold returns.

Table 3 shows Diebold and Yılmaz’s (2012) test results. According to Table 3, gold and oil returns affect the Jordanian stock market’s elasticity by 1.24% and 0.41%, respectively. This finding represents variations in gold returns that contribute to variations in Jordanian stock market elasticity more than variations in oil returns. In comparison, Table 3 indicates that gold and oil returns affect the Jordanian stock market, oil returns, and gold returns.

To find out more details about the impact on the extent to which gold affects the elasticity of the Jordanian market, whether in long, medium, or short term, and to provide additional information about the variables’ pairwise spillover, we used Barunik and Krehlik’s (2018) frequency domain spillover method. Table 4 reports the results. The frequency of one day to four days contributes 1.14% to overall connectivity; the frequency of four days to 10 days contributes just 0.21% to total spillover; and the last frequency of 10 days to infinity provides 0.11% of overall connectivity. Furthermore, gold is the most critical ingredient in this system. More specifically, gold contributes 0.58%, 0.86%, and 0.90% of total spillover.

In contrast, the impact of oil decreases over time until it diminishes in the long term. The impact of oil return on the stock market elasticity is only limited in the short run. For instance, oil return affects elasticity by 0.65% during the first four days, and it vanishes after 10 days. Table 4 indicates that the primary determinant of Jordanian stock market elasticity is previous volatility values.

We employed bivariate wavelet analysis to visualize co-movements between gold and oil returns and stock market elasticity. Moreover, we used partial wavelet coherency to eliminate the effect of COVID-19 on the relationship between variables. Fig. 1 presents the results. We divided the comparison into four stages. Fig. 1-A shows the relationship between oil and stock market elasticity. Oil return volatility leads the stock market elasticity in only a specific period. After that, the relationship becomes undetermined. After removing the effect of COVID-19, Fig. 1-B indicates that the impact of oil vanished. These results suggest that the effect of COVID-19 on Jordan’s stock market is more than the effect of the oil. In other words, volatility in oil returns did not affect elasticity as much as the pandemic did. Regarding gold returns’ volatility, in Fig. 1-C, gold returns are shown to be more significant in driving elasticity than oil returns because the co-movements are significant during the whole sample period. Finally, even after COVID-19’s impact is removed, in Fig. 1-D, most rows indicate that gold returns significantly determine elasticity in the market. These results indicate the importance and efficiency of gold as a safe alternative investment during unexpected events from the Jordanian investors’ point of view. They also indicate the significance of gold in affecting the elasticity of the Jordanian market and are consistent with prior findings.

4.2. Egyptian stock market

Egypt is regarded as an oil-importing country; however, compared to Jordan, oil returns more than gold affects the elasticity of the Egyptian stock market. According to Table 5, the volatility connectedness test showed that oil returns contribute 0.5%, whereas oil revenue contribute...
only 0.24%. However, the total contribution factor for overall connectivity is 1.23%, and most of the stock market elasticity comes from the market itself.

To obtain more details regarding volatility connectivity between the variables, we used Barunik and Krehlik’s (2018) frequency domain spillover method. Table 6 reports the results. Table 6 shows that the frequency of one day to four days contributes 0.88% to overall connectivity, the frequency of four days to 10 days contributes just 0.22% to total spillover, and the frequency of 10 days to infinity contributes 0.98% to overall connectivity. Furthermore, oil is critical in this system. It contributes 0.55%, 0.67%, and 0.90% of total spillover. In comparison with the results of Jordan, we noted that the impact of fluctuations in oil and gold prices on the elasticity of the Egyptian market increases over time, whereas the impact of oil return spillover vanishes over time.

The result of the wavelet coherence test confirmed this relationship. According to Fig. 2-A, oil returns are driving market elasticity. However, because only a limited number of rows lay inside the cone, the correlation existed in the first month of 2020. When COVID-19 broke out, it changed this correlation, diminishing the role of oil. Fig. 2-B confirms this. After taking COVID-19 into account, the number of arrows inside the cone reduces whereas the number of rows outside the cone increases. In other words, before the coronavirus pandemic, oil was driving elasticity, but the relationship changed after the pandemic and oil lost its effect on elasticity. Although elasticity has been demonstrated to be less affected by oil, the influence of gold returns on the Egyptian market, as Fig. 2-C indicates, is limited and the linkage is not directional. Fig. 2-D shows that the connection does not change substantially when the coronavirus effect is excluded. The disparities between the Jordanian and Egyptian markets emerge here, with Jordanian investors resorting to gold as a safe alternative and Egyptian investors selecting other investment options.

These findings contradict Wang et al. (2021), who argued that gold might be deemed a haven. Meanwhile, our results show that Egyptian investors tend to use other alternatives than gold.

### 4.3. Turkish stock market

Turkey is an oil-importing country. We conducted the previous tests on the Turkish market as well. Starting with Diebold and Yilmaz’s test, we found that both oil and gold returns have the same effect on market elasticity: 0.51%. However, according to Table 7, what affects the elasticity of the stock market most is the stock market itself. This is consistent with Kumar et al. (2021) and Jain and Biswal (2016).

Table 8 depicts the influence of the link between oil and gold returns over time on the elasticity of the Turkish stock market. Both gold and oil returns have a similar impact, which diminishes over time. The overall connectivity between the first and fourth days is 0.49%. This decreases...
to 0.17% from four to 10 days, and 0.09% from 10 days to infinity. Once again, these results confirm our previous results.

However, to determine whether this impact would persist even during a pandemic, we conducted wavelet coherence analysis.

Fig. 3 shows the coherency charts for the Turkish stock market. In Fig. 3-A, the co-movements between oil and elasticity are incredibly low during a pandemic, we conducted wavelet coherence analysis. Alternatively, if the arrows point to the left, the coloring scale on the right shows the different significance levels. The color gradient is red, which indicates a statistically significant period. The pointers in the maps mentioned above fluctuate between left and right, which means the co-movements are undetermined. These results show the influence of speculators on the Turkish stock market. Market elasticity relies on not only oil or gold returns but also various buying and selling movements. Our findings confirm those of Covir and Akkoc (2021), who argued that the effect of oil return volatility is only limited to a short period.

Table 7
Diebold and Yilmaz’s test for return spillover connectedness in the Turkish stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM
|-----------|------------|------------|-------------|------|
| Elasticity | 98.99      | 0.51       | 0.51        | 0.34 |
| Oil return | 0.02       | 99.97      | 0.01        | 0.01 |
| Gold return| 0.19       | 0.29       | 99.52       | 0.16 |
| TO         | 0.07       | 0.26       | 0.17        | TCI = 0.51 |

Table 8
Barunik and Krehlik test frequency domain spillover for the Turkish stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM
|-----------|------------|------------|-------------|------|
| Elasticity | 75.10      | 0.32       | 0.32        | 0.02 |
| Oil return | 0.01       | 67.05      | 0.20        | 0.07 |
| Gold return| 0.13       | 0.49       | 73.04       | 0.21 |
| TO_ABS    | 0.05       | 0.27       | 0.17        | TCI = 0.49 |
| TO_WTH    | 0.07       | 0.37       | 0.24        | TCI = 0.68 |

The spillover table for band 0.31 to 0.00 roughly corresponds to 1 day to Inf days.

| Elasticity | Oil return | Gold return | FROM
|------------|------------|-------------|------|
| Elasticity | 15.26      | 0.14       | 0.15        | 0.10 |
| Oil return | 0.01       | 20.25      | 0.08        | 0.03 |
| Gold return| 0.04       | 0.10       | 16.71       | 0.04 |
| FROM_ABS  | 0.01       | 0.08       | 0.08        | TCI = 0.17 |
| FROM_WTH  | 0.08       | 0.46       | 0.44        | TCI = 0.98 |

The spillover table for band 0.00 to 0.31 roughly corresponds to 0 to 10 days.

| Elasticity | Oil return | Gold return | FROM
|------------|------------|-------------|------|
| Elasticity | 8.52       | 0.09       | 0.09        | 0.06 |
| Oil return | 0.00       | 12.35      | 0.05        | 0.02 |
| Gold return| 0.02       | 0.02       | 9.46        | 0.02 |
| FROM_ABS  | 0.01       | 0.04       | 0.05        | TCI = 0.09 |
| FROM_WTH  | 0.09       | 0.36       | 0.46        | TCI = 0.91 |

Table 9
Diebold and Yilmaz’s test for return spillover connectedness in Bahrain stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM
|-----------|------------|------------|-------------|------|
| Elasticity | 99.58      | 0.27       | 0.15        | 0.00 |
| Oil return | 99.93      | 0.02       | 0.02        | 0.00 |
| Gold return| 99.66      | 0.11       | 0.11        | 0.00 |
| TO         | 0.03       | 0.19       | 0.06        | TCI = 0.28 |

Table 10
Barunik and Krehlik’s test frequency domain spillover for the Bahrain stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM
|-----------|------------|------------|-------------|------|
| Elasticity | 75.51      | 0.66       | 0.61        | 0.57 |
| Oil return | 67.64      | 0.52       | 0.27        | 0.37 |
| Gold return| 83.74      | 0.48       | 0.48        | 0.65 |
| TO_ABS    | 0.50       | 0.38       | TCI = 1.17  |      |
| TO_WTH    | 0.40       | 0.67       | 0.51        | TCI = 1.59 |

The spillover table for band 0.00 to 0.31 roughly corresponds to 4 days-10 days.

| Elasticity | Oil return | Gold return | FROM
|------------|------------|-------------|------|
| Elasticity | 14.81      | 0.01       | 0.23        | 0.08 |
| Oil return | 19.37      | 0.14       | 0.07        | 0.45 |
| Gold return| 15.42      | 0.09       | 0.09        | 0.56 |
| FROM_ABS  | 0.50       | 0.12       | TCI = 0.25  |      |
| FROM_WTH  | 0.44       | 0.30       | 0.73        | TCI = 1.48 |

The spillover table for band 0.31 to 0.00 roughly corresponds to 10 days to Inf days.

| Elasticity | Oil return | Gold return | FROM
|------------|------------|-------------|------|
| Elasticity | 8.05       | 0.04       | 0.04        | 0.46 |
| Oil return | 11.81      | 0.07       | 0.05        | 0.47 |
| Gold return| 8.4        | 0.04       | 0.04        | 0.39 |
| FROM_ABS  | 0.05       | 0.07       | TCI = 0.13  |      |
| FROM_WTH  | 0.47       | 0.16       | 0.69        | TCI = 1.32 |

Fig. 3. Turkish stock market elasticity, gold, and oil co-movement maps

The arrows show the differences in phase between the two series. Right-pointing arrows indicate that the variables are in phase (co-move). Right-downward-pointing arrows demonstrate that oil and gold returns drive elasticity. Right-upward-pointing arrows suggest that oil and gold returns follow elasticity. The variables are considered out of phase if the arrows point to the left. Arrows that point to the left and up indicate that oil or gold returns are lagging. Alternatively, if the arrows point to the left and down, oil or gold returns lead. The coloring scale on the right shows the different significance levels. The color gradient is red, which indicates a statistically significant effect, to dark blue, which indicates the absence of any relationship.
test results. The oil-elasticity cross correlation becomes stronger with more rows inside the area of significance, confirming that oil returns are leading the elasticity. Fig. 4 -B shows the PWC test results, oil return has more effect on the Bahrain stock market. According to Fig. 4 -A, oil returns are leading the elasticity. However, the gold-price-elasticity relationship, in Fig. 4 -C, is less powerful. Few significant areas appear on the correlation map. Moreover, in Fig. 4 -D, after using PWC test to exclude the COVID-19 effect, the correlation becomes undetermined, and the rows totally disappear. These findings contradict those of Rafuiddin et al. (2021), who concluded that only oil return and not gold affects the Kuwait stock market. Although the effect of gold is limited to short periods, it affects the elasticity of stock markets.

Fig. 4 presents the wavelet coherency test results for the Bahrain stock market. According to Fig. 4-A, oil returns are leading the elasticity. Oil returns change first, followed by elasticity. Fig. 4-B shows the PWC test results. The oil-elasticity cross correlation becomes stronger with more rows inside the area of significance, confirming that oil returns are leading elasticity. However, the gold-price-elasticity relationship, in Fig. 4-C, is less powerful. Few significant areas appear on the correlation map. Moreover, in Fig. 4-D, after using PWC test to exclude the COVID-19 effect, the correlation becomes undetermined, and the rows totally disappear. These findings are comparable to what we saw in the Egyptian market in terms of market elasticity being influenced more by oil returns than gold returns. Oil returns have a greater influence on the Bahrain stock market because the country’s economy is mostly based on petroleum.

4.4. Bahrain stock market

Bahrain is an oil-exporting country. According to Table 9, which shows Diebold and Yilmaz’s test results, oil return has more effect on stock market elasticity than gold. Its contribution to total elasticity volatility is 0.28%, whereas that of gold is only 0.15%. However, the total volatility of the system is 0.28%.

Table 10 shows the spillover connectivity between variables and the interaction among oil, gold returns, and stock market elasticity during different periods. For example, the total connectivity factor from one to four days is 1.27%, that from four to 10 days is 0.25%, and that from 10 to infinity is 0.13%. The impact of oil on market elasticity is more significant than that of gold; oil’s effect remains whereas that of gold shrinks in the long run. These findings contradict those of Rafuiddin et al. (2021), who concluded that only oil return and not gold affects the Kuwait stock market. Although the effect of gold is limited to short periods, it affects the elasticity of stock markets.

4.5. Kingdom of Saudi Arabia (KSA) stock market

KSA is one of the leading oil exporters and essential members of OPEC. According to the Diebold and Yilmaz test results (Table 11), gold return volatility affects stock market elasticity by 0.32%. Oil return volatility affects stock market elasticity only by 0.01%. The total connectivity factor for the system is 0.42%. However, these results show that the Saudi market depends on multiple sources of investment and does not depend only on oil returns.

For more information about this relationship, we present the Barunik and Krehlik test results in Table 12. According to the table, the effect of oil and gold return volatility increases when the total connectivity factor from day one to four is 0.94%, that from four to 10 days is 1.17%, and that for above 10 days is 1.14%. The impact of gold return increases by 0.33%, 0.55%, and 0.62%. In contrast, the impact of oil return decreases by 0.43%, 0.32%, and 0.2%.

| Variables | Elasticity | Oil return | Gold return | FROM
|-----------|------------|------------|-------------|-----|
| Elasticity | 99.57 | 0.1 | 0.32 | 0.14 |
| Oil return | 0.27 | 99.72 | 0.01 | 0.09 |
| Gold return | 0.36 | 0.19 | 99.45 | 0.18 |
| TO | 0.21 | 0.1 | 0.11 | TCI = 0.42 |

Table 12

| KSA | Elasticity | Oil return | Gold return | FROM_ABS | FROM_WTH |
|-----|------------|------------|-------------|----------|----------|
| Elasticity | 16.66 | 0.03 | 0.13 | TCI = 0.94 |
| Oil return | 0.06 | 19.48 | 0.16 | 0.07 | 0.43 |
| Gold return | 0.1 | 0.14 | 15.82 | 0.08 | 0.44 |
| FROM | 0.05 | 0.06 | 0.1 | TCI = 0.2 |
| FROM_WTH | 0.29 | 0.32 | 0.55 | TCI = 1.17 |
| Elasticity | 9.64 | 0.02 | 0.08 | TCI = 0.12 |
| Oil return | 0.04 | 11.94 | 0.11 | 0.05 | 0.46 |
| Gold return | 0.06 | 0.04 | 8.75 | 0.04 | 0.35 |
| FROM | 0.03 | 0.02 | 0.06 | TCI = 1.14 |
| FROM_WTH | 0.32 | 0.32 | 0.62 | TCI = 1.14 |
Diebold and Yilmaz

In Table 13, the results explain Saudi investors’ awareness of the danger of falling oil returns and the need to invest in gold as a safe haven. They also confirm Rafiuddin et al. (2021), who found no long-term impact for oil or gold return on stock market elasticity. However, they are inconsistent with Albulescu et al. (2021), who found that COVID-19 does not affect the relationship among oil, gold, and the stock market.

Table 13

Diebold and Yilmaz’s test for return spillover connectedness in the UAE stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM |
|-----------|------------|------------|-------------|------|
| Elasticity | 99.76      | 0.08       | 0.16        | 0.08 |
| Oil return | 0.07       | 99.92      | 0.00        | 0.03 |
| Gold return | 0.21      | 0.33       | 99.46       | 0.18 |
| TO | 0.09       | 0.13       | 0.05        | TCI = 0.28 |

Again, we used the wavelet coherency approach to obtain more details about the relationship. In Figure (5-A), there is a change in the relationship between oil return and market elasticity. In the first 50 days, market elasticity determines oil returns, whereas on the 200th day, market elasticity becomes the determinant of oil returns. However, in general, the relationship becomes undetermined after the 200th day. These results are consistent with the size of the Saudi economy and its role as a vital member of OPEC. After testing robustness in Figure (5-B), the relationship does not change, which means that the coronavirus pandemic did not affect the relationship between oil returns and market elasticity.

These results are consistent with Tissaoui et al. (2021), who concluded that the direction of the relationship between oil return and stock market liquidity varies. Our findings indicate that the oil and gold effect is limited in the short-term and medium-term periods.

Figure (5-C) shows that gold returns had a more substantial impact on the elasticity of the Saudi stock market between 31 March and 7 July. After this period, the effect diminished. In Figure (5-D), the PWC test confirms the vital role of gold as a determinant of elasticity. These results explain Saudi investors’ awareness of the danger of falling oil returns and the need to invest in gold as a safe haven. They also confirm the effectiveness of gold hedging in the Saudi market during the pandemic. However, the key difference between oil and gold returns and their correlation with the stock market elasticity is that oil returns move simultaneously with elasticity, whereas gold returns move out of phase (e.g., gold returns lead elasticity, but not instantaneously). These results are congruent with those of Rafiuddin et al. (2021), who found no long-term impact for oil or gold return on stock market elasticity. However, they are inconsistent with Albulescu et al. (2021), who found that COVID-19 does not affect the relationship among oil, gold, and the stock market.

4.6. UAE stock market

The UAE economy is considered open and not solely dependent on oil revenues. In comparison to the Saudi and Bahrain markets, according to Table 13, gold returns more than oil affect the elasticity of the UAE financial market. Oil return volatility affects elasticity movement by 0.08%, whereas gold return volatility affects elasticity movement by 0.16%. However, the system’s total connectivity factor is 0.28%.

Table 14

Barunik and Krehlik’s test frequency domain spillover for the UAE stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM_ABS | FROM_WTH |
|-----------|------------|------------|-------------|----------|----------|
| Elasticity | 74.39      | 0.21       | 0.83        | 0.35     | 0.47     |
| Oil return | 0.17       | 68.12      | 0.55        | 0.24     | 0.33     |
| Gold       | 0.84       | 0.97       | 74.03       | 0.60     | 0.82     |
| return     |            |            |             |          |          |
| TO_ABS     | 0.34       | 0.39       | 0.46        | TCI = 1.19 |
| To_WTH     | 0.46       | 0.54       | 0.63        | TCI = 1.62 |
| The spillover table for band 0.79 to 0.31 roughly corresponds to 4 days - 10 days. Elasticity | 15.64 | 0.03 | 0.05 | 0.03 | 0.16 |
| Oil return | 0.03       | 19.29      | 0.14        | 0.06     | 0.35     |
| Gold       | 0.13       | 0.15       | 15.44       | 0.09     | 0.55     |
| return     |            |            |             |          |          |
| TO_ABS     | 0.05       | 0.06       | 0.06        | TCI = 0.18 |
| To_WTH     | 0.31       | 0.35       | 0.38        | TCI = 1.05 |
| The spillover table for band 0.31 to 0.00 roughly corresponds to 10 days to Inf days. Elasticity | 8.82 | 0.01 | 0.02 | 0.01 | 0.08 |
| Oil return | 0.03       | 11.58      | 0.08        | 0.04     | 0.37     |
| Gold       | 0.04       | 0.04       | 8.37        | 0.03     | 0.27     |
| return     |            |            |             |          |          |
| TO_ABS     | 0.02       | 0.02       | 0.03        | TCI = 0.07 |
| To_WTH     | 0.23       | 0.16       | 0.33        | TCI = 0.72 |

Fig. 5. Saudi stock market elasticity, gold, and oil co-movement maps

The arrows show the differences in phase between the two series. Right-pointing arrows indicate that the variables are in phase (co-move). Right-downward-pointing arrows demonstrate that oil and gold returns drive elasticity. Right-upward-pointing arrows suggest that oil and gold returns follow elasticity. The variables are considered out of phase if the arrows point to the left. The arrows that point to the left and up indicate that oil or gold returns are lagging. Alternatively, if the arrows point to the left and down, oil or gold returns lead. The coloring scale on the right shows the different significance levels. The color gradient is red, which indicates a statistically significant effect, to dark blue, which indicates the absence of any relationship.
Fig. 6. UAE stock market elasticity, gold, and oil co-movement maps
The arrows show the differences in phase between the two series. Right-pointing arrows indicate that the variables are in phase (co-move). Right-downward-pointing arrows demonstrate that oil and gold returns drive elasticity. Right-upward-pointing arrows suggest that oil and gold returns follow elasticity. The variables are considered out of phase if the arrows point to the left. The arrows that point to the left and up indicate that oil or gold returns are lagging. Alternatively, if the arrows point to the left and down, oil or gold returns lead. The coloring scale on the right shows the different significance levels. The color gradient is red, which indicates a statistically significant effect, to dark blue, which indicates the absence of any relationship.

4.7. Qatari stock market
Qatar is an oil-exporting country. The results in Table 15 indicate that oil more than gold returns affect the elasticity of the stock market. Diebold and Yilmaz’s return spillover test shows that the total connectivity factor is 1.22%, the highest among the oil-exporting countries. However, the oil return changes the elasticity by 1.04%, whereas the gold return changes it by only 0.12%.

Table 15
Diebold and Yilmaz’s test for return spillover connectedness in the Qatar stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM
|-----------|------------|------------|-------------|--------|
| Elasticity | 98.84      | 1.04       | 0.12        | 0.39   |
| Oil return | 0.96       | 98.80      | 0.23        | 0.40   |
| Gold return | 0.64      | 0.67       | 98.69       | 0.44   |
| TO | 0.53       | 0.57       | 0.12        | TCI = 1.22 |

According to Fig. 7-C, gold returns are affected only during a short period, and the direction of the relationship is undetermined. However, after we exclude the effect of the pandemic, the partial wavelet test in Fig. 7-D confirms the weak effect of the gold return on stock market elasticity, with the blue color taking up more space in the relationship map. Fig. 7-A indicates a rapid movement between market elasticity and long-term oil returns. According to the wavelet map, the oil returns significantly started leading market elasticity at the start of 2021. Fig. 7-B also confirms these results. After considering the pandemic’s impact, the effect of oil remained significant in the long run during 2021. However, the results also indicate the consequential impact of the pandemic on the stock market. According to the wavelet map, the elasticity during the mid-term period did not significantly affect the oil or gold return. These results correspond with Mohanty et al. (2011) and Hamdi et al. (2019) because they show that oil price spillover has a long-term effect on the elasticity of the Qatari stock market.

4.8. Kuwait stock market
Diebold and Yilmaz’s test in Table 17 indicates that the elasticity of the Kuwait stock market is mainly affected by gold return of 3.66%; oil return contributes only 0.56%. Furthermore, the total connectivity factor is 0.43%.

The Barunik and Krehlik test results in Table 18 presents the Barunik and Krehlik test frequency domain spillover, shows that the total connectivity factors are 1.13%, 1.22%, and 1.20% for the short, medium, and long term, respectively. Moreover, the effect of gold return is limited in the short term, only 10%. Meanwhile, the spillover oil return decreases over time but stays even in the long term.

Table 16
Barunik and Krehlik test frequency domain spillover for the Qatari stock market, oil returns, and gold returns.

| Qatar | Elasticity | Oil return | Gold return | FROM_ABS | FROM_WTH |
|-------|------------|------------|-------------|----------|----------|
| Elasticity | 73.84 | 0.62 | 0.10 | 0.24 | 0.33 |
| Oil return | 0.65 | 65.14 | 0.20 | 0.28 | 0.40 |
| Gold return | 0.53 | 0.54 | 73.68 | 0.36 | 0.50 |
| TO_ABS | 0.39 | 0.39 | 0.10 | TCI = 0.88 |
| To_WTH | 0.55 | 0.54 | 0.14 | TCI = 1.23 |
| The spillover table for band 0.79 to 0.31 roughly corresponds to 4 days–10 days. |
| Elasticity | 16.07 | 0.25 | 0.01 | 0.09 | 0.50 |
| Oil return | 0.19 | 20.55 | 0.02 | 0.07 | 0.41 |
| Gold return | 0.07 | 0.09 | 16.12 | 0.06 | 0.32 |
| FROM_ABS | 0.09 | 0.11 | 0.01 | TCI = 0.22 |
| FROM_WTH | 0.50 | 0.65 | 0.07 | TCI = 1.22 |
| The spillover table for band 0.31 to 0.00 roughly corresponds to 10 days to Inf days. |
| Elasticity | 8.93 | 0.18 | 0.00 | 0.06 | 0.58 |
| Oil return | 0.12 | 13.11 | 0.01 | 0.04 | 0.41 |
| Gold return | 0.03 | 0.03 | 8.88 | 0.02 | 0.20 |
| FROM_ABS | 0.05 | 0.07 | 0.00 | TCI = 0.12 |
| FROM_WTH | 0.50 | 0.66 | 0.03 | TCI = 1.20 |

Fig. 6 presents the wavelet results regarding the co-movements among variables. Fig. 6-A indicates that the oil-returns-elasticity relationship is out of phase and that oil returns are leading stock market elasticity. Furthermore, the PWC test results in Fig. 6-B confirm the direction of the relationship, with the rows pointing in the same direction. Fig. 6-C indicates increasing demand for gold as a safe haven, leading to an increase in gold returns. This increase is due to the increase in market elasticity. In other words, elasticity drives gold returns. Nonetheless, after the PWC test is used to account for COVID-19, the effect of elasticity on gold returns becomes less. This suggests that, in addition to elasticity, gold is influenced by investors’ fears of the coronavirus outbreak turning into a serious economic disaster, forcing them to take shelter in traditional havens. Our findings are in line with those of Wang et al. (2021), who argued that investors in the UAE market consider gold a safe haven. However, they contradict the results of Haroon and Rizvi (2020) and Zaremba et al. (2021), who argued that COVID19 did not significantly affect the UAE market.
movements between oil returns and the elasticity of the stock market. Barunik and Krehlik test frequency domain spillover for the Kuwait stock market, oil returns, and gold returns. Table 18 Barunik and Krehlik test frequency domain spillover for the Kuwait stock market, oil returns, and gold returns.

Table 17 Diebold and Yilmaz’s test for return spillover connectedness in the Kuwait stock market, oil returns, and gold returns.

| Variables | Elasticity | Oil return | Gold return | FROM_ABS | FROM_WTH |
|-----------|------------|------------|-------------|----------|----------|
| Elasticiy  | 99.19      | 0.59       | 4.13        | 0.27     |
| Oil return | 0.56       | 98.84      | 0.60        | 0.10     |
| Gold return| 3.66       | 0.71       | 95.63       | 0.06     |
| TO         | 1.41       | 0.43       | 1.58        |          |

The spillover table for band 0.79 to 0.31 roughly corresponds to 4 days to 10 days.

| Variables | Elasticity | Oil return | Gold return | FROM_ABS | FROM_WTH |
|-----------|------------|------------|-------------|----------|----------|
| Elasticity | 14.85      | 0.16       | 1.18        | 0.34     | 2.46     |
| Oil return | 0.15       | 20.29      | 0.08        | 0.09     | 0.69     |
| Gold return| 0.61       | 0.13       | 14.81       | 0.20     | 1.48     |
| FROM_ABS  | 0.20       | 0.07       | 0.32        |          |          |
| FROM_WTH  | 1.44       | 0.54       | 2.32        |          |          |

The spillover table for band 0.31 to 0.00 roughly corresponds to 10 days to Inf days.

5. Conclusion and recommendation

5.1. Conclusion

This study aimed to examine the spillover return between oil and gold and the elasticity of stock markets for a group of countries in the pandemic on the stock market. Fig. 8-B indicates that oil returns are still leading the elasticity of the stock market. The wavelet map shows that the pointers are pointing to the left and down. Gold prices have less of an effect on the elasticity of the stock market. In Fig. 8-C, the map shows that the movements are out of phase and are limited to the short and medium periods. In other words, the returns of gold move first, and after a while, the elasticity follows the gold return. Fig. 8-D confirms this relationship. After we exclude the effect of COVID19, the association becomes limited in the short run and the strength of the connection decreases. These results indicate that investors in the Kuwait Stock Exchange are more dependent on oil revenues than alternative investments such as gold, which may pose a risk during negative shocks in oil prices. These results are consistent with those of Ali et al. (2022), who argued that COVID-19 had changed the relation among financial market components in stock markets. According to our results, the pandemic changed the relationship among oil, gold, and stock market elasticity. The blue color prevailed over the rest of the colors after January 7, 2021, 170 days after the pandemic’s outbreak in Kuwait. Finally, the Kuwait financial market results show that investors are less dependent on gold as a haven against changes in oil prices. These results are similar to those pertaining to the Bahrain financial market.

In general, the previous results agree with our study’s hypotheses. The results show the varying impacts of oil price changes on stock markets in both oil-exporting and oil-importing countries. Furthermore, the panic caused by the pandemic among investors is evident in the oil and nonoil countries from the increase in demand for yellow metal (e.g., Jordan and the UAE). These impacts led to the reduction in the stock market’s elasticity. Our results are consistent with those of Albulescu et al. (2021), Wei et al. (2021), and Ali et al. (2022), who argued that COVID-19 changed the effect of gold and oil on stock market performance. Moreover, the high demand for gold indicates the scale of the panic that pandemic caused.
behavior and turning to more precautionary alternatives because of the pandemic and fears of it turning into an economic disaster. The results indicated a difference in the impact of fluctuations in oil returns on the elasticity of the financial markets. The elasticity in most oil-exporting countries was significantly affected by oil returns, except Saudi Arabia, which was less affected. The elasticity of the financial markets in oil-importing countries was slightly affected by oil returns, except for Egypt, which was the most responsive to changes in oil prices among the importing countries. The results also indicated the gold and oil return spillover difference in the short and long term. For instance, the gold return spillover in the Kuwait stock market was the highest during the medium term. The oil return spillover was the highest in the Qatar stock market during the short term.

The coronavirus pandemic played a significant role in affecting the elasticity of financial markets and changing investment destinations. The study showed that investors reacted by changing their investment behavior and turning to more precautionary alternatives because of the spread of the pandemic and fears of it turning into an economic disaster.

Finally, the results differed among the sample countries, which means there is heterogeneity among investors in the financial markets. For example, the elasticity in the Turkish stock market did not show a significant instantaneous response to the changes in oil or gold returns. It took both gold and oil returns a while to affect the elasticity of the name market.

5.2. Recommendations

We encourage all investors to hedge against the risks caused by the coronavirus crisis by investing in gold. However, in the case of Turkey, because the effect of changes in oil or gold returns is not instantaneous, there is a greater opportunity to make gains by predicting the reaction of the Turkish stock market. Further, investors can take advantage of the pandemic as a temporary crisis to buy oil futures contracts and make profits. Investing in gold is the best option in the short term, whereas investing in oil is the right option in the long term. Therefore, we recommend that investors make their financial portfolios more dynamic to switch between investing in oil futures and gold. Finally, given the different reactions of the financial markets in the Middle East, this disparity can be taken advantage of by creating a cross-border investment portfolio that includes the stock markets of the countries of the Middle East.

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