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IMPACT OF OIL AND GOLD PRICES ON SOUTHEAST ASIAN STOCK MARKETS: EMPIRICAL EVIDENCE FROM QUANTILE REGRESSION ANALYSIS

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Abstract

According to Chang and Li (2022), the COVID-19 pandemic may have had an impact on the European and American capital markets' dependence on crude oil. However, no studies have assessed the returns and impacts of crude oil and gold prices on Southeast Asian stock markets in conjunction with the COVID-19 pandemic. To address this gap, a quantile regression model was used to analyze data of Southeast Asia stock prices from 2016 to 2023, alongside the daily closing prices of Dubai crude oil and world gold. The findings suggest that crude oil has a large trickle-down impact on the Southeast Asian market returns. This highlights the importance of dynamic linkages over time by reporting dynamic spillover to be statistically significant in Southeast Asian stock returns. Most stock returns show that volatility shocks are enduring. In Singapore and Thailand, the gold returns significantly and favorably affect the stock returns at all quantiles. At various quantiles, the impact of gold returns is notably favorable in the remaining scenarios.

JEL Classifications: C32, E44, G11, G14
Keywords: oil price, gold price, quantile regression, stock market

1. INTRODUCTION

In 2020, the global economy experienced two notable disruptions, namely the onset of the outbreak of COVID-19 and the downturn in crude oil prices it caused. The confluence of these two issues was anticipated to incite a protracted economic predicament and precipitate a period of economic decline. The rapid expansion of the COVID-19 outbreak's economic impacts produced unprecedented impacts on stock market volatility and the impulsive nature of economic policy. Stock volatility levels during the crisis are equivalent to or greater than those seen in October 1987 and December 2008. According to a recent study by Chang and Li (2022), the COVID-19 pandemic may have had an impact on the European and American capital markets' dependence on crude oil. Their empirical findings showed a robust asymmetric and symmetric link between the price of crude oil and stock in the European and US markets. The rapid spread of the COVID-19 pandemic caused this relationship to break.

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COVID-19 cases were first reported in Wuhan, China, in December 2019, and the virus rapidly began to disrupt the world economy. Early predictions suggested that the virus would cause a pandemic, with many countries losing at least 3% of their gross domestic product (GDP) by 2020. According to the World Health Organization (WHO), the initial documented instance of COVID-19 infection occurred on December 31, 2019, and the declaration of a pandemic was made on March 11, 2020. Following the COVID-19 pandemic's onset and rapid spread, Asia, Europe, and America eventually rose to become its focal points, with various nations exhibiting varying patterns of growth and development. As of November 28, 2022, there were over 637 million confirmed cases of COVID-19 worldwide, with approximately 6.5 million deaths (WHO, 2023). Since then, a global economic downturn has thrown numerous nations into a deep recession, raising the risk of a broad economic depression (Corbet et al., 2021; Khanthavit, 2020).

The COVID-19 outbreak greatly raised uncertainty, while such a shock to the financial and energy markets had never been experienced before. In May 2020, there was an unexpected decline in the price of crude oil, which reached its lowest point in four years. The expeditious dissemination of the COVID-19 outbreak coincided with this drop. However, in addition to changes in the demand for crude oil, the crude oil supply may also have been affected. With the "outbreak period" of the virus beginning in the Middle East, the possibility of a worsening pandemic situation in the region was unavoidable, which may have led to impacts on the exportation of crude oil. Consequently, there will be a rapid increase in the oil supply. Investors worldwide have reported that the US stock market experienced its most volatile month on record in March 2020, with circuit breakers being triggered four times within a 10-day period (Zhang & Hamori, 2021). Gold is another significant factor. Gold has long been regarded as a secure investment, particularly for countries with strong inflation, where consumers buy this asset to protect their money from rising prices. Oil and gold can be said to be significant factors in stock market investment choices (Zeinedini et al., 2022).

This research studied the effect of fluctuations in oil prices on the returns of the stock market in Southeast Asian nations. Numerous studies have been conducted to investigate the impacts of fluctuations in prices of crude oil and gold on various economic indicators. For instance, Wang et al. (2022) studied the connection between the dynamics of oil prices, inflation rates, and the pace of economic growth in nations that import and export oil (Angola, Arabia, Canada, China, Germany, India, Iraq, Italy, Japan, Kazakhstan, Korea, Kuwait, the Netherlands, Nigeria, Russia, Saudi Arabia, Spain, the UAE, the UK, and the US). Chen et al. (2022) looked at the dynamic relationships between the price of gold, currency rates, and the price of crude oil in BRICS nations. Bedoui et al. (2019) analyzed the association between oil prices and nominal exchange rates, which are related to the valuation of the US Dollar against the five major currencies utilized in global commerce, namely the British Pound, Canadian Dollar, Euro, Japanese Yen, and Swiss Franc. The effects of oil price changes on the Indian economy were examined by Gupta and Goyal (2015).

The Association of Southeast Asian Nations (ASEAN) is a legally established regional intergovernmental organization comprised of ten sovereign states of Southeast Asia, which aims to promote political and economic cooperation among its member nations. The organization fosters intergovernmental collaboration and enables the amalgamation of the economic, political, military, educational, and sociocultural aspects of its constituents with other nations in the Asia-Pacific region. The group of countries consisting of 10 member nations, namely Brunei, Cambodia, Laos, Indonesia, Malaysia, Myanmar, the Philippines, Singapore, Thailand, and Vietnam, collectively accounts for nearly 8.5% of the global population (673.9 million people), and 3.5% of its GDP (USD 3.4 trillion). As a result, ASEAN has become one of the largest economies to date (World Bank, 2023). Additionally, ASEAN is a vibrant market and a sought-after place for investments, with accelerating economic growth (Kijboonchoo et al.,

2018; Siriphattrasophon, 2018). A key factor in the success of economic development is co-movement, which Sethapramote (2015) proved to be a prominent pattern. Nasution et al. (2022), Panigrahi et al. (2020), and Sethapramote (2015) demonstrated that ASEAN nations have solid economic foundations and higher correlation levels than other nations. In addition, the bond markets of ASEAN nations are more integrated than those of nations outside of the group (Chan et al., 2018). Last but not least, this group includes the energy consumption hubs with the highest growth rates and most dynamic economies worldwide. Since the mid-1990s, the region has imported a substantial amount of oil, while rising oil prices have had a considerable adverse effect on both consumers and the economy as a whole. The region's oil imports in 2020 amounted to more than 2.6 million barrels per day, with the Middle East and Africa being the primary sources. Notably, Thailand and the Philippines accounted for 40% of the total oil imports in the region (International Energy Agency, 2022).

The main contributions of this study are summarized below. First, the study is the first of its type to assess the returns and impact of crude oil and gold prices on six Southeast Asian stock markets, in conjunction with the COVID-19 pandemic, using the quantile regression model developed by Koenker and Hallock (2001). Quantile regression analysis enables the deduction of evidence regarding the co-movement of oil and stock returns under particular market circumstances. These circumstances include bearish (lower quantile), bullish (upper quantile), and normal (intermediate quantile), which denotes a state in which the market is neither bullish nor bearish. The full conditional distribution of the dependent variable is thus described via quantile regression analysis (Mensi et al., 2014; Nusair & Al-Khasawneh, 2018). Second, consistent with the results of the static analysis, the findings show that an asymmetric impact predominantly occurs over a long period, whereas the return spillover is primarily short term. Third, compared to the pre-pandemic period, the findings indicate a higher correlation between the returns from crude oil and returns of ASEAN countries' stock markets during the COVID-19 outbreak. The findings also show that stock markets can shock the oil market. Their increased interconnection is a result of the amplified transmission of the crisis effect between oil returns and stock markets. Overall, these findings support the notion in the market contagion literature that financial crises cause strong return correlations between the returns of crude oil and stock prices.

The remainder of the article is divided into the following sections: Literature on the topic is presented in Section 2. The data and methods used in the research are introduced in Section 3. The results are covered in Section 4, and the article is concluded in Section 5.

2. LITERATURE REVIEW

Several scholarly investigations have been carried on the connection between the price of crude oil and returns in stock markets. According to Kilian (2009), the three primary subcategories of price fluctuations are: demand for oil shock, supply-side shock, and oil-specific demand shock. Each of these factors have a unique influence on the outcomes of the stock market. As of now, there are two perspectives that prove the association between the shocks of crude oil and stock markets. First, changes in the price of oil have a negligible or erratic effect on stock market performance. Apergis and Miller's (2009) study of eight industrialized countries found that shocks in oil prices have a negligible beneficial influence on stock market performance. Additionally, this effect is largely significant for idiosyncratic demand shocks while having little impact on shocks to the oil supply and the overall world aggregate demand. Tchatoka et al. (2019) claim that in most nations, the link between oil shocks and stock markets will alter over time. This association might be favorable during the course of the study time, but if the study term is extended, it might also change.

Furthermore, it is noteworthy that oil shocks have both favorable and unfavorable impacts on stock markets. The fluctuation of crude oil prices exerts an adverse influence on the

performance of the equity market of several countries that rely on oil imports. According to Cunado and Perez de Gracia (2014), the majority of European nations that import oil, experience a more pronounced negative effect on their stock market returns from oil supply shocks than oil demand shocks. When examining demand shocks related to the oil price in Japanese stocks, Abhyankar et al. (2013) also found evidence of a negative link. Maghyereh and Abdoh (2022) confirmed this finding. The argument posits that a singular association exists between fluctuations in the supply of oil and returns on stocks, characterized by a negative correlation. However, in many oil-exporting countries, stock market returns are positively impacted by oil price shocks (Park & Ratti, 2008).

The COVID-19 pandemic, which ravaged the world from 2020-2022, had a devastating effect on trade, the economy, and multiple other areas. In an attempt to decrease the negative effect, economists initiated multiple investigations into these interconnections. As stock markets drive the world economy, numerous studies concentrated on factors that connected equity markets with the COVID-19 pandemic. For example, Baker et al. (2020) observed the unprecedented impact of the dissemination of COVID-19 on the US stock market, which was comparable to the previous occurrence of an infectious ailment, the Spanish Flu. Their empirical evidence suggested that the US equities responded to COVID-19 as strongly as they did to the Spanish flu, because of government restrictions on trade, business, and other areas. Al-Awadhi et al. (2020) employed a panel data analysis to evaluate the effects of the outbreak of COVID-19 on the stock market in China. The study took place during the period spanning from January 10, 2020, to March 16, 2020, shortly after the COVID-19 outbreak was initially detected in China. The Hang Seng Index and Shanghai Stock Exchange Composite Index company datasets were utilized. The authors determined that the daily escalation in verified cases and the aggregate fatality count attributed to COVID-19 had a statistically significant adverse effect on the stock returns of all corporations.

The oil market experienced a significant setback in 2020 due to the outbreak of COVID-19, resulting in a substantial decline in oil prices. Sharif et al. (2020) used a time-domain strategy and frequency dynamics to examine the oil price spike, the stock market, global risk, and uncertainty in US economic policy during the outbreak of COVID-19. They found that the effect of the outbreak of COVID-19 on all of these variables was unparalleled, leading to the emergence of low-frequency bands. Additionally, they ascertained that COVID-19 exerted a more substantial impact on geopolitical risk as opposed to the level of economic uncertainty experienced within the US. Zhang and Hamori (2021) conducted an analysis of the impact on returns and volatility spillover of the outbreak of COVID-19, the crude oil market, and equity markets in the US, Japan, and Germany. These researchers discovered that volatility spillover mostly occurs over long time periods, whereas return spillover occurs over shorter time periods. In addition, Vo et al. (2022) analyzed the dynamics of Asia-Pacific stock returns, assessing how stock market responses to the COVID-19 outbreak appeared to vary over time. Applying pandemic control measures was found to lower market volatility at the national and regional levels. Since 2021, there has been a notable reduction in the influence of newly detected COVID-19 infections and the measures taken to manage the epidemic on the volatility of the stock market. Between mid-January 2020 and mid-February 2022, Cervantes et al. (2022) examined the link between the fear caused by the outbreak of COVID-19 and stock markets. According to their research, changes in fear indices caused by the COVID-19 outbreak did not significantly affect raw stock market returns, but the opposite was true for time-frequency decompositions.

Meanwhile, contradictory findings about the relationship between gold prices and stock market returns have been recorded. There are two key variables used to comprehend this ambiguous relationship. Lin et al. (2019) demonstrated that irregular events can cause a single-direction risk contagion that spreads from the crude oil and gold markets to the stock markets.

The COVID-19 pandemic's sudden emergence disrupted the dependency structure of various markets, as evidenced by Chang and Li's (2022) findings on the significant asymmetric and symmetric dependence structure between the stock markets and the global crude oil market.

3. DATA AND METHODOLOGY

3.1 Data

Data collection consisted of everyday rates for a five-day work week of the oil and stock markets of the Southeast Asian countries, including Indonesia (IDN), Malaysia (MYS), the Philippines (PHL), Singapore (SGP), Thailand (THA), and Vietnam (VNM). Due to insufficient data, Brunei, Cambodia, Laos, and Myanmar were excluded. The Dubai oil price (OIL) was used in this paper since OIL serves as a standard for determining the cost of crude oil throughout the Middle East as well as Asia (Fattouh, 2006). The daily prices of the global gold (GLD), the Dubai crude oil based on the US dollar, and the stock prices were considered. Data were extracted from Refinitiv Eikon; this data set includes events that occurred between January 4, 2016, and October 31, 2023. To analyze the effects of risk spillover from the crude oil and gold markets to the stock markets affected by the pandemic, the sample was split into two sub-periods: Sub-period 1 (Before the crisis period), covering January 4, 2016, to December 31, 2019; and Sub-period 2 (After the crisis period), covering January 1, 2020, until the end of the sample period.

After the collapse of all prices in the first quarter of 2020, they began to recover gradually during the second quarter of 2020. Between 2018 and 2019, Crude oil prices remained relatively constant. However, toward the end of 2021, oil prices plummeted significantly, and there was a small recovery at the beginning of 2022. Table 1 shows the descriptive statistics of crude oil, world gold, and Southeast Asian stock market returns. The returns on all assets are close to zero. Among all returns, the oil market's return has the highest volatility. With the exception of the Singapore stock, oil, and gold markets before the crisis, most returns have a negative skew. A strong tail and peak concerning a normal distribution is present in every return series, as the kurtosis values are greater than three. At the 1% level, the Jarque–Bera test rejected the normality of every return series. Moreover, Table 1 presents the unit root test results as calculated via the Augmented Dickey and Fuller (1979) test, the Phillips and Perron (1988), and the Kwiatkowski et al. (1992) test. The findings indicate that the return series for all indices exhibit stationarity at the 1% level.

3.2 Methodology

In order to analyze the impact of crude oil and global gold on the different quantiles of stock returns in Southeast Asia, the following regression model was used:

$$SR_{it} = \alpha + \beta_1 OIL_t + \beta_2 GLD_t + \beta_3 SR_{it-1} + \varepsilon_t \quad (1)$$

where SR_{it} is the stock return of Southeast Asian countries at time t, OIL_t is the return of the crude oil price at time t, GLD_t is the return of the gold price at time t, and ε_t denotes the error term. The conditional quantile function of SR_{it}, given the covariates, can be expressed as follows:

$$QSR_{it}(\tau \mid x_t) = \alpha(\tau) + \beta_1(\tau) OIL_t + \beta_2(\tau) GLD_t + \beta_3(\tau) SR_{it-1} \quad (2)$$

where $QSR_{it}(\tau|x_t)$ denotes the τth conditional quantile of SR_{it}, and $0 < \tau < 1$. $\alpha(\tau)$ and $\beta_j(\tau)$, $j = 1$ and 2 are the regression quantile coefficients. To get an estimate of the regression quantile $\beta_j(\tau)$

Figure 1 Daily Closing Prices and Returns of Southeast Asian Stock Indices, Cruel Oil, and Gold

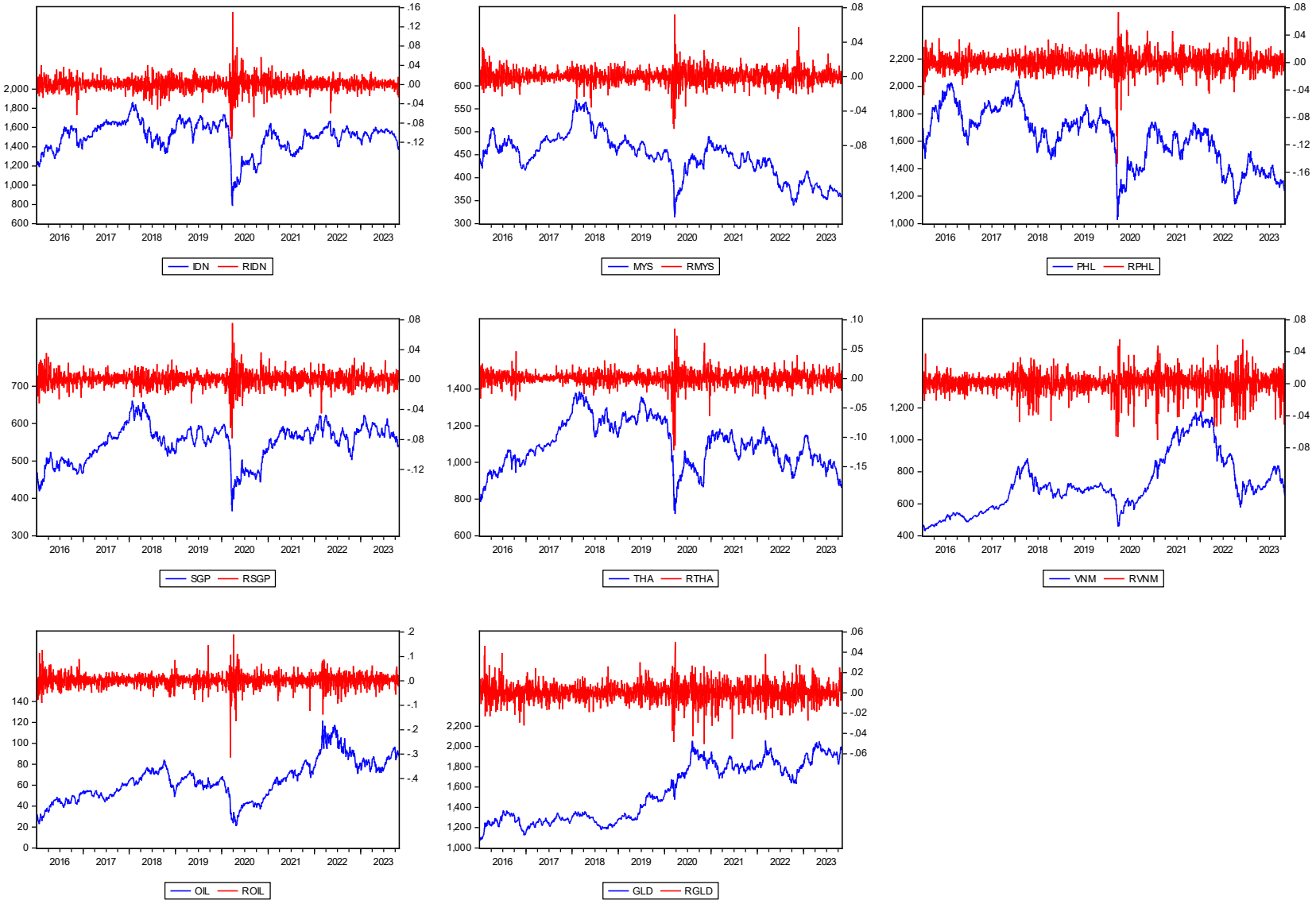

Table 1 Descriptive Statistics: Returns of Southeast Asian Stock Indices, Crude oil, and Gold

Country	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	ADF	PP	KPSS
Whole sample period											
Indonesia	0.0001	0.0000	0.1501	-0.1139	0.0138	-0.2365	18.3813	20,138.5***	-41.7005***	-42.0259***	0.0358
Malaysia	-0.0001	0.0000	0.0718	-0.0612	0.0083	-0.1624	12.1074	7,062.7***	-29.3699***	-43.3091***	0.0274
Philippines	-0.0002	0.0000	0.0728	-0.1484	0.0124	-1.2842	18.6741	21,453.7***	-45.4959***	-45.5558***	0.0247
Singapore	0.0001	0.0001	0.0753	-0.0792	0.0095	-0.3898	12.6662	7,997.6***	-27.9222***	-43.0945***	0.0317
Thailand	0.0000	0.0000	0.0841	-0.1225	0.0113	-1.4732	23.4143	36,178.7***	-16.9042***	-46.3403***	0.0388
Vietnam	0.0002	0.0007	0.0551	-0.0708	0.0124	-0.8358	7.4359	1,911.0***	-42.7661***	-43.2030***	0.0736
Oil	0.0005	0.0016	0.1879	-0.3153	0.0262	-0.8857	18.3253	20,240.0***	-45.4221***	-45.4220***	0.0521
Gold	0.0003	0.0004	0.0497	-0.0507	0.0086	-0.1767	7.0530	1,407.6***	-45.2065***	-45.2202***	0.0459
Before crisis period											
Indonesia	0.0003	0.0000	0.0401	-0.0645	0.0116	-0.3009	5.2461	234.5***	-30.3833***	-30.3308***	0.0493
Malaysia	0.0000	0.0000	0.0337	-0.0362	0.0067	-0.0143	5.7021	316.7***	-29.3036***	-29.3115***	0.0598
Philippines	0.0000	0.0000	0.0350	-0.0481	0.0100	-0.0256	4.0864	51.3***	-31.9776***	-31.9765***	0.0521
Singapore	0.0002	0.0001	0.0352	-0.0322	0.0078	0.0553	4.7951	140.3***	-29.2661***	-29.2960***	0.0496
Thailand	0.0004	0.0002	0.0458	-0.0378	0.0082	-0.1898	5.6131	302.4***	-30.4814***	-30.4741***	0.0338
Vietnam	0.0004	0.0007	0.0374	-0.0480	0.0095	-0.5428	6.0345	450.5***	-31.2350***	-31.3872***	0.0688
Oil	0.0007	0.0015	0.1440	-0.0917	0.0222	0.2854	7.5770	922.8***	-34.8696***	-34.8551***	0.0247
Gold	0.0003	0.0002	0.0462	-0.0322	0.0075	0.3853	6.5473	571.6***	-32.6141***	-32.6144***	0.1127
After crisis period											
Indonesia	-0.0002	0.0000	0.1501	-0.1139	0.0158	-0.1764	20.3523	12,551.1***	-28.8443***	-29.4556***	0.0719
Malaysia	-0.0002	0.0000	0.0718	-0.0612	0.0096	-0.1841	12.0995	3,455.7***	-19.7944***	-31.0654***	0.0417
Philippines	-0.0003	0.0000	0.0728	-0.1484	0.0145	-1.6156	19.4275	11,679.3***	-32.0695***	-32.2147***	0.0573
Singapore	-0.0001	0.0000	0.0753	-0.0792	0.0110	-0.5156	13.1927	4,373.1***	-18.7584***	-30.8844***	0.0766
Thailand	-0.0004	0.0000	0.0841	-0.1225	0.0137	-1.5667	20.7753	13,574.2***	-11.0566***	-33.4256***	0.0688
Vietnam	0.0000	0.0008	0.0551	-0.0708	0.0149	-0.8229	6.3026	567.3***	-29.6600***	-29.9028***	0.1002
Oil	0.0003	0.0016	0.1879	-0.3153	0.0298	-1.3411	19.8671	12,153.9***	-30.4871***	-30.4733***	0.1112
Gold	0.0003	0.0006	0.0497	-0.0507	0.0096	-0.4404	6.6669	592.6***	-31.4128***	-31.4548***	0.0664

Notes. The ADF, PP, and KPSS tests are the empirical statistics of the augmented Dickey and Fuller (1979) test, the Phillips and Perron (1988) test, and the Kwiatkowski et al. (1992) test, respectively. *** represents the statistical significance at the 1% level.

in equation (2), we can solve the following minimization problem:

$$\min \sum_{i=1}^{n} \rho_{\tau}(SR_{it} - \alpha(\tau) - \beta_1(\tau)OIL_t - \beta_2(\tau)GLD_t - \beta_3(\tau)SR_{it-1}) \quad (3)$$

where $\rho_\tau(u) = u(\tau - I(u < 0))$ is the check function, and $I(\cdot)$ is an indicator function. In equation (2), $\beta_1(\tau)$ quantifies the incremental impacts of the volatility in crude oil returns at the τ quantile level, and $\beta_2(\tau)$ quantifies the incremental impacts of the volatility in gold returns at the τ quantile level. In the quantile regression model, several quantile levels were used to accurately capture various stock market circumstances. On the basis of the empirical investigation, nine quantiles were selected ($\tau = 0.1$ to 0.9), where the low (0.1 to 0.3), middle (0.4 to 0.6), and high quantiles (0.7 to 0.9) indicate bearish, normal, and bullish market circumstances, respectively. Hence, the use of quantile regression analysis enables examination of the influence of the volatility in crude oil and gold returns across various stock market circumstances.

4. EMPIRICAL RESULTS AND DISCUSSION

This section discusses the outcomes of the usual OLS equation (1) and the quantile regression equations (1) and (2) shown in Tables 2-4. First, the findings associated with the transmission of returns for crude oil and world gold on the Southeast Asian countries' stock returns throughout the entire sample period are presented in Table 2 (from January 4, 2016, to October 31, 2023). The OLS model findings demonstrate that there is a statistically significant beneficial impact of crude oil returns on the stock returns of Southeast Asian markets. The impact associated with gold returns is significantly positive in all countries except Vietnam. Meanwhile, the effect of the lag of stock returns is significantly positive in all countries except the Philippines and Thailand. The OLS model results appear to be consistent with earlier research, such as Nusair and Al-Khasawneh (2018), which indicates that fluctuations in oil prices have a significant and favorable impact on the stock returns of the Gulf Cooperation Council (GCC) countries. Unfortunately, as was already indicated, OLS does not account for variations in the relationship across various market circumstances. This is because it only captures the mean relationship between the dependent variable and a specific group of explanatory factors according to the conditional mean of the dependent variable. In contrast, quantile regression delivers a more inclusive representation by simulating the relationship of the dependent variable at specific quantiles. Thus, it provides insight into the correlation between oil and stock returns across various market circumstances, including bearish, normal, or bullish (Mensi et al., 2014; Nusair & Al-Khasawneh, 2018).

The findings indicate that the impact of oil returns on the conditional stock return distribution is uniformly favorable in most nations. There is an exception with Indonesia, the Philippines, and Vietnam, where the impact is not statistically significant at higher quantiles. Consequently, co-movement is seen to exist at almost all quantiles between the stock markets of the Southeast Asian nations and oil returns. Furthermore, the outcomes in all instances indicate that fluctuations in oil prices impact stock returns more strongly at both extremes (upper and lower quantiles) than at the intermediate quantiles. This suggests that highly volatile markets — bullish and bearish —respond to fluctuations in the price of oil more quickly than average markets. This is because the economies of the Southeast Asian nations are greatly impacted by changes in oil prices as they rely largely on oil income. With regards to world gold returns, the quantile regression findings indicate that this has a statistically significant positive impact on stock returns across all quantiles for Singapore and Thailand. In all other instances, the impact of gold returns is substantially positive across various quantiles. In comparison, the lag of stock returns in Thailand has a positive impact on itself in all quantiles.

Table 2 The Effects of Crude Oil and Gold on Southeast Asian Stock Returns for the Whole Sample Period

Country	Variable	OLS	Quantile level								
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Indonesia	α	-0.0000	-0.0138***	-0.0082***	-0.0048***	-0.0017***	-0.0000	0.0019***	0.0048***	0.0083***	0.0140***
	β_1	0.0705***	0.1242***	0.0936***	0.0774***	0.0533***	0.0347***	0.0320***	0.0259*	0.0208	0.0250
	β_2	0.0992***	0.1150*	0.0338	0.0346	0.0671*	0.0392	0.0850**	0.0663	0.0381	0.0996*
	β_3	0.0763***	0.1356***	0.0659	0.0340	-0.0049	-0.0030	-0.0224	-0.0237	-0.0608**	-0.0876***
Malaysia	α	-0.0002	-0.0093***	-0.0054***	-0.0032***	-0.0015***	-0.0000	0.0011***	0.0028***	0.0052***	0.0092***
	β_1	0.0435***	0.0598***	0.0470***	0.0369***	0.0323***	0.0205**	0.0222**	0.0300***	0.0238***	0.0303***
	β_2	0.1021***	0.0290	0.0584**	0.0844***	0.0830***	0.0647***	0.0911***	0.1062***	0.1343***	0.1400***
	β_3	0.0512**	0.0870***	0.0447	0.0531*	0.0490*	0.0309	-0.0013	0.0176	0.0186	0.0376
Philippines	α	-0.0002	-0.0136***	-0.0083***	-0.0050***	-0.0019***	-0.0000	0.0021***	0.0047***	0.0083***	0.0136***
	β_1	0.0418***	0.0472**	0.0385***	0.0409***	0.0289**	0.0066	0.0242**	0.0260	0.0262	0.0256
	β_2	0.0786**	0.0200	-0.0471	0.0069	-0.0087	0.0064	0.0142	0.0436	0.0762**	0.1491***
	β_3	-0.0094	0.0392	0.0238	-0.0100	-0.0301	-0.0124	-0.0127	0.0054	-0.0135	0.0091
Singapore	α	-0.000	-0.0100***	-0.0058***	-0.0032***	-0.0014***	0.0002	0.0017***	0.0035***	0.0060***	0.0094***
	β_1	0.0636***	0.0779***	0.0699***	0.0571***	0.0552***	0.0533***	0.0519***	0.0496***	0.0518***	0.0593***
	β_2	0.1490***	0.0650*	0.1203***	0.1002***	0.1276***	0.1257***	0.1569***	0.1866***	0.1687***	0.1804***
	β_3	0.0514**	0.1011**	0.0558	0.0481*	0.0308	0.0406	0.0393	0.0418	0.0223	0.0055
Thailand	α	-0.0000	-0.0111***	-0.0067***	-0.0037***	-0.0014***	0.0002	0.0019***	0.0040***	0.0070***	0.0112***
	β_1	0.0816***	0.0809***	0.0735***	0.0641***	0.0424***	0.0281***	0.0492***	0.0607***	0.0642***	0.0664***
	β_2	0.1178***	0.0760*	0.1240***	0.1248***	0.0917***	0.0495**	0.0995***	0.1301***	0.1225**	0.0860**
	β_3	-0.0101	0.0777**	0.0437	0.0158	0.0062	-0.0021	0.0000	-0.0034	-0.0116	-0.0336
Vietnam	α	0.0002	-0.0133***	-0.0070***	-0.0034***	-0.0007***	0.0008***	0.0027***	0.0052***	0.0079***	0.0128***
	β_1	0.0506***	0.0734***	0.0612***	0.0350***	0.0136	0.0194**	0.0196**	0.0176	0.0057	0.0228
	β_2	-0.0506	-0.1081***	-0.0804	-0.0360	-0.0231	-0.0176	-0.0228	-0.0168	-0.0151	-0.0326
	β_3	0.0547**	0.3076***	0.1779***	0.0862***	0.0216	-0.0071	-0.0301	-0.0466*	-0.0578*	-0.1330***

Note. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 3 The Effects of Crude Oil, and Gold on Southeast Asian Stock Returns Before the Crisis Period

Country	Varia-ble	OLS	Quantile level								
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Indonesia	α	0.0002	-0.0130***	-0.0078***	-0.0047***	-0.0016***	0.0001	0.0020***	0.0050***	0.0085***	0.0138***
	β_1	0.0481***	0.0834***	0.0752***	0.0637***	0.0485**	0.0123	0.0238	0.0335	0.0440	0.0376*
	β_2	0.0912*	0.0954	0.0655	0.0316	0.0393	0.0075	0.0617	0.0678	0.0531	0.1020
	β_3	0.0555*	0.1717***	0.1677***	0.1065**	0.0332	0.0138	0.0028	-0.0058	-0.0404	-0.0909**
Malaysia	α	-0.0000	-0.0079***	-0.0045***	-0.0027***	-0.0013***	0.0001	0.0013***	0.0025***	0.0045***	0.0079***
	β_1	0.0429***	0.0427***	0.0394***	0.0292***	0.0275**	0.0216*	0.0227**	0.0323***	0.0452***	0.0535***
	β_2	0.0588**	-0.0204	0.0304	0.0530	0.0639*	0.0592*	0.0866***	0.0983***	0.0978**	0.0719
	β_3	0.0973***	0.1836***	0.1485***	0.1047***	0.0995***	0.0596	0.0770*	0.0895**	0.1224**	0.1390**
Philippines	α	-0.0000	-0.0124***	-0.0073***	-0.0044***	-0.0017***	0.0000	0.0020***	0.0044***	0.0075***	0.0123***
	β_1	0.0500***	0.0588***	0.0268*	0.0428**	0.0407**	0.0012	0.0221	0.0272	0.0704***	0.0922***
	β_2	0.0179	-0.0988	-0.0624	-0.0444	-0.0260	0.0005	-0.0333	0.0138	0.0735	0.1023
	β_3	0.0047	0.0032	0.0021	-0.0249	-0.0208	-0.0054	-0.0288	-0.0082	-0.0132	0.0748
Singapore	α	0.0001	-0.0090***	-0.0052***	-0.0030***	-0.0013***	0.0002	0.0017***	0.0032***	0.0055***	0.0090***
	β_1	0.0627***	0.0508***	0.0426**	0.0487***	0.0501***	0.0460***	0.0462***	0.0493***	0.0593***	0.0731**
	β_2	0.0830***	0.0053	0.0291	0.0756*	0.0640	0.0745*	0.1119***	0.1173***	0.1284***	0.1772**
	β_3	0.0869***	0.0749*	0.0408	0.0692*	0.0620*	0.0744*	0.1089***	0.0922**	0.0965*	0.0603
Thailand	α	0.0003	-0.0091***	-0.0053***	-0.0027***	-0.0007***	0.0004*	0.0018***	0.0036***	0.0060***	0.0100***
	β_1	0.0580***	0.0894	0.0675***	0.0546***	0.0285**	0.0309**	0.0404***	0.0433**	0.0575***	0.0697***
	β_2	0.0378	-0.0118***	0.0315	0.0839**	0.0361	0.0238	0.0620	0.0853*	0.0815	0.0520
	β_3	0.0690**	0.1884***	0.0767*	0.0641	0.0267	0.0162	0.0534	0.0548*	0.0254	0.0005
Vietnam	α	0.0003	-0.0107***	-0.0060***	-0.0032***	-0.0007**	0.0007**	0.0024***	0.0046***	0.0069***	0.0107***
	β_1	0.0352***	0.0595***	0.0445***	0.0344***	0.0289**	0.0272**	0.0287**	0.0226	0.0162	0.0195
	β_2	-0.0218	-0.0348	-0.0331	0.0184	0.0129	0.0136	0.0182	0.0056	0.0385	-0.0094
	β_3	0.0314	0.2055***	0.1150**	0.0759*	0.0105	-0.0261	-0.0573	-0.0885**	-0.0627	-0.0829*

Note. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

Table 4 The Effects of Crude Oil, and Gold on Southeast Asian Stock Returns After the Crisis Period

Country	Variable	OLS	Quantile level								
			0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Indonesia	α	-0.0002	-0.0146***	-0.0083***	-0.0050***	-0.0018***	-0.0001	0.0019***	0.0043***	0.0081***	0.0145***
	β_1	0.0830***	0.1408***	0.0985***	0.0811***	0.0548***	0.0437**	0.0332**	0.0262	0.0169	0.0032
	β_2	0.1012**	0.1034	-0.0080	0.0353	0.1012*	0.0493	0.1087*	0.1260**	0.0342	0.1283
	β_3	0.0871***	0.1422***	-0.0175	-0.0363	-0.0345	-0.0199	-0.0403	-0.0535	-0.0652*	-0.0814
Malaysia	α	-0.0003	-0.0103***	-0.0066***	-0.0038***	-0.0017***	-0.0002	0.0011***	0.0032***	0.0059***	0.0102***
	β_1	0.0433***	0.0568***	0.0584***	0.0395***	0.0361***	0.0286*	0.0270	0.0221	0.0172*	0.0142
	β_2	0.1284***	0.0940	0.0945	0.1061***	0.0960**	0.0758**	0.0773**	0.1273***	0.1522***	0.1117***
	β_3	0.0281	0.0627	0.0064	0.0147	0.0039	-0.0061	-0.0334	-0.0419	0.0045	0.0465
Philippines	α	-0.0004	-0.0147***	-0.0093***	-0.0054***	-0.0026***	-0.0001	0.0021***	0.0050***	0.0090***	0.0149***
	β_1	0.0356**	0.0397	0.0512**	0.0361*	0.0296**	0.0143	0.0262	0.0142	-0.0031	-0.0159
	β_2	0.1180**	0.0615	-0.0547	0.0200	0.0121	0.0085	0.0268	0.0697	0.1008**	0.1618***
	β_3	-0.0157	0.0182	0.0434	-0.0182	-0.0350	-0.0222	-0.0020	0.0070	-0.0438	-0.0510
Singapore	α	-0.0002	-0.0114***	-0.0063***	-0.0038***	-0.0014***	0.0002	0.0017***	0.0040***	0.0066***	0.0096***
	β_1	0.0625***	0.0834***	0.0735***	0.0757***	0.0578***	0.0593***	0.0538***	0.0395***	0.0516***	0.0473**
	β_2	0.1887***	0.1537**	0.1809***	0.1356***	0.1701***	0.1611***	0.1950***	0.2297***	0.1872***	0.1734***
	β_3	0.0350	0.1079	0.0694	0.0376	0.0155	0.0069	-0.0123	-0.0054	-0.0208	-0.0295
Thailand	α	-0.0004	-0.0133***	-0.0083***	-0.0050***	-0.0022***	-0.0002	0.0022***	0.0045***	0.0077***	0.0132***
	β_1	0.0949***	0.0677***	0.0829***	0.0724***	0.0506**	0.0288*	0.0536**	0.0676***	0.0567**	0.0235
	β_2	0.1572***	0.1634*	0.1825***	0.1935***	0.1424***	0.0529	0.1240***	0.1419***	0.1636**	0.0689
	β_3	-0.0400	0.0736**	0.0070	-0.0398	-0.0136	-0.0153	-0.0257	-0.0302	-0.0215	-0.0137
Vietnam	α	-0.0000	-0.0163***	-0.0088***	-0.0038***	-0.0007*	0.0008**	0.0031***	0.0058***	0.0092***	0.0150***
	β_1	0.0603***	0.1425***	0.0933***	0.0379	0.0119	0.0165	0.0112	0.0214	0.0027	0.0213
	β_2	-0.0722	-0.1185	-0.1392**	-0.0578	-0.0632	-0.0356	-0.0353	-0.0317	-0.0776	-0.0352
	β_3	0.0645**	0.3862***	0.1999***	0.0971**	0.0299	0.0046	0.0012	-0.0187	-0.0632	-0.1388***

Note. ***, **, and * represent statistical significance at the 1%, 5%, and 10% levels, respectively.

In the other cases, the effect of the lag of stock returns is found to be significantly positive across various quantiles.

Second, the return transmission outcomes for crude oil, gold, and Southeast Asian stock returns before the crisis period (from January 4, 2016, to December 31, 2019) are displayed in Table 3. The findings obtained from the OLS model indicate that there is a statistically significant positive relationship between crude oil returns and stock returns in Southeast Asian markets. The effect of the gold return is only significantly positive in Indonesia, Malaysia, and Singapore. Nonetheless, the effect of the lag of stock returns is significantly positive in all countries except the Philippines and Vietnam. The quantile regression analysis reveals a consistently positive and statistically significant impact of oil returns on conditional stock returns in all nations, with the exception of Indonesia, the Philippines, and Vietnam. The quantile regression results indicate that only in Singapore do the gold returns significantly and positively affect stock returns across all quantiles. At various quantiles, the impact of gold returns is notably favorable in the remaining scenarios. However, the effect of the lag of stock returns is significantly positive at different quantiles.

Lastly, Table 4 presents the return transmission results for crude oil, gold, and Southeast Asian stock returns after the crisis period (from January 1, 2020, to October 31, 2023). The OLS model findings demonstrate that there is a statistically significant positive impact of crude oil return on the stock returns of Southeast Asian markets. The impact caused by gold returns is consistently beneficial in all countries except Vietnam. Nevertheless, the effect of the lag of stock returns is significantly positive only in Indonesia and Vietnam. The quantile regression analysis reveals that both oil and gold returns have a statistically significant and positive impact on stock returns across all quantiles in the context of Singapore. In the remaining scenarios, the impact of both gold and oil returns is considerably favorable at various quantiles. Conversely, the effect of the lag of stock returns is statistically positive and significant across various quantiles.

5. CONCLUSION

This study attempts to examine, through empirical means, the degree of correlation between the returns of Southeast Asian stocks, Dubai crude oil, and world gold, both before and after the onset of the outbreak of COVID-19. Regarding movements in the stock returns of six Southeast Asian nations, specifically Indonesia, Malaysia, the Philippines, Singapore, Thailand, and Vietnam, and the fluctuations in the crude oil and world gold returns over a period spanning from January 4, 2016, to October 31, 2023, the results imply that there is a significant spillover effect from crude oil on the returns of the Southeast Asian stocks. This finding aligns with Nusair and Al-Khasawneh (2018), who contradicted the notion that crude oil returns exert an immediate influence on the returns of the stock market from the GCC nations. Being the first study conducted for the whole sample period, this study reports dynamic spillover to be statistically significant in Southeast Asian stock returns, highlighting the significance of dynamic associations over time. Volatility shocks exhibit a persistent nature in the majority of the analyzed stock returns. However, after the COVID-19 pandemic, the findings of the quantile regression demonstrate that, in the instance of Singapore, both gold and oil returns show a positive and statistically significant influence on stock returns across all quantiles. Under the remaining circumstances, both oil and gold have a notably favorable influence on returns across various quantiles. Overall, the coefficients have a notable beneficial impact on the stock returns of Southeast Asian markets.

The findings of this research have significant implications for both investors and policymakers. Based on the results, it is advisable for investors to carefully and strategically allocate their assets to sectors that tend to gain from increasing oil prices and assess potential

possibilities in companies related to the energy industry. Furthermore, investment possibilities may arise from the positive correlations between oil prices and stock performance in this industry. When allocating investments to industries that would profit from increasing oil prices, it is important to ensure that your portfolio is diverse. Portfolio diversity serves to distribute risk and lessen the consequences of unfavorable fluctuations in certain sectors. However, including crude oil and stocks associated with crude oil would diminish the advantages of diversification. Therefore, investors ought to include assets that have a low correlation with oil prices to achieve portfolio diversification. Policymakers must be attentive to the possibility of volatility both in oil and the stock market. Abrupt and substantial fluctuations in oil prices may trigger a series of consequences for stock returns and the general stability of the market. Thus, policymakers must consider the external vulnerabilities that arise from being reliant on oil prices. The economy might be vulnerable to external shocks when it excessively depends on industries that are impacted by oil, particularly in the case of significant fluctuations in the price of oil globally.

6. CONFLICT OF INTEREST

There are no conflicts of interest to declare.

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