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SUBJECT

Pakistan Stock Exchange

RECEIVED 29 September 2024

REVISED 04 December 2024

ACCEPTED 12 December 2024

PUBLISHED 31 December 2024

CITATION

Iqbal, I., Khan, A. B., Nadeem, W.,
Ahmad, T., & Nawaz, M. (2024). Nexus
Between Oil and Stock Prices: A Case of
Pakistan Stock Exchange (PSX). *Journal
of Banking and Social Equity*, 3(2), 107-
116. <https://doi.org/10.52461/jbse.v3i2.3559>

JBSE



DOI



ACADEMIC PAPER

Nexus Between Oil and Stock Prices: A Case of Pakistan Stock Exchange (PSX)

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ABSTRACT

The objective of this research is to examine the association between oil prices and stock return in the emerging market of Pakistan using an advanced econometric analysis named wavelet approach. This approach was chosen due to its ability to study complex, non-linear interactions throughout time. In particular, the wavelet-based technique helps you examine the short and long-term implications of oil price fluctuations on stocks. This research found that oil prices play a crucial role in explaining Pakistan's stock market return. This research uses historical data from July 10, 2020, to July 10, 2024, to demonstrate how outside events like a pandemic might impact the share price movement of the Pakistan Stock Exchange (PSX). This study helps readers comprehend how oil prices impact the Pakistani stock market. This information may help investors in the stock market to make sensible choices, especially in an uncertain environment. These insights can also help policymakers create plans to make the economy more robust to external shocks.

KEYWORDS

Oil Price, Stock Market, COVID-19, KSE-100 Index, Pakistan Stock Exchange (PSX).

INTRODUCTION

Oil is an important energy source that is distributed around the world in an uneven way. Such imbalance creates a need for the government to maintain a stable oil supply. Changes in the oil prices impact the investment decisions of the investors. Moreover, variations in oil prices also influence the economies of the world. In a nutshell, the changes in oil prices are important factors that impact every country irrespectively



developing or developed. A study accomplished by Bekzhanova et al. (2023) found that oil is an important element for the economic base of modern economies. Moreover, different countries of the world are searching for the other alternative to oil. Crawford et al. (2021) argued that change in oil prices impacts the investments and earnings of corporations. This is because oil, oil-based energy, and oil-based products are important inputs or outputs for various corporations. Ma et al. (2021) stated that oil price changes are attracting greater attention from researchers due to their role as a global energy source and energy input. Moreover, it is also a source of volatility towards other macroeconomic indicators. Sultanova et al. (2024) claimed that changes in the prices of oil are reflected in the economies of both developing and developed countries. Therefore, there is a need to analyze the factors which impact stock prices. One of the major factors which impacted stock prices was the coronavirus pandemic.

The origin of the COVID-19 was the Wuhan, China. It started in December 2019 and rapidly took control of the world (Phiri et al., 2023). Hence, It was announced a “global health emergency by the World Health Organization (WHO). Wang et al. (2024) study reported that COVID-19 infection in the world has affected a large number of stock exchanges. Zhang et al. (2021) reported that because of COVID-19, the dividends of the corporations took a downward trend. This phenomenon negatively impacted the performance of the companies. During COVID-19, in March 2020, a collapse in oil prices occurred because of failed negotiations between major oil producer countries which include Russia. However, in April 2020, Russia and OPEC formed a consensus to lower the production of oil to 9.7 million barrels per day (Chien et al., 2021).

According to Asaad (2021), COVID-19 created a significant amount of volatility in the oil prices. It is a common belief among industry practitioners that stock prices increase as oil prices increase. Hasan, Mahi, Hassan and Bhuiyan (2021) reported that COVID-19 acted as a Dark Swan occasion, creating widespread uncertainties among businesses all over the world. In another article, Hasan, Mahi, Sarker and Amin (2021) observed that COVID-19, which started as a well-being crisis, quickly turned into a major financial disaster. By considering the bullish and bearish conditions of the stock market, Managi et al. (2022) analyzed the oil and stock price nexus with the help of the wavelet technique. They divided the data set into pre and post-COVID-19 times. They concluded that stock prices declined because of oil price shocks and lockdown policies.

The start of COVID-19 created a negative effect on the performance of stock exchanges. Things became worse when the WHO announced that the COVID-19 is the health pandemic globally. COVID-19 severely affected the public (Phiri et al., 2023). As a result, governments across the globe had to establish a ‘state of emergency’ and concentrate on reducing the “rate of transmission” by locking down large cities. According to Abdullah and Aman (2024), global oil prices play a huge role in the developed and developing countries in equal measures. There was a question in the mind of investors that how the volatility in oil prices impacted the overall performance of the global stock market after several crises like financial crisis 2007-2008, BREXIT in 2016 and European debt crisis in 2011.

Pakistan meets most of its energy needs through gas reserves which are available in large quantities (Khan et al., 2022). The nexus between oil and stock is of prime interest to investors, interested in decreasing their portfolio risk at times of highly volatile conditions. The results of this study showed that oil prices fluctuations effected stock prices volatility indirectly. The mechanism behind it is that oil prices volatility effects the profitability, costs and operating expenses of businesses, specifically energy-related businesses. It is important to examine Pakistan’s equity market, which is directly effected with oil price volatility. Due to the high energy cost, many industries suffer high production costs therefore their stock prices and profitability decline. The nexus between oil and stock is complex and lack consensus. The previous studies provide mixed results by quoting positive, negative, and no correlation. Therefore, a need arises to explore such a relationship in detail.



Hanif (2020) examined the association between equity prices and oil prices. He found that as the oil price increases, the stock price faces a downfall. Castro and Jiménez-Rodríguez (2024) reported that oil prices increased after World War II, as a result, oil prices increased in Japan, UK, Canada, and US markets. Therefore, these markets suffered a financial loss. According to Asafo-Adjei et al. (2024), the nexus between oil and stock is getting the attention of researchers from all over the world. Moreover, the intensity of analyzing such a relationship is increasing over time. However, most of the attention is given to the developed countries. The financial industry of Pakistan faced various difficulties due to the occurrence of different financial crises. Moreover various variables such as foreign direct investment, inflation rate and interest rates have the potential to impact the prices of stocks of developing and developed economies (Wang et al., 2024). According to the study of Li and Umair (2023), since decades oil has its crucial importance as the main source of power in most fields such as industries, and transport among others globally. If there is an unanticipated increase in oil prices then it can be an indication of a potential economic meltdown and drop in the performance of stock prices. As Pakistan depends upon oil imports, the oil price volatility have a dampening effect on the stock market returns. Due to this fact, it is imperative to analyze the association among stock and oil in the developing country like Pakistan, specifically for the pre and post COVID-19 time.

LITERATURE REVIEW

Although there is extensive literature that addressed the nexus among stock and oil prices, however, there is a gap related to the studies that addressed the oil-stock relationship during and post-COVID-19 period. Furthermore, according to Managi et al. (2022), the observed evidence regarding the linkage among stock performance and oil prices is important for investors, managers and policymakers. However, such a relationship has provided an inconclusive picture since decades. In a review article by Degiannakis et al. (2018) on the oil-stock relationship, highlighted the correlation among stock returns and oil prices was influenced by various factors, comprising whether the analysis used data from indices of stock markets, the firm level, sector-specific indices, either a country export crude oil or import crude oil. The findings of the studies also differ based on whether studies consider asymmetric or symmetric oil price changes or focus on unexpected price fluctuations. Additionally, it was observed that most of the study's findings suggest that fluctuation in stock returns was due to the increased volatility in oil prices.

A research work done by Narayan and Gupta (2015) aimed to explore equity prices and oil prices relationship. Data from the US stock market was utilized to examine the association between the said variables. This study used a predictive regression model to study this impact. The findings of their study suggested that stock returns are predicted through oil prices. The evidence from the sample data was supported by additional evidence from data outside the sample, confirming predictability. The negative as well as positive variations in the prices of oil significantly predicted the US stock returns. The findings of this research suggested that negative changes in oil prices were relatively more influential in predicting stock returns. Another study by Kilian and Park (2009) postulated that the reaction of oil prices shock to the share prices in the US stock market depends on various factors for example whether the price change is affected by the supply and demand shocks of crude oil. It was evidenced that crude oil prices caused 22% of changes in the stock prices. The findings of this study were aligned with the theories suggesting that the shocks in oil price shocks primarily resulted from a decrease in domestic final demand which ultimately affects the US stock market.

The association among changes in the prices of oil and stock from the South Asian region was tested by Alamgir and Amin (2021). The “Nonlinear Autoregressive Distributed Lag model” was used in this research to test the oil-stock relationship. The results of this research showed the significant effect of oil prices on the stock returns. It was evidenced that the negative as well as positive oil price shocks resulted in the asymmetric response of stock returns. Their findings also indicated that the rise in oil prices in the global market tends to boost stock returns. Through the findings of this study, it could be implied that



markets of countries related to South Asia do not follow Efficient Market Hypothesis. The suggestions made by the authors to the policymakers of the South Asian countries were to take steps to improve the efficiency of the stock market by addressing barriers to its development and by enhancing the country's infrastructure.

Zhang et al. (2021) reported that as the economic activity reduced due to COVID-19, the oil-stock relationship became weak. In addition to Zhang et al. (2021) study, the research work done by Abuzayed and Al-Fayoumi (2021) claimed that there was a difference between the nature of the association between prices of oil and stock return pre and post COVID-19 period. Such a relationship was greater and more significant after the decline in COVID-19 as compared to the COVID-19 period when the COVID-19 was on its peak. By applying the quantile regression method, the study done by Zeinedini et al. (2022) reported a significant relationship between prices of oil and the Tehran Stock Exchange index. They recommended that investors should track the movement of oil and stock prices while making investment decisions.

According to the literature, the most important commodity is oil which crucially impacts the global economies (Li & Wei, 2018). Similarly, oil prices are cited as the key important variable in influencing the stock market. The mechanism behind it is that an oil price rise leads to more cash flow generation which enhances the value of business, increase in demand, and government budgets. In another study, it was evidenced that the oil price and stock returns relationship is important for the diversification of risk and portfolio and for the policymakers also (Awartani & Maghyereh, 2013). In terms of the equity markets of China, Europe, and UK, Chien et al. (2021) reported low level of co-movement between sock prices and oil among these markets.

By considering the market in the United States, a study by Jawadi and Sellami (2022) found that there exists a strong interaction between stock prices and oil prices. Zhang and Hamori (2021) addressed that COVID-19 increased the risk level in the overall economic system. As a result, a downward trend in the oil prices was observed. Due to this phenomenon, stock markets took a downfall. In order to detect the shift in the dependence structure, the Prabheesh et al. (2020) study applied the structural break techniques. They observed that the occurrence of a time-varying dependence between prices of oil and equity prices. They also reported that the countries which rely on the export of oil, a decline in oil prices is ensued by a decline in equity prices. It is due to the overall decline in economic activity and aggregate demand. The decline in both of these factors reduces the future earnings of the companies related to the oil sector.

Crawford et al. (2021) claimed that previous literature failed to create a consistent correlation between changes in the prices of oil and stock return. In this regard, they analyzed the dependance of a company's earning on oil. They observed that the effect of oil prices on stock returns differs industry by industry. Moreover, such a relationship is dependent upon the earnings and investments of the companies. This relationship also depends on the nature of dependence on oil of a specific country, for example, either a company export oil or import oil. They also found that investors are more interested in oil-related earnings as compared to non-oil-related earnings. Sardar and Sharma (2022) analyzed the non-linear interactipon between the prices of oil and equity prices. They reported that an upward shift in the oil price shocks also causes an upward shift in the stock returns. They stated that after 2008, oil production in the United States increased rapidly. On the other side, a decline in imports was observed. Moreover, an increase in oil prices became favorable for the economy of the US. Consequently, stock prices and the income level of the country took a rise. The study by Ma et al. (2021) analyzed the dependance of stock market on the prices of oil. They found that oil return is a strong predictor of stock return. Similar relationship was also tested by Dawar et al. (2021) using a quantile-based regression method. Their results revealed that there is not high significant impact of changes in oil prices on equity prices. They reported that the reflection of clean energy equity returns towards prices of oil is different in different economic conditions. They also postulated that the oil-equity prcies interaction is significant and negative during the bearish trend in the stock market. However, an insignificant correlation interaction was found during the bullish trend in the stock market. They recommended that in the future, such as relationship can be



analyzed in diverse market conditions.

At the sectoral level, Caporale et al. (2022) analyzed oil-equity price nexus in BRICS-T (Brazil, India, China, South Africa, Russia, and Turkey) countries. The sample of their study includes oil exporters (Brazil and Russia) as well as oil importers (Turkey, South Africa, India, and China) countries. They selected the data period which started on January 2001 and ends at March 2021. Their findings highlighted that overall oil prices have a significant and positive correlation with stock prices. They argued that different global crises such as COVID-19 amplified the interdependence between oil prices and stock prices. Such a relationship seems true for such sectors which have a heavy reliance on oil. A research work done by Katsampoxakis et al. (2022) in context of the European countries examined the oil-stock relationship using the vector autoregression (VAR) model. Their sample consists of countries who are either importer or exporter of oil. Their results indicated that during the high volatility periods, the causal correlation between oil prices and stock return was observed in oil importer as well as exporter nations. Moreover, they suggested that the oil and stock prices relationship should be considered by fund managers and investors while devising a strategy.

In terms of the Indian market, the Prabheesh and Kumar (2021) study analyzed the dynamic interaction between equity prices and oil prices with the help of structural vector autoregression econometric technique. They reported that COVID-19 created uncertainty in both the oil and stock market. It happened because investors adopted a cautionary approach during the COVID-19 period. In the market of Nigeria, Nwosa (2021) found the adverse aftershocks of COVID-19 pandemic on equity prices and oil prices compared to the impact of global financial crises. This relationship was also tested in the UK market by Mugaloglu et al. (2021). their study used a “structural vector autoregressive (VAR)” model during the phase of COVID-19. The findings of their research showed that during the COVID-19 the oil shocks resulted in the decline of stock prices. However, in the pre and post-COVID-19 periods increase in oil prices resulted in an upward shift in stock prices.

Oil-stock price relationship was tested in the markets of Brazil, Chile, India, Mexico, and Russia (Rakshit & Neog, 2022). The researcher found a positive interaction between equity prices and oil prices across all the selected economies. Moreover, the stock market returns were more volatile during the COVID-19 period. Another study by Duppati et al. (2023) used the VAR model and quantile-causality approach to examine the oil-stock relationship in the times of COVID-19 period for developed and emerging countries. They found a strong substantial effect of oil prices on the stock market during COVID-19. In the context of the United States stock market, Sharif et al. (2020) analyzed the oil-stock price causal relationship through the wavelet coherence method. Their study reported a significant positive association among the said variables during the COVID-19 pandemic. Gaytan et al. (2023) examined the connection between oil shocks and equity returns in the Latin American stock markets using the VAR model and Wavelet analysis. They observed that structural demand shocks during the pandemic remain high. They observed that pass-through effects of oil prices on the stock returns vary from time to time. By considering these findings, policymakers can formulate a better policy according to the shocks and this could help in building the confidence among the investors by mitigating the risk through optimum portfolio management.

DATA AND METHODOLOGY

This section represents the technique, methodology, and sources of data collection used in the current study to document the stock price and stock market relationship. The study's population consists of the oil price between July 10, 2020, and July 10, 2024. The stock market performance in Pakistan is also analyzed throughout that time frame. The KSE-100 index daily prices are taken for analysis. Global crude oil prices are collected to study its impact on Pakistan's stock market. The novel Wavelet analysis method was used in this study. Unlike Fourier analysis, wavelet analysis considers unique data specific to a given time period. Consequently, it is very helpful in identifying short connections or stops. In wavelet analysis, a time series



is converted into basic wavelets, which are copies of a primary wavelet but differ in location and size. The visualization of oscillations is made possible by the analysis of the series, in both temporal and spectral dimensions. Unlike Fourier analysis, which can only be used with stationary series, the wavelet analysis technique can be used with both dynamic and stationary time series. The differentiation described here makes wavelet analysis adaptable and practical for a variety of types of data.

RESULTS AND DISCUSSION

Figure 1 shows the variation in oil and stock prices from the year 2020 to 2024. The price of oil and stocks fluctuated from one peak to another during this time, making both extremely unstable. Figure 2 breaks down the oil price frequency into its component frequencies. The top panel shows the various frequencies at different times, while the bottom panel shows a range of frequencies. The bottom panel illustrates the various frequencies at which oil prices may be accessible. On the other hand, although the prices are accessible for different durations, the top panel displays the same series with different prices for a series of different time durations.

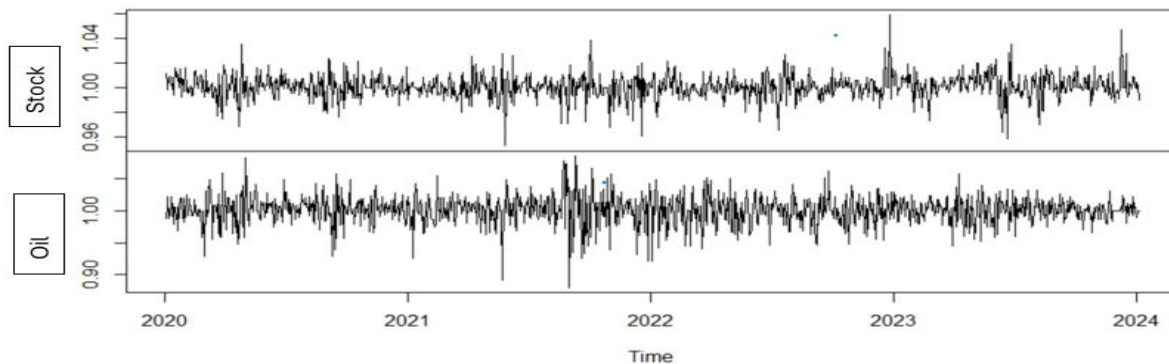


Figure 1: Oil and Stock Volatility.

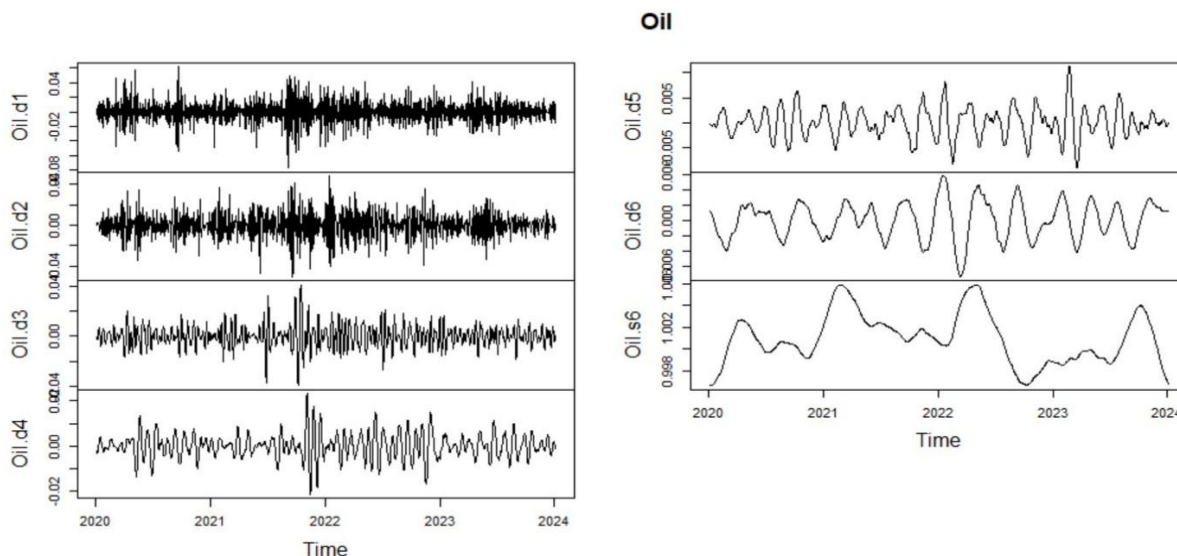


Figure 2: Decomposition of Oil.

Figure 3 displays the frequency of the stock price after it has been divided into its component frequencies. The original KSE-100 series is depicted in the left panel, and its division into many frequency bands is shown in the right panel. These frequency ranges include lower-frequency long-term trends as well as



high-frequency daily fluctuations. From high-frequency daily oscillations to low-frequency long-term swings, these frequency bands span a range of frequencies. They cover a broad spectrum of frequencies. The left panel displays one raw look of the time series KSE-100.

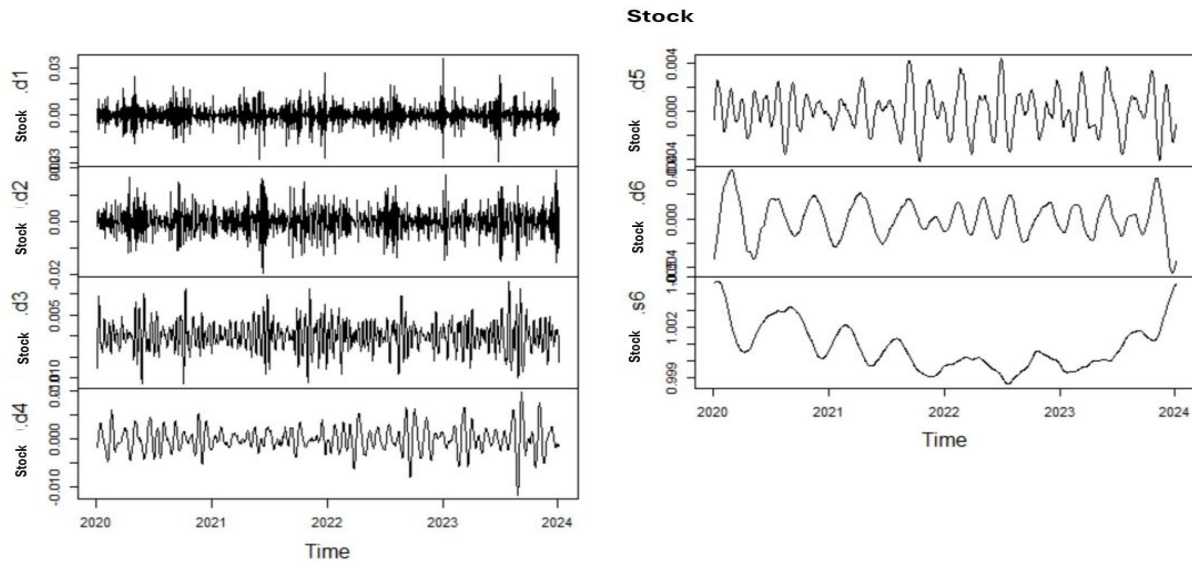


Figure 3: Decomposition of Stock.

Figure 4 shows the wavelet coherence among stock prices and oil prices with respect to time and a variety of frequencies. The time period is shown on the horizontal axis, whereas the frequencies are represented on the vertical axis. “Cone of influence” is the area covering inside the white line. The area above the white line indicates the significant relationship among selected variables. However, the area under the white line is influenced by discontinuity. That is why, this area is hard to explain. In the area within the “cone of influence”, the red area shows a high correlation between oil and stock prices. It can be observed from the figure that the significant interaction between stock and oil prices exists in different time domains and frequencies. This phenomenon indicates that since the start of COVID-19 in Pakistan, the oil and stock prices have shown both short-term and long-term relationships. In the same manner, the [Katsampoxakis et al. \(2022\)](#) research found a strong interaction between equity prices and stock prices during the high volatility periods. Such a significant relationship was found in the market of the United States by [Jawadi and Sellami \(2022\)](#) and [Zhang and Hamori \(2021\)](#) respectively.

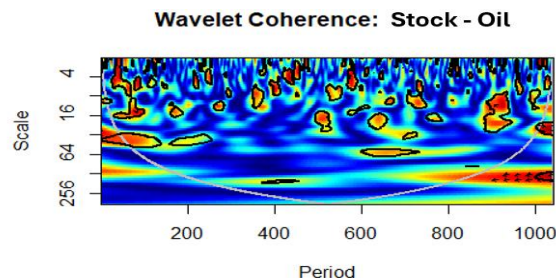


Figure 4: Wavelet Coherence.

According to [Managi et al. \(2022\)](#), stock prices declined during the Covid-19 because of oil prices shocks and lockdown policies. Similar significant results were found between equity prices and oil prices during COVID-19 in the United States ([Jawadi & Sellami, 2022](#)) and the United Kingdom stock market ([Mugaloglu et al., 2021](#)). Moreover, [Abuzayed and Al-Fayoumi \(2021\)](#) study found that the oil prices and



stock return relationship was significant and stronger after the COVID-19 period. It can be observed from Figure 4 that in the medium to long term, the oil-stock prices relationship is weak. These results support the claim made by Zhang et al. (2021) that the correlation between equity prices and oil prices declined by around 89.5 percent after the emergence of COVID-19. In another attempt made by Chien et al. (2021), it was found that low comovement existed among oil prices and equity returns in the markets of China, Europe, and the United States.

CONCLUSION

An attempt has been made in this study to analyze the in-depth association between oil prices and share price returns. The data period selected in this research covers the COVID-19 pandemic (a time marked by significant economic uncertainties). This study uses the data period ranges from 2020–2024, and has offered a special environment for studying how changes in oil prices affected stock market performance, especially in emerging countries like Pakistan. This time frame encompasses the start of the epidemic, which ensured the global disruptions in stock markets, and its gradual recuperation. The financial markets have been significantly impacted due to the aftermath of COVID-19 pandemic. The current study's result show that the volatility of the oil price and changes in equity prices have a dynamic and intricate relationship in the Pakistan Stock Exchange (PSX). The findings of the current study will be helpful for policymakers in understanding the dynamic interaction between oil and stock prices during the COVID-19 pandemic period. This will help the policymakers in making efficient plans to make the economy more robust in crisis periods such as COVID-19.

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