RIDING THE WAVE: OIL PRICE FLUCTUATIONS AND STOCK MARKETS' RESPONSES IN OIL EXPORTING VS IMPORTING ECONOMIES

1.*Madiha Zafar
National University of Sciences and Technology (NUST), Pakistan

2. Muhammad Owais Qarni
National University of Sciences and Technology (NUST), Pakistan

3. Ajid Ur Rehman
National University of Sciences and Technology (NUST), Pakistan

ABSTRACT

This study identified the dynamics of return spillover between crude oil return and stock markets' return of crude oil exporting and importing economies. For this objective, the study employs an extensive sample of major oil-exporting countries (United Arab Emirates, Saudi Arabia, Iraq, Canada, and Russia) and oil-importing countries (United States, China, India, South Korea, and Japan). The analysis covered a dataset of 1035 observations from 2019 to 2022 by using the spillover index methodologies of Diebold & Yilmaz (2012) and the Spillover Asymmetric Measures (SAM) model of Barunik et al. (2016). The key findings revealed notable spillover effects of stock returns between the stock return and the change in the price of crude oil. An increase in return spillover was noted among the exporting and importing countries at the time of increasing crude oil prices compared to aggregated spillover and periods of decreasing oil pricing. The magnitude of return spillover was high in oil-importing economies as compared to oil-exporting economies. During periods of price decline and price increase for crude oil. Overall, the study's findings posit valuable insights into the complex dynamics of spillover effects between crude oil prices and stock markets in exporting and importing countries.

Keywords: Crude oil pricing; COVID-19; Stock market; Contagion; Spillover index; Importing and exporting Countries of crude oil

https://doi.org/10.56249/ijbr.03.01.64
* Corresponding author.
E-mail address: madiha.005@hotmail.com (Madiha Zafar)

1 INTRODUCTION

Historically, the stock market has been identified as one of the leading economic cycle indicators and significantly impacts oil demand (Cevik et al., 2021). Oil is a crucial energy source used to measure an economy's stability due to its high dependency on oil products (Alamgir & Amin, 2021). Consumption of crude oil is increasing, specifically in emerging and Asian markets. China and India consume almost 30% of world oil (Am & Shanmugasundaram, 2017). As emerging economies with massive consumption of crude oil, China and India make these economies more vulnerable due to fluctuations in prices of crude oil. The Stock market is known as a barometer of the economy and closely relates to oil prices. Oil prices at the world level are more crucial for estimation than the national oil price (Alamgir & Amin, 2021). Oscillation in prices of world crude oil may affect stock market indices via cash flow and gains of corporations. Theoretically, it is justified that movement in the price of oil negatively impacts the prices of stock (Cevik et al., 2021). The high price of oil has an adverse effect on economic performance or activities, as triggered by increasing input price, reducing firms' profit due to high spending on energy consumption. This uncertain situation increases risk premiums, impacting the price of stocks (Alamgir & Amin, 2021). Due to increased crude oil prices, the inflation level in oil-importing economies increases, lowering the saving potential and reducing investment.

Fluctuation in oil prices and its effect on the stock market has drawn attention in the recent decade. The International Energy Agency (IEA) predicted by 2030 that, 30% of the energy mix would be oil fulfilled (Van & Lesage, 2009). Oil prices directly impact the stock market via prospective cash flow and indirectly impact discounted cash flow (Basher et al., 2012). Volatility in oil prices has an influence on developing and developed countries. However, this impact is more pronounced in developing countries due to the fact that high uncertainty in the prices of oil and the vulnerability of these countries to immature financial policies and its impact on investors. Along similar lines, import-dependent countries experience greater susceptibility to these fluctuations (Wang et al., 2022). In developing countries, the cost of living increases due to a spike in global fuel prices, which hampers the growth of these economies.

The transmission of volatility in crude oil pricing delineates across commodities and markets. The interconnectivity of markets contributes to a high correlation, influencing risk transmission between international markets of crude oil. The involvement of global capital flow and investors becomes a significant factor in amplifying risk transmission among international markets of crude oil, risk-associated financial markets, and commodities. On the contrary, risk induced by an international market of crude oil circulates rapidly via capital flow, investors' expectations, market information, and other platforms (Jia et al., 2021). Crude oil price fluctuations influence investors' expectations in oil import and export-reliant countries.

Variations in the prices of crude oil can shift the demand and supply, which directly affects the stock market return of oil-importing and exporting countries (Jia et al., 2021). Any variation in shocks related to the supply and demand of crude oil influences global prices of oil, and its effect on stock market returns varies. A change in oil price triggered by supply-side shocks can negatively affect stock returns due to increased production costs for importing countries. Conversely, fluctuation in demand changes oil prices with positive and negative influences on stock returns (Xu et al., 2019) due to constraints on the capacity of the oil market (Cevik et al., 2021). Demand-side shocks are generated by increased economic growth in the oil-importing economies and thus support supplementary economic growth. Meanwhile, increases in prices of crude oil due to supply-side shock do not positively impact the economic growth of oil-importing economies. During supply-side shock, an increase in prices costs more than the growth benefits that can be realized due to the expansion of economic activities.

Volatility in stock prices significantly has a global influence, such as business cycle, demand and supply factor, and oil production, which in turn impacts the earnings of producing countries (Cevik et al., 2021). Contemporary literature regarding spillover and contagion between prices of crude oil and the return of the stock market identifies the time-varying nature of this relationship. Research reports mixed results about this relationship. The COVID-19 pandemic generated a demand-side crude oil price shock because of reduced demand for crude oil (Sarwat et al., 2023; Talha et al., 2025). Throughout the COVID-19 pandemic, governments enforced various measures to curtail the spread of the pandemic that affected business activities and thus reduced crude oil demand.

This study provides multifaceted implications and contributions. The study expands the prevailing literature and explores the dynamic nature of spillover and contagion association between fluctuations in crude oil prices and stock market returns of oil-producing and oil-dependent countries. Empirically, the study analyses spillover effects of fluctuation of prices of crude oil and returns of stocks of five major oil exports reliant countries (United Arab Emirates - ADX, Saudi Arabia - TASI, Canada - TSX, Russia – MOEX and Iraq - ISX,) and five major oil imports reliant countries (China - SSE, United States – S&P 500, India - BSE, South Korea - KOSPI, and Japan – NIKKEI 225).

The existing study contributes to the prevailing literature on crude oil prices and returns of stocks by implementing the spillover index methodologies of Diebold & Yilmaz (2012) and the Spillover Asymmetric Measures (SAM) model of Barunik et al. (2016). Study findings revealed that Japan-- NIKKEI 225 is the extortionate return spillover from others, while Canada-TSX disseminated extortionate return spillover. Further, we found that oil-importing economies exhibit more spillover and contagion than oil-exporting economies because of generating the demand side shock in the international market of crude oil. The importing economies of crude oil exhibited reduced returns on the stock market as a result of the closing of business activities in response to government restrictions imposed during the COVID-19 pandemic. Crude oil exporting economies not only faced COVID-19 restrictive measures imposed by governments but also experienced a decline in prices of crude oil due to reduced demand worldwide. Overall findings indicate that throughout the COVID-19 pandemic period, fluctuation in prices of crude oil on the return of the stock market is more pronounced in crude oil importing than in stock markets of crude oil exporting economies. This is because crude oil exporting economies have diversified their income sources and reduced their dependencies on exporting crude oil as a major source of their income. Crude oil price reflects the outlook of an economy. Therefore, the return spillover among exporting and importing-reliant economies because of oil price fluctuations will assist investors, portfolio managers, and policymakers in making informed decisions regarding the diversification of portfolios and minimization of risk.

The remaining paper is arranged by following sections: Section 2 corresponds to the literature review; sections 3 and 4 represent the methodology and descriptive statistics of the study;

sections 5 and 6 discuss the findings and spillover asymmetric measures, whereas in the final section, we conclude the paper with possible implications.

2 LITERATURE REVIEW

The price of crude oil is a key factor affecting global economic growth and financial markets worldwide (Nan et al., 2022). Crude oil is a primary energy source that fuels the engine of economic growth all around the globe. Fluctuation in crude oil prices influences economies and financial markets (Ji et al., 2020). Volatility in the prices of crude oil and the pandemic of COVID-19 have disrupted the growth potential of many financial markets worldwide (Sharif et al., 2020). Various measures undertaken by governments worldwide in response to the pandemic of COVID-19 affect global financial markets and enhance hardships for struggling economies (Ma et al., 2020). Many businesses faced closure due to an unfavorable business environment during the pandemic of COVID-19.

Fluctuation in prices of crude oil affects worldwide financial markets (Jiang et al., 2020). To understand this mechanism, Apergis & Miller (2009) have classified changes in prices of oil into three components, i.e., aggregated specific global oil, demand and supply shock. Developed countries' stock markets showed the specific shock related to the supply of oil has not impacted the return of stocks. In contrast, the specific shock of oil demand impacted the returns of the Canadian stock market. The stock market's response in the scenario of a negative or positive shock of oil price was found to be asymmetric.

Oil price shocks can affect the stock market in two ways. These have two categories such as supply-side shock and demand-side supply (Cunado & de Gracia, 2014). Supply-side oil price shocks have an adverse effect on oil-importing economies of stock markets as the cost of production in these economies increases, contributing to the diminishment of profits and stock prices. Am and Shanmugasundaram (2017) analyzed the impacts of oil price shocks on the stock markets of oil trading economies. These identified significant links between crude oil prices and stock markets of oil trading economies. Results revealed an increase of 1% in crude oil price was linked with 0.13% increases in stock markets. Similar direct increase in prices of stock of oil-producing economies. The primary source of foreign exchange earnings for oil-exporting economies is based on crude oil export. A price rise in crude oil enhances the value of the

domestic currency, which translates into a higher value of accumulated wealth and increased investments. The increase in investment enhances the demand for equity investment, which causes a surge in the prices of stock. The opposite occurs for countries with oil import activities related to prices of crude oil. The fluctuation of prices in crude oil affects the stock markets of developing and developed economies equally (Haris et al., 2025; Shaukat et al., 2024; Sarwar et al., 2024).

Park & Ratti (2008) reported a negative impact of oil price fluctuations on the stock markets of the USA and 13 economies of Europe from 1986 to 2005. Significant growth in stock market prices of South Asian oil-importing economies was observed during the health crisis of the COVID-19 pandemic, as the prices linked with crude oil were decreased due to demand-side shock (Alamgir & Amin, 2021). Throughout the COVID-19 pandemic, the demand for crude oil declined globally, causing a reduction in the prices of crude oil (Gulzar et al., 2024; Sarwar et al.,2025). Reduction in crude oil prices translated to reduced cost of production in dependent economies of oil-importing and fuelled growth of the stock market. Equity markets of oil-importing economies are more vulnerable to the price of crude oil fluctuations than exporting countries (Ali, 2022). Crude oil price fluctuation affects the stock markets of countries involved in oil export and import; however, this effect is more prominent in crude oil importers countries. Instead of Saudi Arabia, Gulf equity markets are identified as receivers of spillover from crude oil price fluctuations (Malik & Hammoudeh, 2007). As a major oil exporter, Saudi Arabia has a crucial role in maintaining a balance between supply and demand in the worldwide crude oil market and is thus a transmitter of spillover to crude oil prices.

Awartani and Maghyereh (2013) and Arouri et al. (2011) identified the presence of significant bidirectional volatility transmission between the stock market and crude oil prices of the GCC economies during the period 2004 to 2012. Prevailing studies showed significant spillovers between the prices of crude oil and equity markets of G-7 economies (Khalfaoui et al., 2019). Aimer (2016) tested for spillover effects between equity markets and crude oil prices of oil exporting and importing economies and reported that the aggregate volume of exports and imports significantly magnified the spillover between crude oil prices and equity markets in the oil economies with oil trading. The findings indicated unidirectional spillover of crude oil towards the equity of nations with oil import and export activities. The magnitude of spillover

between the equity market and the global market of crude oil depends on the volatility of crude oil markets (Mamipour & Feli, 2017). In periods of low volatility, the international market of crude oil exhibits low spillover towards equity markets, whereas in the duration of peak volatility, the magnitude of spillover is significantly high. Ren et al. (2023) put forward evidence for the existence of volatility spillover between stock markets and crude oil by application of several spillover models.

Xu et al. (2019) explained that the spillover of volatility toward the equity market from oil prices is asymmetric across economic recessions and booms. The presence of spillover within crude oil and equity markets is based on time and the severity of the turmoil. Wang & Wang (2019) also identified a time-dependent spillover of volatility between Chinese equity markets and global crude oil. The evolving nature of volatility spillover revealed the notion in favor of the “Meteor Shower” and “Heat waves” theories (Engle et al., 1988). From 2009 to 2018, spillover between share markets of crude oil and crude oil exporting and importing economies has also been identified (Ashfaq et al., 2019). The magnitude of spillover is more pronounced for oil-importing economies when crude oil prices increase. Khalfaoui et al. (2019) also found similar evidence of volatility contagion amid crude oil and equity markets of economies engaged in oil trading.

There is an existence of volatility between financial commodity and crude markets (Jia et al., 2021). Various recent studies reported volatility spread within crude oil, financial markets, and commodities. This spillover is more prevalent at the time of any positive shocks in the prices of crude oil and during periods of crisis. Jiang et al. (2022) also identified the presence of asymmetric spillover in China's markets of commodity, agriculture, and crude oil. The presence of a spillover effect between the prices of crude oil and foreign exchange markets of crude oil exchanging economies is reported in a most recent study by Sun et al. (2023). The renewable energy equity market in China also exhibited the presence of asymmetric bidirectional spillover with the international market of crude oil during the COVID-19 health crisis pandemic (Nong et al., 2022). It was identified that renewable energy firms with significant market capitalization tend to transmit spillovers to the market of crude oil. In contrast, renewable energy firms with small market capitalization tend to be recipients of the spread of a global market of crude oil. Tsiaras et al. (2022) examined the spillover and contagion time-varying impacts among the

international crude oil markets, foreign exchange, and Islamic CDS markets of Saudi Arabia. Their findings indicated the presence of spillover impacts of crude oil markets towards foreign exchange and Islamic CDS markets of Saudi Arabia from 2011 to 2020.

Despite the evidence of the crucial impact of prices of crude oil on equity market performance, Osah & Mollick (2023) contended these findings and identified a time-varying influence of shocks of crude oil on capital markets and oil-exporting and importing economies. Supporting the time-varying influence of crude oil shock on stock markets, Filis et al. (2011) identified that supply-side shock has an insignificant impact on the prices of the stock market. On the other side, demand-side shock in crude oil prices significantly influenced the performance of the stock market in oil-exporting and importing economies. Chang et al. (2013), while investigating spillover of volatility between the stock market of the USA and the UK, prices of crude oil reported that there exists an insignificant spillover among crude oil prices and stock markets of the United States and the United Kingdom during the period 1998 to 2009. Similarly, Huang et al. (2015) investigated the associations between prices of crude oil and China's stock market. The finding suggested the non-presence of any significant association between the two markets.

A review of existing literature on the topic revealed the existence of mixed evidence regarding the presence of spillover and contagion among crude oil and financial markets in countries involved in oil trading. It has also been revealed that this relationship is time-dependent and varies with changes in the period under study. In order to establish more concrete evidence on the dynamics of spillover and contagion relationship between crude oil and financial markets in countries involved in oil trading, further investigation into the topic is essential.

3 METHODOLOGY

Analytical tool development has enabled researchers to better analyze the dynamic nature of spillover and contagion among interconnected markets. The methodology of spillover index Diebold & Yilmaz (2009) initially provided estimates dependence on the ordering of the variables. An improvement in methodology has been made by Diebold and Yilmaz (2012), eliminating the flaw by estimating results independent of ordering the variables in the model. Despite the attractive properties of Diebold and Yilmaz's (2012) spillover index model, it can not

capture the impact of spillover for any negative and positive price movement in a specific market.

The distinctive positive and negative shock effects on spillover and contagion among interconnected markets could be captured by the Spillover Asymmetric Model (SAM) developed by Barunik et al. (2016). The SAM provides isolated spillover measures for positive and negative shocks in interconnected markets by applying N-variable VAR models for any negative and positive shocks to integrated markets.

By applying the Diebold and Yilmaz (2012) jointly spillover index method with insight from Barunik et al. (2016) SAM model, an in-depth analysis of the mechanism of return contagion among the market of crude oil and equity markets of crude oil exporting and importing economies can be carried out for a better understanding of the phenomenon.

3.1 SPILLOVER INDEX

The Diebold and Yilmaz (2012) method calculates aggregate spillover effects by applying variance decomposition. Details of the applied methodology are given below. Due to the covariance stationary, we considered the VAR(P), N-variable.

$$Y_t = \Sigma_{i=1}^{q} \psi_t y_{t-j} + \varepsilon_t \quad (1)$$

Where $Y_t = Y_1, Y_2$and ψ is a parameter matrix. The current study used ^{Y} as the volatilities vector for each chosen market. An autonomous and uniformly distributed vector of residual terms is given below.

$$y_t = \Sigma_{i=0}^{\phi} c_i \varepsilon_{t-i} \quad (2)$$

Equation (2) is used to estimate the moving average, representing coefficient matrices following the recursion C_i. The identity matrix $^{i<0}$ is presented by C_0. W-step ahead prediction of residual variance because of a shock to Y_i, which is estimated as spillover, and W-step ahead prediction of residual variance Y_i is because of the shock to Y_j, $i,j=1,2,.....N$, which was estimated as a spillover of cross-market.

We obtained the orthogonality by using Cholesky factorization coerce, causing the variance decomposition dependencies on the order of the variables. This concern is resolved by using Diebold and Yilmaz (2012) method and implementing Koop et al. (1996) and Pesaran & Shin (1998), henceforth KPPS, generalized VAR method. KPPS W-step ahead prediction error variance (Pesaran & Shin, 1998; Koop et al., 1996) is computed as,

$$x_{ij}^{p}(W) = \frac{\vartheta_{ii}^{-1}\Sigma_{w=0}^{W-1}(f_i C_w \Theta e_i)2}{\Sigma_{w=0}^{W-1}(f_i C_w \Theta e_i)} \quad (3)$$

In equation (3), the matrix is presented by Θ, shows the standard deviation of residuals values in equation indicated by me, and the selected vector with one value as *an ith* element or zero contrarily is indicated by e_i. This is due to the shock that every variable has not been orthogonalized, as the sum of all rows of variance decomposition is not equal to 1.

$$\Sigma_{j=1}^{n}\tau_{ij}^{g}(W) \neq 1 \quad (4)$$

Diagonal elements of the contagion spillover matrix present the contribution of volatility spillover of markets. Off-diagonal elements of rows indicated the contribution of the spillover volatility matrix from other markets; however, off-diagonal elements of columns present the contribution of volatility spillover towards other markets. Every entry related to the matrix of variance decomposition is scaled by the sum value of rows and columns to estimate the spillover index as:

$$\tau_{ij}^{g}(W) = \frac{\tau_{ij}^{g}(W)}{\Sigma_{j=1}^{n}\tau_{ij}^{g}(W)} \quad (5)$$

As per construction

$$\Sigma_{j=1}^{n}\tau_{ij}^{g}(W) = 1\Sigma_{i.j=1}^{n}\tau_{ij}^{g}(W) = N \quad (6)$$

We calculated the total volatility spillover as follows:

$$S^{g}(W) = \frac{\Sigma_{i.j=1}^{n}\tau_{ij}^{g}(W)}{\Sigma_{i.j=1}^{n}\tau_{ij}^{g}(W)} \times 100 = \frac{\Sigma_{i.j=1}^{n}\tau_{ij}^{g}(W)}{N} \times 100 \quad (7)$$

For the Spillover Asymmetric Measure (SAM) model, we have applied the N-variable VAR model of Diebold and Yilmaz (2012) to analyze the influence of crude oil price increases or decreases on the equity returns of crude oil exporting and importing economies.

4 DISCUSSION OF RESULTS

4.1 DESCRIPTIVE STATISTICS

To investigate the dynamics of spillover return influence due to fluctuation in the price of crude oil towards the stock market of the economies with oil export and import activities. The data set consisting of 1035 observations dated from January 1, 2019, to December 19, 2022, is analyzed. The stock markets of the top five major economies of oil exporting (United Arab Emirates - ADX, Saudi Arabia - TASI, Canada - TSX, Russia - MOEX and Iraq - ISX) and importing economies (China - SSE, United States – S&P 500, India - BSE, South Korea - KOSPI, and Japan – NIKKEI 225) are included in the study sample to estimate the effect of spillover of crude oil. Table 1 consisted of descriptive statistics on the prices of crude oil and the return of the stock market.

Descriptive statistics show the return on the stock market of five exporting and importing economies. ISX exhibits the highest mean return and spillover during the sample period. WTI crude oil witnesses the lowest return. The standard deviation statistic indicates that ISX stock prices were the most volatile during this sample period. The statistics of the kurtosis, skewness, and the Jarque–Bera test none of the series adheres to a normal distribution

Table 1: *Return—Descriptive Statistics*

	WTI	TASI	ADX	TSX	ISX	MOEX	S&P 500	KOSPI	BSE	Nikkei K225	SSE
Mean	0.00	0.000312	0.000886	0.000357	1.863671	9.25E-05	0.000508	0.000211	0.000605	0.000380	0.000272
Maximum	0.530864	0.070702	0.084100	0.119570	1921.440	0.200358	0.093828	0.086012	0.089749	0.080381	0.057114
Minimum	-3.02	-0.08	-0.08	-0.12	-1.00	-0.33	-0.12	-0.08	-0.13	-0.06	-0.08
Std. Dev.	0.109782	0.010633	0.011563	0.012077	59.72553	0.019010	0.014205	0.012156	0.012954	0.012273	0.010878
Skewness	-21.29	-1.38	-0.17	-1.17	32.12367	-4.53	-0.52	-0.02	-1.16	0.176694	-0.54
Kurtosis	569.3525	14.78462	17.27436	37.64182	1032.954	107.3825	15.59159	10.33073	20.63185	7.251695	8.733163
Jarque-Bera	13910764	6316.883	8792.208	51988.32	45925193	473412.8	6884.158	2317.601	13638.45	784.9524	1467.876
Observations	1035	1035	1035	1035	1035	1035	1035	1035	1035	1035	1035

Note: *The indices analyzed are WTI (West Texas Intermediate Crude oil), TASI (Tadawul All Share Index, Saudi Arabia), ADX (Abu Dhabi Securities Exchange), TSX (Toronto Stock Exchange, Canada), ISX (Iraqi Stock Exchange, Iraq), MOEX (Moscow Exchange, Russia), S&P 500 (Standard & Poor's 500, United States), KOSPI (Korean Composite Stock Price Indexes, South Korea), BSE (Bombay Stock Exchange, India), Nikkei 225 (Japan), and SSE (Shanghai Stock Exchange, China). Statistics are rounded to two decimal places. All statistics are significant at a 1% level of significance.*

4.2 RETURN SPILLOVER INDEX

Table 2: *Return Spillover index: WTI crude oil and stock markets of economies involved in oil import and export*

	WTI	TDL	ADX	TSX	ISX	MOEX	S&P 500	KOSPI	BSE	Nikkei 225	SSE	From Others
WTI	88.32	2.11	3.41	1.84	0.01	0.76	1.02	0.65	1.33	0.41	0.16	11.68
TDL	1.18	60.53	10.58	8.38	0.07	2.43	7.43	3.27	4.23	0.20	1.70	39.47
ADX	2.11	11.73	58.89	9.56	0.14	2.19	6.10	3.19	4.21	0.50	1.37	41.11
TSX	0.90	6.69	6.33	38.35	0.14	3.61	26.48	5.19	10.48	0.30	1.53	61.65
ISX	0.11	0.47	0.07	0.37	96.72	0.57	0.33	0.35	0.36	0.28	0.37	3.28
MOEX	0.84	2.65	2.30	6.59	0.02	72.81	4.44	2.87	6.05	0.13	1.30	27.19
S&P 500	0.67	5.50	3.52	30.862	0.11	2.50	42.84	4.32	8.28	0.10	1.29	57.16
KOSPI	0.60	3.84	3.63	12.18	0.11	4.19	11.54	48.65	8.77	0.17	6.32	51.35
BSE	1.36	5.22	4.49	14.05	0.12	4.10	11.49	8.94	47.10	0.58	2.53	52.90
NIKKEI 225	0.92	3.14	3.95	13.29	0.207	3.14	18.06	14.56	3.59	35.21	3.94	64.795
SSE	0.34	1.97	1.25	3.85	0.10	1.54	4.53	9.69	3.99	0.07	72.66	27.34
Contribution to others	9.03	43.34	39.53	100.981	1.02	25.03	91.40	53.03	51.28	2.75	20.51	437.90
Contribution including own	97.35	103.87	98.43	139.33	97.74	97.84	134.24	101.68	98.38	37.96	93.17	39.8%1

Note: *The indices analyzed are WTI (West Texas Intermediate Crude oil), TASI (Tadawul All Share Index, Saudi Arabia), ADX (Abu Dhabi Securities Exchange), TSX (Toronto Stock Exchange, Canada), ISX (Iraqi Stock Exchange, Iraq), MOEX (Moscow Exchange, Russia), S&P 500 (Standard & Poor's 500, United States), KOSPI (Korean Composite Stock Price Indexes, South Korea), BSE (Bombay Stock Exchange, India), NIKKEI 225 (Japan), and SSE (Shanghai Stock Exchange, China).*

Table 2 represents the index of return spillover, which indicates the average return spillover within the WTI crude oil and oil exporting and importing stock markets. The average return spillover within WTI crude oil and equity market of oil import and export economies is 39.8% during the overall period of the sample. The market's highest return spillover was showed by ISX (96.72%), with only 3.28% contributions from others to its returns. The NIKKEI-225 is the biggest recipient of return spillover from others (64.79%), followed by TSX (61.65%), S&P 500 (57.16%), and BSE (52.90%). NIKKEI-225 received the highest return spillover from the S&P 500 (18.05%) and, on the other side, received the lowest volatility spillover from ISX (0.207%). NIKKEI-225 has minimal influence on other markets, ranging from 0.13 to 0.58%. The spillover index results align with the study of Osah & Mollick (2023), which reported a significantly positive association between oil price return and stock market indices' return. We report that the highest spillover is from WTI occurs to ADX stock returns.

TSX is the highest transmitter to others for return spillover (100.98%), led by the S&P 500 (91.40%) and KOSPI (53.03%). The highest return spillover from TSX occurs in the S&P 500 (30.86%), followed by BSE (14.05%) and NIKKEI-225 (13.29%). The return spillover from TSX to the importing markets ranges from 3.85 to 30.86%. The highest return spillover from TSX to the importing markets occurs for S&P-500 (30.86), and the lowest return spillover among the importing economies occurs for SSE (3.85). ISX returns are least influenced by others (3.28%). NIKKEI-225 received the highest spillover of return (64.79%) from others, while ISX is the minor return recipient (3.28%) from other markets in the sample. Saudi Arabia and Canada are the two biggest oil exporters in the USA. Canada exports 43% of its oil to the USA, whereas Saudi Arabia exports 13.5% to the USA. The USA is an oil-importing country with an increasing demand for crude oil as a source of energy (Khalfaoui et al., 2019). As a major importer of crude oil, the USA business cycle is more prone to fluctuation in crude oil prices.

We applied the 200-day rolling window to study the transformative nature of return spillover among sample markets across time. By using the rolling window, we checked the robustness of the model. We found the low sensitivity by using the different horizons of windows, which shows the robustness of the model. The evaluation by rolling window encapsulates the cyclical patterns of return spillover, which is unable to be apprehended via the static spillover index. The

time-varying return contagion (Fig. 1) indicates varying patterns in reflex to COVID-19 events. A rapid increase in spillover is observed in the first quarter of 2020 because of the COVID-19 pandemic, with a slight decrease in spillover throughout the second quarter of 2020. A sharp decline in spillover is visible in the first quarter of 2021 due to policies adopted to minimize the impact of COVID-19. The return spillover indicated a slow increasing and falling drift until the second quarter of 2020 because of COVID-19.

In the first quarter of 2020, return spillover within the oil importing and exporting economies increased as COVID-19 turbulence started in December 2019, followed by an overall decreasing trend. In Feb 2020, the return spillover indicated a rapid increase because of the COVID-19 event in January 2020, with a subsequent decline afterward. The return spillover indicates a rapid increase from December 2019 to the first quarter of 2020. As per the start of the second quarter of 2020, return spillover showed a decreasing pattern till the end of the sample period, depicting more responsive behavior to stabilizing global financial and economic setup. Financial crises impact the behavior of investors at national and international levels. As per Khalfaoui et al. (2019), any shock can change investors' perceptions of their personal investment and risk tolerance behavior. According to Nong et al. (2022), during the outbreak of COVID-19, the worldwide economy was impacted severely, and countries boosted their economies with large-scale investment options. All countries focused on developing renewable energy; energy transition became most prominent globally at that time.

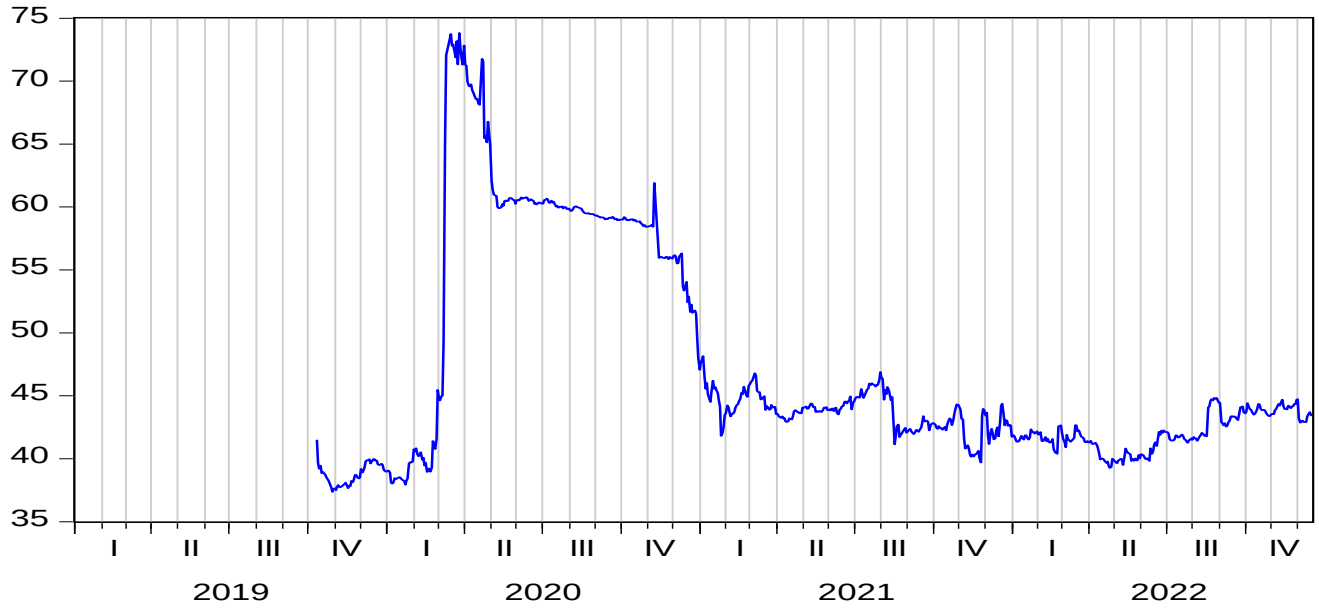

Figure 1: *Average Return spillover WTI crude oil and stock markets of economies with oil export and oil import*

4.3 SPILLOVER ASYMMETRIC MEASURES

4.3.1 ASYMMETRIC CONNECTEDNESS AMONG WTI CRUDE OIL (DECLINE) AND STOCK MARKET OF ECONOMIES WITH OIL EXPORT

Table 3 corresponds to the return spillover index and denotes spillover effects because of the decline in prices of crude oil for returns of equity markets of crude oil exporting economies. The average spillover among crude oil prices declined with a 19.2% decrease in equity markets' returns of crude oil exporting economies. Return spillover due to crude oil price decline is lower than the aggregate spillover (Table 2) and spillover due to crude oil price increase (Table 5). This finding highlights the spillover asymmetry within the selected economies. The index of return spillover in Table 3 presents that TSX received the highest spillover (32.06) from other markets and transmitted the highest spillover (32.44) to others. Meanwhile, ISX experienced the least spillover (1.46) from other markets and transferred the lowest spillover (0.36) to WTI and other crude oil exporting equity markets. The highest self-spillover is indicated by ISX (98.54). The minimal persistence of own market spillover is indicated by TSX (67.94). The time-varying pattern identified by the average return spillover amid crude oil price decline and major Crude oil-exporting economies is depicted in Figure 2. Rolling windows analysis (Figure 2) reveals a sharp increase in the spillover between declining prices of crude oil markets and equity markets

of crude oil exporting economies due to the pandemic of COVID-19 in 1st quarter of 2020. A gradual decrease in spillover was observed in the 2nd quarter of 2020 due to the stabilization of the worldwide economy after the COVID-19 pandemic. As Alamgir & Amin (2021) explained in the scenario of the asymmetric model, positive oil shock is linked to increases of 0.5% in the stock index. In contrast, a negative shock in oil prices is linked to a 0.3% decline in stock indexes. In the long run, any positive and negative change in oil price positively impacts the prices of stock, but the related magnitude is higher in the possibility of a positive oil price shock than a negative one, as per the findings of Wang & Liu (2016), spillover presence within oil-exporting countries and stock markets. Consequently, stocks in oil-exporting countries are influenced by global market news.

Table 3: *Return Spillover Asymmetric Measures – WTI crude oil (Decline) and stock markets of economies with oil export*

	WTI	TASI	ADX	TSX	ISX	MOEX	From Others
WTI	94.18	1.42	2.77	1.00	0.00	0.62	5.82
TASI	0.88	71.44	13.57	10.81	0.06	3.25	28.56
ADX	2.01	14.64	68.63	11.93	0.10	2.69	31.37
TSX	0.98	12.09	11.77	67.94	0.19	7.02	32.06
ISX	0.01	0.48	0.08	0.30	98.54	0.59	1.46
MOEX	0.72	3.65	2.98	8.40	0.01	84.25	15.75
Contribution to others	4.61	32.27	31.17	32.44	0.36	14.17	115.02
Contribution including own	98.79	103.71	99.80	100.38	98.90	98.41	19.2%

Note: *The indices analyzed are WTI (West Texas Intermediate Crude Oil), TASI (Tadawul All Share Index, Saudi Arabia), ADX (Abu Dhabi Securities Exchange), TSX (Toronto Stock Exchange, Canada), ISX (Iraqi Stock Exchange, Iraq), and MOEX (Moscow Exchange, Russia).*

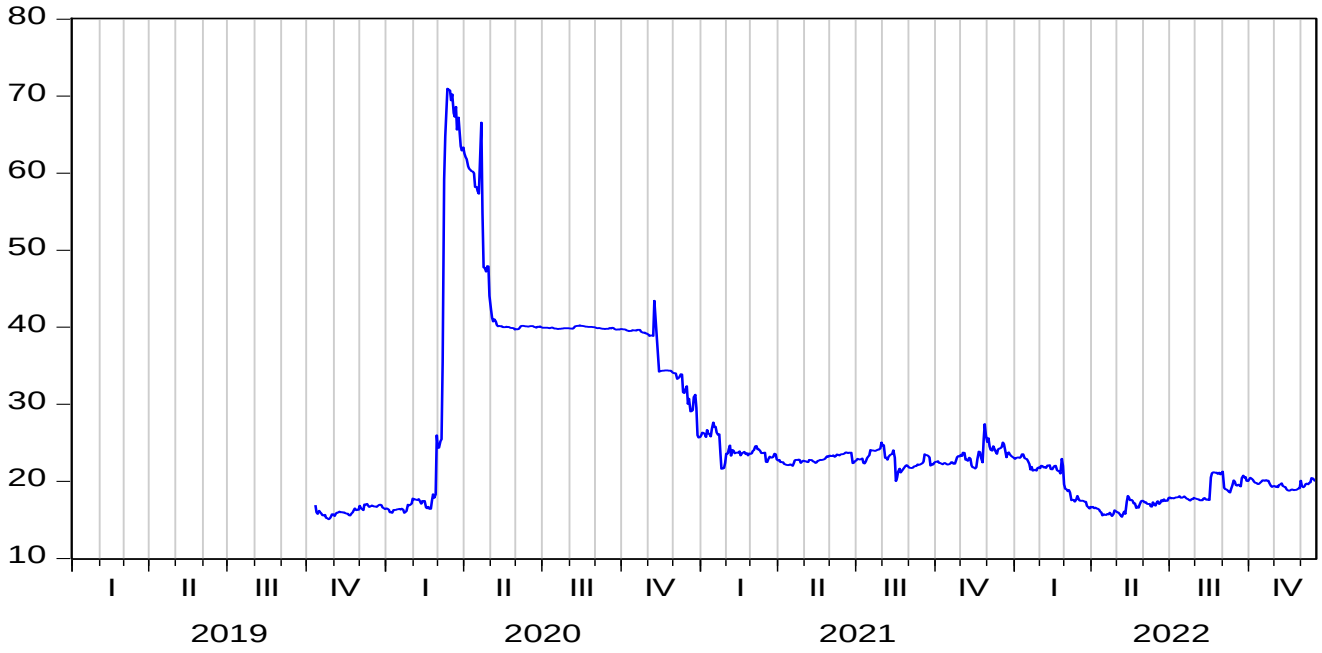

Figure 2: *Average Return Spillover Asymmetric Measures – WTI crude oil (Decline) and stock markets of economies with oil export*

4.3.2 ASYMMETRIC CONNECTEDNESS AMONG WTI CRUDE OIL (DECLINE) AND STOCK MARKET OF ECONOMIES WITH OIL IMPORT

Table 4, the return spillover index, captures spillover effects because of the decline in crude oil prices for returns in equity markets of crude importing economies. The average spillover of crude oil prices decline, and equity market returns of crude oil importing economies are 29.2%. Return spillover due to crude oil price decline is lower than the aggregate spillover measure (Table 2) and spillover due to crude oil price increase (Table 6). These findings confirm the asymmetry in the spillover among the selected economies. Alamgir and Amin (2021) explained a decrease in international oil prices is considered a negative signal for businesses, influencing their future outlook. This resulted in diminished stock returns and contributed to a slowdown in the economic activities of countries reliant on imports.

The spillover index of return (Table 4) indicates that NIKKEI-225 received the maximum spillover (53.89) from others and transferred least spillover (2.63) to others. Meanwhile, the WTI price decline experienced the lowest spillover (2.85) from others and transferred the minimum

spillover (4.83) to other crude oil and importing equity markets. Maximum internal market spillover is indicated by WTI (97.15). The least degree of self-market persistence spillover is indicated by NIKKEI-225 (46.11). The time-varying trend of average return spillover amid crude oil price decline and major Crude oil importing economies' equity markets is depicted in Figure 3. Rolling windows analysis (Figure 3) reveals a sharp increase in the spillover between declining prices in markets of crude oil and equity markets of crude oil importing economies due to the COVID-19 pandemic in the 1st quarter of 2020. A gradual decrease in spillover was observed in the 2nd quarter of 2020 due to the stabilization of the global economy after the COVID-19 pandemic. The spillover among crude oil importing economies is higher than that among crude oil exporting economies (Table 3) in response to declining crude oil prices during the COVID-19 pandemic. This highly responsive nature of stock markets of crude oil importing economies to the fluctuation in crude oil prices.

Table 4: *Return Spillover Asymmetric Measures – WTI crude oil (Decline) and stock markets of economies with oil import.*

	WTI	S&P 500	KOSPI	BSE	NIKKEI 225	SSE	From Others
WTI	97.15	0.79	0.53	0.62	0.82	0.08	2.85
S&P 500	1.27	72.59	7.86	15.68	0.44	2.18	27.41
KOSPI	0.64	15.45	63.76	11.83	0.28	8.03	36.24
BSE	1.37	16.25	12.69	65.37	1.02	3.30	34.63
NIKKEI 225	1.22	24.02	18.82	4.74	46.11	5.08	53.89
SSE	0.33	5.10	10.44	4.12	0.07	79.94	20.06
Contribution to others	4.83	61.62	50.35	36.99	2.63	18.67	175.08
Contribution including own	101.99	134.21	114.11	102.36	48.73	98.61	29.2%

Note: *The indices analyzed are WTI (West Texas Intermediate Crude oil), S&P 500 (Standard & Poor's 500, United States), KOSPI (Korean Composite Stock Price Indexes, south Korea), BSE (Bombay Stock Exchange, India), NIKKEI 225 (Japan), and SSE (Shanghai Stock Exchange, China).*

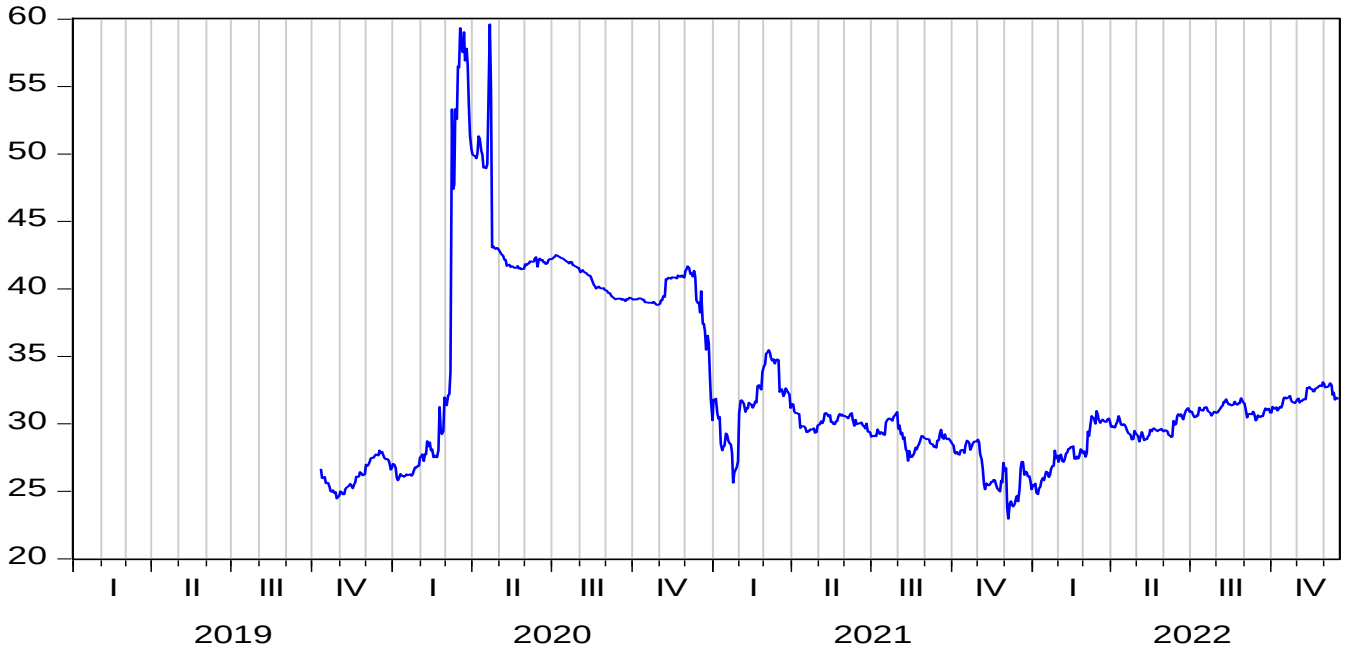

Figure 3: *Average Return Spillover Asymmetric Measures – WTI crude oil (Decline) and stock markets economies with oil-import*

4.3.3 ASYMMETRIC CONNECTEDNESS AMONG WTI CRUDE OIL(INCREASE) AND THE STOCK MARKET OF OIL-EXPORTING ECONOMIES

Table 5, return spillover index, captures the spillover effects due to crude oil price increases for returns of equity markets of crude oil exporting economies. The average spillover among crude oil prices increases, and the equity markets' returns on crude oil exporting economies are 20.8%. Return spillover due to crude oil price increase is lower than the aggregate spillover measure (Table 2) and is higher than spillover due to crude oil price decrease (Table 3). These findings confirm the asymmetry in the spillover among the selected economies. As per Alamgir and Amin (2021), a rise in oil prices can affect both demand and supply channels. Oil prices also impacted the economic activities of countries. In crude oil economies with oil import and export activities, a rise in oil price can increase the cost of production, which impacts production costs and decreases the availability of primary products.

The spillover index of return in Table 5 presents that TSX obtained the maximum spillover (33.50) from others and transferred the highest spillover (33.75) to other markets. Meanwhile,

ISX experienced the least spillover (2.10) from others and transferred the least spillover (0.49) to the equity markets of other crude oil importing economies. The extreme self-market spillover is depicted by ISX (97.90), and the lowest self-market persistence spillover is depicted by TSX (66.50). The time-dependent pattern shown by the average return spillover amid crude oil price increases and significant crude oil importing economies' equity markets is depicted in Figure 4. Rolling windows analysis (Figure 4) reveals a sharp increase in the spillover between increasing prices of the international market of crude oil and equity markets of crude oil exporting economies due to the COVID-19 pandemic of 1st quarter of 2020. A gradual decrease in spillover was observed in the 2nd quarter of 2020 due to the stabilization of the worldwide economy after the COVID-19 pandemic. A second hike in spillover between increasing prices of crude oil and equity markets of oil-exporting economies is visible during the 3rd quarter of 2021 due to an occasional spike in the pandemic of COVID-19 during this span. As per Wang & Wang (2019), due to financial turmoil, the relationship between the stock market and oil prices rises drastically, as evidenced by the return spillover throughout the Covid-19 crisis. This heightened contagion spillover tends to diminish as trading resumes during the global recovery. The reduced uncertainty resulted in lower spillover within oil and stock markets due to the stabilization of the global financial system.

Table 5: *Return Spillover Asymmetric Measures – WTI crude oil (Increase) and stock markets of economies with oil export.*

	WTI	**TASI**	**ADX**	**TSX**	**ISX**	**MOEX**	**From Others**
WTI	89.53	2.32	3.60	2.66	0.10	1.80	10.47
TASI	2.40	70.18	13.81	10.38	0.06	3.17	29.82
ADX	1.99	14.94	68.09	12.07	0.08	2.83	31.91
TSX	2.93	11.62	11.78	66.50	0.24	6.93	33.50
ISX	0.61	0.50	0.09	0.32	97.90	0.59	2.10
MOEX	2.15	3.51	3.06	8.33	0.01	82.95	17.05
Contribution to others	10.08	32.88	32.34	33.75	0.49	15.32	124.86

Contribution including own	99.61	103.06	100.43	100.25	98.39	98.27	20.8%

Note: *The indices analyzed are WTI (West Texas Intermediate Crude oil), TASI (Tadawul All Share Index, Saudi Arabia), ADX (Abu Dhabi Securities Exchange), TSX (Toronto Stock Exchange, Canada), ISX (Iraqi Stock Exchange, Iraq), and MOEX (Moscow Exchange, Russia).*

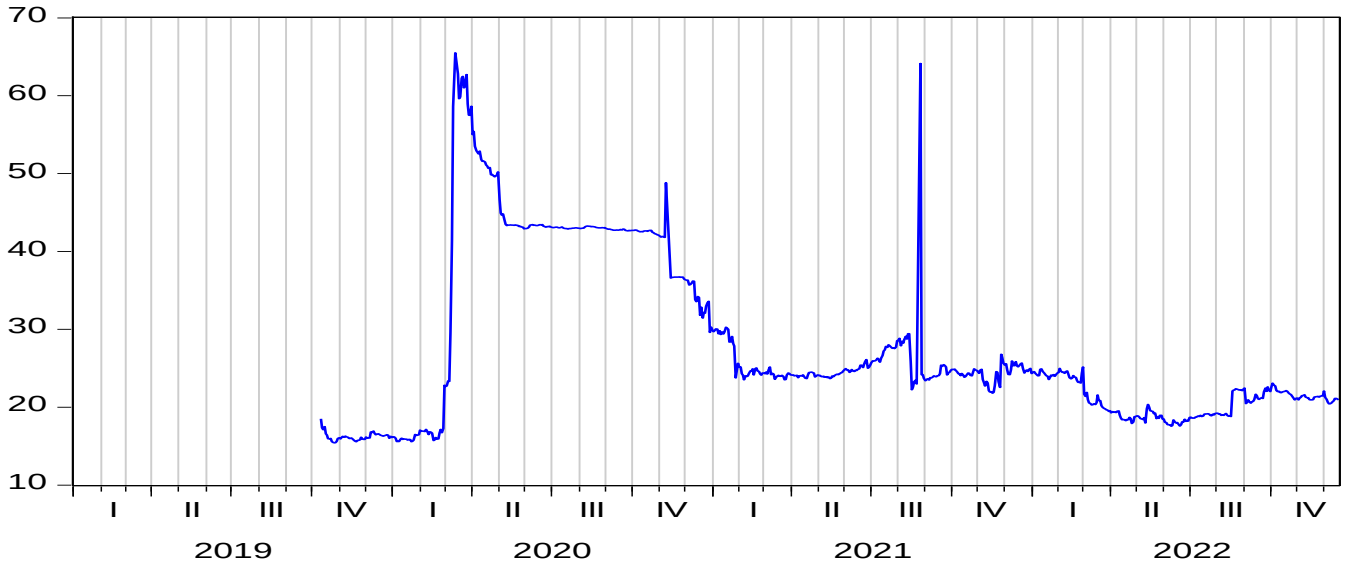

Figure 4: *Average Return Spillover Asymmetric Measures – WTI crude oil (Increase) and stock markets of oil exporting economies*

4.3.4 ASYMMETRIC CONNECTEDNESS AMONG WTI CRUDE OIL (INCREASE) AND STOCK MARKET OF OIL-IMPORTING ECONOMIES

Table 6, return spillover index, captures the spillover effects due to crude oil price increases for returns of stock markets in crude importing economies. The average spillover among crude oil prices increases, and equity markets' returns of crude oil importing economies are 30.1%. Return spillover due to crude oil price increase is lower than the aggregate spillover measure (Table 2) and is more than spillover due to crude oil price decrease (Table 4). This finding emphasizes the asymmetry of spillover within the selected economies. Alamgir and Amin (2021) stated that because of an increase in the prices of oil, the purchasing power of importing countries decreases due to an increase in inflation. Inflation lowers the saving amount in an economy and thus results

in reduced investment in the stock market. This reduction in investment translates into a decline in stock prices.

The index of return spillover in Table 6 indicated that NIKKEI-225 received the highest spillover (54.05) from other markets and transferred the least spillover (2.55) to other markets. Meanwhile, the WTI price increase received the lowest spillover (4.83) from other equity markets of crude oil importing economies. The highest extent of spillover from one's own market is demonstrated by WTI (95.17). The lowest extent of spillover from one's own market is indicated by NIKKEI-225 (45.95). The time-varying patterning indicated by average return spillover amid crude oil price increases and major crude oil importing economies' equity markets is depicted in Figure 5. Rolling windows analysis (Figure 5) reveals a sharp increase in the spillover between increasing prices in crude oil markets and equity markets of crude oil importing economies equity markets due to the COVID-19 pandemic in 1st quarter of 2020. A gradual decrease in spillover was observed in the 2nd quarter of 2020 due to the stabilization of the worldwide economy after the COVID-19 pandemic.

Table 6: *Return Spillover Asymmetric Measures—WTI crude oil (Increase) and stock markets of economies with oil import.*

	WTI	S&P 500	KOSPI	BSE	NIKKEI 225	SSE	From Others
WTI	95.17	1.46	0.55	1.38	0.78	0.66	4.83
S&P 500	1.87	71.47	7.98	15.94	0.44	2.30	28.53
KOSPI	1.50	15.27	62.55	12.35	0.29	8.05	37.45
BSE	1.47	16.22	13.17	64.68	0.98	3.49	35.32
NIKKEI 225	1.42	23.89	18.51	5.14	45.95	5.10	54.05
SSE	0.38	5.09	10.59	4.37	0.05	79.53	20.47
Contribution to others	6.63	61.92	50.79	39.17	2.55	19.59	180.65
Contribution including own	101.80	133.40	113.34	103.85	48.50	99.12	30.1%

Note: *The indices analyzed are WTI (West Texas Intermediate Crude oil), S&P 500 (Standard & Poor's 500, United States), KOSPI (Korean Composite Stock Price Indexes, South Korea), BSE (Bombay Stock Exchange, India), NIKKEI 225 (Japan), and SSE (Shanghai Stock Exchange, China).*

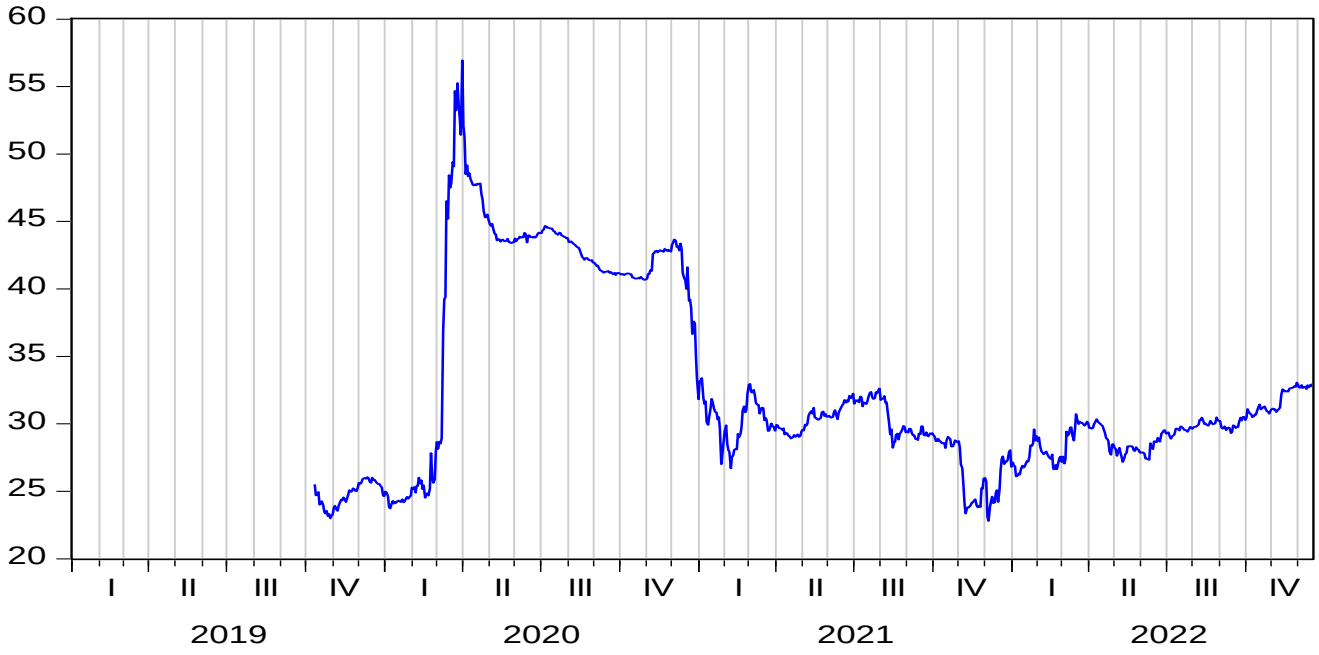

Figure 5: *Average Return Spillover Asymmetric Measures – WTI crude oil (Increase) and stock markets of economies with oil import.*

5 CONCLUSION

The crude oil market is an excellent indicator for providing information related to the dynamics of spillover between stock markets of economies with oil import and export activities during the COVID-19 pandemic. The high price of oil has an adverse effect on economic performance or activities by increasing input price, reducing firms' profit due to spending high money on energy consumption. This uncertain situation increases risk premium, which translates into lower prices of stocks (Jia et al., 2021). Volatility in stock prices significantly impacts global elements such as business cycle, demand and supply, and oil production, directly impacting the earnings of countries with oil exports (Cevik et al., 2021). The comprehensive analysis provides valuable insight into the contagion association between crude oil price fluctuation and returns of the stock market of oil trading economies. The findings are valuable for portfolio managers and international investors. Knowledge of contagion and spillover among crude oil and stock market returns of oil trading economies will help better design diversification and risk mitigation strategies for asset allocation across available investment options.

This study highlights significant spillover effects of stock returns associated with changes in crude oil prices. The findings indicate that NIKKEI-225 stands out as the maximum recipient of return spillover based on other markets, while TSX emerges as the leading transmitter of return spillover. The research observes distinct patterns during decreasing and increasing crude oil prices. During the decline in prices of crude oil, exporting countries experienced a decline in return spillover. ISX received the lowest spillover and transmitted the least to WTI and other exporting countries. Importing countries also witnessed a decrease in return spillover, with the NIKKEI-225 receiving the highest spillover and transmitting the lowest to others. The findings indicate that when crude oil prices increase, return spillover among oil exporting countries increases, and TSX emerges as the highest recipient and transmitter of spillover. The return spillover index for importing economies during oil price increases indicates that NIKKEI-225 receives the highest spillover and transmits the lowest to others.

The stock markets of oil-importing economies are more vulnerable to crude oil price fluctuation than oil-exporting economies. The crude oil importing economies depicted a higher magnitude of spillover during crude oil price increases and decreases than crude oil exporting economies. This phenomenon is explained by the fact that crude oil exporting economies have a well-diversified portfolio of investment, and their earning is not solely dependent on crude oil exports (Haini et al., 2023). This study sheds light on the patterns of spillover effects within crude oil prices and stock markets, providing valuable insights into how these relationships vary across different countries, especially in terms of transmission and reception of return spillover throughout the COVID-19 pandemic. These findings contribute to a better understanding of interconnectedness within crude oil markets and equity markets in crude oil exporting and importing economies.

REFERENCES

Xu, W., Ma, F., Chen, W., & Zhang, B. (2019). Asymmetric volatility spillovers between oil and stock markets: Evidence from China and the United States. *Energy Economics*, *80*, 310-320. https://doi.org/10.1016/j.eneco.2019.01.014

Wang, Y., & Liu, L. (2016). Crude oil and world stock markets: volatility spillovers, dynamic correlations, and hedging. *Empirical Economics*, *50*, 1481–1509. https://doi.org/10.1007/s00181-015-0983-2

Wang, X., Wu, X., & Zhou, Y. (2022). Conditional dynamic dependence and risk spillover between crude oil prices and foreign exchange rates: New evidence from a dynamic factor Copula Model. *Energies*, *15*(14), 5220. https://doi.org/10.3390/en15145220

Wang, X., & Wang, Y. (2019). Volatility spillovers between crude oil and Chinese sectoral equity markets: Evidence from a frequency dynamics perspective. *Energy Economics*, *80*, 995-1009. https://doi.org/10.1016/j.eneco.2019.02.019

Van de Graaf, T., & Lesage, D. (2009). The International Energy Agency after 35 years: Reform needs and institutional adaptability. *The Review of International Organizations*, *4*, 293-317. https://doi.org/10.1007/s11558-009-9063-8

Tsiaras, K., Papanikolaou, A., Poulios, K., & Simos, T. (2022). Volatility spillover effects among crude oil future market, SAR/EUR and Saudi Arabia CDS Market: The evidence of DCC-FIGARCH model.

Talha, M., Saleem, S., Shahbaz, K., Sarwar, U., & Sattar, S. (2025). Investigating financial knowledge driven entrepreneurial intentions: the intermediation of financial knowledge and contingency of risk-taking propensity. *Center for Management Science Research*, *3*(3), 450–469. https://cmsr.info/index.php/Journal/article/view/152

Sun, C., Peng, Y., & Zhan, Y. (2023). How does China's crude oil futures affect the crude oil prices at home and abroad? Evidence from the cross-market exchange rate spillovers. *International Review of Economics & Finance*, *88*, 204-222. https://doi.org/10.1016/j.iref.2023.06.013

Shaukat, M. Z., Yousaf, S. U., Sarwar, U., & Sattar, S. (2024). Thriving in Turmoil: Unraveling the Interplay of Resources, Resilience, and Performance among SMEs in Times of Economic Vulnerability. *Bulletin of Business and Economics (BBE)*, *13*(2), 164–173. https://doi.org/10.61506/01.00312

Sharif, A., Aloui, C., & Yarovaya, L. (2020). COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. *International review of financial analysis*, *70*, 101496. https://doi.org/10.1016/j.irfa.2020.101496

Sarwar, U., Bint-e-Naeem, N., Fahmeed, L., & Atif, M. (2024). Role of Perceived Security and Financial Attitude in Shaping Behavioral Intention under the Moderation of Financial Literacy. *Journal of Asian Development Studies*, *13*(3), 1380–1395. https://doi.org/10.62345/jads.2024.13.3.112

Sarwar, U., Baig, W., Rahi, S., & Sattar, S. (2025). Fostering Green Behavior in the Workplace: The Role of Ethical Climate, Motivation States, and Environmental Knowledge. *Sustainability*, *17*(9), 4083. https://doi.org/10.3390/su17094083

Sarwar, U., Ahmad, M. B., Mubeen, M., Fatima, I., & Rehan, M. (2023). A Bibliometric Analysis of Sustainability Disclosure in High Polluting Industries. *Bulletin of Business and Economics (BBE)*, *12*(3), 28–43. https://doi.org/10.61506/

Ren, X., Li, Y., Sun, X., Bu, R., & Jawadi, F. (2023). Modeling extreme risk spillovers between crude oil and Chinese energy futures markets. *Energy Economics*, *126*, 107007. https://doi.org/10.1016/j.eneco.2023.107007

Pesaran, H. H., & Shin, Y. (1998). Generalized impulse response analysis in linear multivariate models. *Economics letters*, *58*(1), 17-29. https://doi.org/10.1016/S0165-1765(97)00214-0

Park, J., & Ratti, R. A. (2008). Oil price shocks and stock markets in the US and 13 European countries. *Energy economics*, *30*(5), 2587–2608. https://doi.org/10.1016/j.eneco.2008.04.003

Osah, T. T., & Mollick, A. V. (2023). Stock and oil price returns in international markets: Identifying short and long-run effects. *Journal of Economics and Finance*, *47*(1), 116–141. https://doi.org/10.1007/s12197-022-09602-x

Nong, H., Guan, Y., & Jiang, Y. (2022). Identifying the volatility spillover risks between crude oil prices and China's clean energy market. *Electronic Research Archive*, *30*(12), 4593-4618. DOI: 10.3934/era.2022233

Nan, Y., Sun, R., Zhen, Z., & Fangjing, C. (2022). Measurement of international crude oil price cyclical fluctuations and correlation with the world economic cyclical changes. *Energy*, *260*, 124946. https://doi.org/10.1016/j.energy.2022.124946

Mamipour, S., & Feli, A. (2017). The impact of oil price volatility on Tehran Stock Market at sector-level: a variance decomposition approach. *Monetary & Financial Economics*, *24*(13), 205-236. https://doi.org/10.22067/pm.v24i14.58846

Malik, F., & Hammoudeh, S. (2007). Shock and volatility transmission in the oil, US and Gulf equity markets. *International Review of Economics & Finance*, *16*(3), 357–368. https://doi.org/10.1016/j.iref.2005.05.005

Ma, C., Rogers, J. H., & Zhou, S. (2020). Global economic and financial effects of 21st century pandemics and epidemics. *Covid Economics*, *5*, 56–78.

Koop, G., Pesaran, M. H., & Potter, S. M. (1996). Impulse response analysis in nonlinear multivariate models. *Journal of Econometrics*, *74*(1), 119–147. https://doi.org/10.1016/0304-4076(95)01753-4

Khalfaoui, R., Sarwar, S., & Tiwari, A. K. (2019). Analyzing volatility spillover between the oil market and the stock market in oil-importing and oil-exporting countries: Implications on portfolio management. *Resources Policy*, *62*, 22–32. https://doi.org/10.1016/j.resourpol.2019.03.004

Jiang, Z., & Yoon, S. M. (2020). Dynamic co-movement between oil and stock markets in oil-importing and oil-exporting countries: Two types of wavelet analysis. *Energy Economics*, *90*, 104835. https://doi.org/10.1016/j.eneco.2020.104835

Jiang, W., Gao, R., & Lu, C. (2022). The Analysis of Causality and Risk Spillover between Crude Oil and China's Agricultural Futures. *International Journal of Environmental Research and Public Health*, *19*(17), 10593. https://doi.org/10.3390/ijerph191710593

Jia, S., Dong, H., & Yang, H. (2021). Asymmetric Risk Spillover of the International Crude Oil Market in the Perspective of Crude Oil Dual Attributes. *Frontiers in Environmental Science*, *9*, 720278. https://doi.org/10.3389/fenvs.2021.720278

Ji, Q., Liu, B. Y., Zhao, W. L., & Fan, Y. (2020). Modeling dynamic dependence and risk spillover between all oil price shocks and stock market returns in the BRICS. *International Review of Financial Analysis*, *68*, 101238. https://doi.org/10.1016/j.irfa.2018.08.002

Huang, S., An, H., Gao, X., & Huang, X. (2015). Identifying the multiscale impacts of crude oil price shocks on the stock market in China at the sector level. *Physica A: Statistical Mechanics and its Applications*, *434*, 13–24. https://doi.org/10.1016/j.physa.2015.03.059

Harris, M., Ahmad, M. A., Hussain, S., Sarwar, U., Zafar, H., & Khan, M. B. (2025). Stimulating Online Purchase Intentions Through Digitalization: Intermediation of Perceptions and Electronic Word of Mouth in Fashion E-commerce. Journal of Asian Development Studies, 14(1), 1520–1538. https://doi.org/10.62345/jads.2025.14.1.120

Haini, H., Loon, P. W., & Li, P. L. (2023). Can export diversification promote export upgrading? Evidence from an oil-dependent economy. *Resources Policy*, *80*, 103292. https://doi.org/10.1016/j.resourpol.2022.103292

Gulzar, S., Sarwar, U., Sattar, S., Usman, M., & Quibtia, M. (2024). Tax Audit, Tax Penalty, Religiosity and Tax Compliance.*Journal of Asian Development Studies*, *13*(3), 776–79. https://doi.org/10.62345/jads.2024.13.3.64

Filis, G., Degiannakis, S., & Floros, C. (2011). Dynamic correlation between stock market and oil prices: The case of oil-importing and oil-exporting countries. *International review of financial analysis*, *20*(3), 152–164. https://doi.org/10.1016/j.irfa.2011.02.014

Engle III, R. F., Ito, T., & Lin, W. L. (1988). Meteor showers or heat waves? Heteroskedastic intra-daily volatility in the foreign exchange market.DOI 10.3386/w2609

Diebold, F. X., & Yilmaz, K. (2012). Better to give than to receive: Predictive directional measurement of volatility spillovers. *International Journal of Forecasting*, *28*(1), 57-66. https://doi.org/10.1016/j.ijforecast.2011.02.006

Diebold, F. X., & Yilmaz, K. (2009). Measuring financial asset return and volatility spillovers, with application to global equity markets. *The Economic Journal*, *119*(534), 158-171. https://doi.org/10.1111/j.1468-0297.2008.02208.x

Cunado, J., & de Gracia, F. P. (2014). Oil price shocks and stock market returns: Evidence for some European countries. *Energy Economics*, *42*, 365-377. https://doi.org/10.1016/j.eneco.2013.10.017

Chang, C. L., McAleer, M., & Tansuchat, R. (2013). Conditional correlations and volatility spillovers between crude oil and stock index returns. *The North American Journal of Economics and Finance*, *25*, 116–138. https://doi.org/10.1016/j.najef.2012.06.002

Cevik, E. I., Dibooglu, S., Awad Abdallah, A., & Al-Eisa, E. A. (2021). Oil prices, stock market returns, and volatility spillovers: evidence from Saudi Arabia. *International Economics and Economic Policy*, *18*, 157–175. https://doi.org/10.1007/s10368-020-00484-0

Basher, S. A., Haug, A. A., & Sadorsky, P. (2012). Oil prices, exchange rates and emerging stock markets. *Energy economics*, *34*(1), 227–240. https://doi.org/10.1016/j.eneco.2011.10.005

Baruník, J., Kočenda, E., & Vácha, L. (2016). Asymmetric connectedness on the US stock market: Bad and good volatility spillovers. *Journal of Financial Markets*, *27*, 55-78. https://doi.org/10.1016/j.finmar.2015.09.003

Awartani, B., & Maghyereh, A. I. (2013). Dynamic spillovers between oil and stock markets in the Gulf Cooperation Council Countries. *Energy Economics*, *36*, 28–42. https://doi.org/10.1016/j.eneco.2012.11.024

Ashfaq, S., Tang, Y., & Maqbool, R. (2019). Volatility spillover impact of world oil prices on leading Asian energy exporting and importing economies' stock returns. *Energy*, *188*, 116002. https://doi.org/10.1016/j.energy.2019.116002

Arouri, M. E. H., Lahiani, A., & Nguyen, D. K. (2011). Return and volatility transmission between world oil prices and stock markets of the GCC countries. *Economic Modelling*, *28*(4), 1815-1825. https://doi.org/10.1016/j.econmod.2011.03.012

Apergis, N., & Miller, S. M. (2009). Do structural oil market shocks affect stock prices? *Energy economics*, *31*(4), 569–575. https://doi.org/10.1016/j.eneco.2009.03.001

Am, M. A., & Shanmugasundaram, G. (2017). Nexus between crude oil price, exchange rate and stock market: Evidence from oil exporting and importing economies. *International Journal of Humanities and Management Sciences*, *5*(1).

Ali, M. (2022). Nonlinear Spillover and Dynamic Connectedness Between International Crude Oil and Dow Jones Islamic Market. *Economics and Business Quarterly Reviews*, *5*(3).

Alamgir, F., & Amin, S. B. (2021). The nexus between oil price and stock market: Evidence from South Asia. *Energy Reports*, *7*, 693-703. https://doi.org/10.1016/j.egyr.2021.01.027

Aimer, N. M. M. (2016). Conditional correlations and volatility spillovers between crude oil and stock index returns of Middle Eastern countries. *Open Access Library Journal*, *3*(12), 1. http://dx.doi.org/10.4236/oalib.1103218