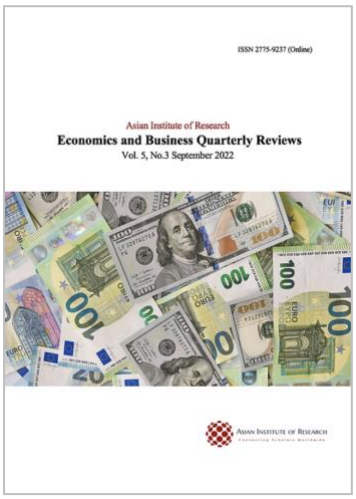

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Nonlinear Spillover and Dynamic Connectedness Between International Crude Oil and Dow Jones Islamic Market

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Abstract
This study examines crude oil prices throughout the world, as well as significant stock returns of European oil importers and exporters (the UK, Germany, France, Italy, Switzerland, and the Netherlands) (Norway and Russia). Indexes of sustainability stocks have a greater correlation with countries that import oil than with those that export oil. There was a stronger correlation between oil prices and stock prices both during and after the global financial meltdown in 2008. Study findings reveal a strong correlation between worldwide crude oil prices and major indices of countries that purchase or export oil. Our results have the potential to assist socially aware investors in hedging and diversifying their portfolios.

Keywords: Nonlinear Spillover, Crude Oil, Islamic Market

1. Introduction

Oil shocks have a significant impact on economic factors because of the reliance on energy in emerging and developed economies alike. In terms of commodity markets, oil is the most important. Oil price shocks may have a major impact on stock returns, and price swings directly affect the inputs that determine manufacturing prices, so this connection is highly fascinating. Manufacturing costs significantly impact profitability and cash flow, which in turn affects dividends. Since the present value of future cash flows is directly correlated with stock prices, oil prices have a direct influence on stock prices.

Throughout the 2008 global financial crisis, the price of a barrel of oil rose from $20 in October 2001 to $145 in July 2008, during the study period sample. The price of a barrel of oil plunged below $30 in 2016 before returning to $70 by the beginning of 2020. Since oil prices have an impact on stock returns, it's essential to know how they influence them. Policies are significantly reliant on this link, which is also used by a broad variety of decision-makers throughout the economy, including both domestic and international ones.

To effectively manage portfolio risk, it's necessary to address oil market volatility spillover onto other asset classes.

Few studies have been done on the volatility spillover between SRI and other key financial assets, such as oil and gold. SSIs provide a visual representation of SRI. SRI is heavily influenced by environmental, social, and governance (ESG) considerations, which have an impact on long-term returns, portfolio selection, and beneficial social outcomes. Socially responsible investing (SRI) incorporates both financial and non-financial factors.

The Dow Jones Sustainability Indices encompass both financial and non-financial ESG factors in their overall and sector-specific benchmarks. Those looking to meet both financial and nonfinancial goals may use the DJSI-W, according to Schaeffer et al. There were $22.89 trillion in sustainable assets in Europe, the United States, and Canada in 2016 and $30.683 trillion in 2018 according to Arai et al. (a growth of 34 percent in two years). The total assets of the Eurozone ($14.08 trillion), the United States ($12.00 trillion, 39.1 percent), Japan ($2.18 trillion), Canada ($1.70 trillion), and Australia and New Zealand ($0.73 trillion) in 2018 are summarised in the table below.

We used Dynamic Conditional Correlation (DCC)-Multivariate Generalized Autoregressive Conditional Heteroscedasticity (MGARCH) as a statistical model for the research period (28 September 2001 to 10 January 2020) to examine how oil prices, the DJSI-W, the DJSI-E, and the key stock indices in European oil-importing/exporting nations dynamically interact and spillover volatility. It has been shown that spillover testing shows significant volatility transmission between SSIs, global oil prices, and important indices from both oil-importing and oil-exporting countries.

2. Literature Review

Oil prices and the energy business have been the subject of a great deal of study, and the results have been rather interesting. Some researchers have looked at the connection between oil prices and stock markets in oil-exporting countries. Saudi Arabia, the United Arab Emirates, and Russia were a few of the countries that Trabelsi examined. Oil prices and stock returns have an inverse positive link, which Trabelsi identified at the aggregate and sector levels. A similar finding was made in the countries of Canada, Norway, Russia, Kuwait, Saudi Arabia, and the United Arab Emirates. The only exception was Mexico (HSBC, 2020).

Oil price volatility, regional political issues, as well as new developments in MENA stock markets, have us interested in the MENA stock markets. This paper examines the decoupling of Islamic markets in the Middle East and North Africa from conventional financial markets by assuming that Islamic stocks and ukk are an alternative set of assets because of their isolation from global markets and their distinctive features. So we look at the impact of stock market volatility on a select set of Middle Eastern and North African (MENA) countries, including Bahrain, Egypt, Jordan, Kuwait, Morocco, Oman, Qatar, and the United Arab Emirates, on the Islamic stock ukk markets and the UK market. The earliest and most comprehensive Shariah-compliant indexes are made up of shares of companies that have been verified by Dow Jones (HSBC, 2020).

Many scholars have studied the macroeconomic impact of oil price shocks. High oil prices after World War II led to an economic slowdown. Mork found a correlation between oil price volatility and the GDP of the United States. Exports and government policy decisions in developing nations are both affected by an increase in the price of oil. Oil price changes have a greater influence on an economy with stable prices than on an economy with variable prices. Volatility in the price of short-term oil affects the growth rate of the European industrial production indices (IPI). According to a different study, oil prices have a greater influence on Asian economies when paid in the domestic currency. Core inflation has been impacted by oil price shocks since the 1980s (Hussin, 2013).

Real oil prices are positively connected with macroeconomic shocks (e.g., liquidity and inventory). Researchers showed that developing nations are more exposed to the volatility of the oil price than industrialized ones. The relationship between macro-variables and oil prices seems to have decreased since the 1970s, when macro-activities seemed to have a stronger response to oil price shocks. The volatility of West Texas Intermediate (WTI) prices, induces a decrease in investment spending (Jawadi, 2014).

Stock trading is an important part of the overall economy. Understanding how oil price shocks cause market volatility is critical. Oil price volatility has been studied extensively in the past, motivating more recent scholars to look into the topic. Stock returns in various nations or areas are impacted by oil prices in different ways. About the US stock market, oil price shocks and volatility had a significant influence on returns. stock returns may be lowered by positive oil price shocks, which also have an uneven influence on oil price volatility's effect on stock returns. Most nations' stock returns decline dramatically as oil prices change, but the Norwegian stock market has an unusually favorable link with this price movement. Asymmetric responses to oil price changes were not detected in the stock market returns of Europe's oil-importing nations, according to the researchers. Norway's oil stockpile climbed by 2.5 percent for every 10 percent rise in oil prices (Jawadi, 2014).

The literature has been enriched by several other notable authors. During the global financial crisis, this influence altered both oil-importing and oil-exporting nations. The beneficial influence of oil prices tends to reduce stock returns. Oil prices and economic policy uncertainty affect stock returns. Using a wavelet multi-resolution analysis, oil price changes during the financial crisis had little effect on US stock prices (Kenourgios, 2016).

We rely on these academics' work in the current study since our method pertains to literature-wide notions. stock prices react differentially to distinct oil-source shocks. oil exporters and importers based on oil breakdown. Division between the price of crude oil by driving variables and studied its impacts on agricultural product markets. Following the initial economic meltdown, agricultural product prices behaved differently to various causes of crude oil price shocks. The link between oil price changes and big NIEs. Different oil price fluctuations affected NIE stock prices substantially. NIE share prices and crude price shocks are linked (Kenourgios, 2016).

The impact of structural oil prices on Asian oil-consuming economies and found that macro-activities react differently to oil prices. The influence of crude prices on BRICS macroeconomic activity using a SVAR model to deconstruct driving variables. Only Russia is immune to aggregate demand shocks. The association between the price of crude oil and the US stock market in several sectors by deconstructing price fluctuations into demand, supply, and demand shocks. Demand surprise was the most meaningful driver of stock performance in their investigation (Liu, 2017).

Oil demand shock affects G7 stock market volatility. An SVAR model to deconstruct oil price shocks influencing China's petroleum industry chain. This chain's listed firms correlated positively with oil production shock and cautious demand shock. Oil supply and demand shocks affected China's stock returns over time (Liu, 2017).

Second, the price of oil and stock returns overflow. Recognizing the spillover effect allows for a good study of the time-varying link between the oil crisis and stock market returns. Oil spillover affects various industries based on implied volatility. Analysis of spillover effects across commodity categories and found the energy sector had the biggest influence. Spillover effects in petroleum and exporting countries. Required power shock is the net oil shock transmitter. Oil has minimal influence on stock returns, but worldwide financial markets overflow into crude oil prices. The ripple impacts of oil volatility and oil and gas firm stocks impact crude oil price changes. WTI and its refined petroleum products dominate US and UK gas futures correlations. Husain et al. (2019) found that the stock index volatility affects commodities, especially oil (Majdoub, 2017).

Many experts have studied financial risk estimates after 2008's subprime mortgage crisis. Most research on oil prices and stock markets uses VAR. Many have studied oil price volatility under severe stock market situations. Others have found that exceptional stock market performance enhances oil's influence on stock prices using the QR approach. QR-based QQ frame shows impacts in various quantiles of both variables. At bilateral quantiles, oil price shocks affected US stock returns. energy use boosts economic development. QQ approach to study oil market unpredictability and stock markets; negative impacts were detected in most sample nations, notably during the Islamic stock market downturn (Majdoub, 2017).

we utilized WTI global crude oil to estimate swings. China's oil futures market was just founded in March 2018 and its oil trading system is not sophisticated. World crude prices have a bigger influence on G7 stock results. We used SVAR to deconstruct crude oil prices. We used the connectedness spillover approach to discover the time-varying link between deconstructed oil price shock returns. Finally, we used QQ regression to get distinct, intuitive oil shock findings (Mensi, 2017).

No one knows how oil shocks affect stock markets. Most researchers concentrated on unilateral shock or oil's influence on stocks. Unlike past empirical research, we attempt to systematically investigate oil price-stock returns to discover danger when the share market or oil shock is dominating. We also study deconstructed oil prices and market returns. We examine the co-movement of oil price quantiles and G7 stock values, focusing on the asymmetry of tail dependency (Mensi, 2017).

Additional studies focus on the link between oil prices in nations that import and export oil. The dynamic relationship between oil-exporting countries like Canada, Mexico, and Brazil and oil-importing countries like the United States and the Netherlands has been studied by several researchers in the past. For both countries, the relationship between oil imports and exports was shown to be time-varying. Additionally, Guesmi and Fattoum used it for a sample of five oil-importing states and four oil-exporting nations (the United Arab Emirates) in their study (UAE, Kuwait, Saudi Arabia, and Venezuela). Like Filis et al., Guesmi and Fattoum observed no difference in the time-varying link between oil-importing and oil-exporting countries. Stock prices and oil prices had a linear relationship, but there was also an asymmetry link between oil prices in sending and receiving countries (Rizvi, 2015).

3. Data and Methodology

In our study, we looked at the dynamic interactions between SSIs and the key indices of oil-importing and oil-exporting countries to examine how their volatility spills over. Between September 28, 2001, and January 10, 2020, 4770 observations were accumulated for each of these indicators. In 2001, DJSI-E began reporting, and hence this sampling period began in the same year. Plans for the OSLO International Bank It was included in the European stock market indices since Norway and Russia are oil-exporting countries. Indexes from France's CAC 40 (the French FTSE 100 index), Italy's FTSE MIB, Switzerland's SMI, and Armenia's AEX comprise this list of countries that import (Netherlands). A proxy for crude oil prices is Brent crude oil, which is used as a benchmark and accounts for 70% of global trade. DJSI-E and DJSI-W were used for the European and World SRI stock market indexes, respectively, to measure environmental and social performance.

We employ Diebold and Yilmaz's (2012, 2014) spillover index methods with Antonakakis et al. (2014, 's 2015) dynamic covariance modification to analyze the volatility spillovers between Islamic markets and global factors (2020). For the first time, a new method is being used to investigate the dynamic links between Islamic marketplaces in the Middle East and North Africa and the global economy. This is significant. Diebold and Yilmaz (2012, 2014) developed a new rolling-window model, the modified TVP-VAR model, that gives more accurate parameters, is more resilient to outliers, and does not need to choose the rolling-window size, and so has the benefit of not losing any data.

Type	Markets	Notations
Country Islamic Stock Markets	DJ Islamic United Arab Emirates	ARE
	DJ Islamic Bahrain	BHR
	DJ Islamic Egypt	EGY
	DJ Islamic Jordan	JOR
	DJ Islamic Kuwait	KWT
	DJ Islamic Morocco	MAR
	DJ Islamic Oman	OMN
	DJ Islamic Qatar	QAT
	Saudi Arabia Tadawul All Share	SAU
Ṣukūk Market	DJ *Ṣukūk* Index	SUK
Regional Islamic Stock Market	MSCI Islamic Europe Middle East and Africa	MEN
Global Islamic Stock Market	DJ Islamic World	WRA
Global Conventional Stock Market	S&P 500 Index	SPX
Global Commodity Markets	US Crude Oil - WTI Spot	WTI
	Gold Spot Price	XAU
Global Risk Factor	The US Government Bond - 10-year Yield	USB

Figure 1: Descriptive Statistics (Notations)

Panel A: Descriptive Statistics											
NAME	**BRENT**	**DJSI-W**	**DJSI-E**	**NOR**	**RUS**	**GER**	**UK**	**FRA**	**ITL**	**SWIS**	**NETH**
Mean	0.020	0.012	0.008	0.037	0.042	0.024	0.003	0.008	−0.004	0.018	0.006
Maximum	17.895	8.246	9.294	10.802	19.987	10.797	9.647	10.595	10.877	9.426	10.028
Minimum	−16.349	−6.749	−8.524	−11.336	−18.934	−7.433	−9.480	−9.472	−13.331	−6.241	−9.590
Std Dev	2.114	1.012	1.204	1.528	1.946	1.414	1.241	1.382	1.477	1.039	1.364
Skewness	0.050	−0.203	−0.135	−0.545	−0.339	−0.002	−0.213	−0.007	−0.207	0.017	−0.071
Kurtosis	7.411	8.986	9.451	9.161	13.677	8.215	10.704	8.960	8.518	8.656	10.355
J.B.	3869a	7155a	8284a	7780a	22,749a	5406a	11,832a	7059a	6085a	6359a	10,755a
ARCH (5)	72.2a	264.4a	2403a	275a	126.1a	184.1a	263.1a	187.4a	118a	258.5a	311.4a
$Q^2(20)$	1547a	5873a	5133a	7200a	3344a	4767a	5151a	4228a	2523a	5420a	6945a
Q(20) Ljung	13.7	34.9	19.4	16.2	25.1	11.2	28.6	22.1	22.2	12.9	15.0
ADF	−28.5a	−3.0.3a	−31.1a	−29.8a	−28.8a	−30.1a	−32.1a	−31.6a	−29.7a	−30.8a	−30.6a
Panel B: Unconditional Correlations between Indices											
BRENT	1.000	0.263	0.247	0.414	0.310	0.197	0.291	0.230	0.224	0.186	0.238
DJSI-W	0.263	1.000	0.921	0.663	0.510	0.855	0.883	0.877	0.778	0.800	0.873
DJSI-E	0.247	0.921	1.000	0.710	0.486	0.912	0.934	0.959	0.871	0.854	0.939

Figure 2: Relationship between International markets and Dow Jones Islamic Market

From the above analysis, Italy was exposed to the highest risks among the international markets. Italy was followed by Germany, Switzerland, and Switzerland had the lowest risk.

	Mean	Skew.	Kurt.	JB	LM (20)	ADF
ARE	0.008	3.7 [a]	22.6 [a]	59203 [a]	462.6 [a]	-9.1 [a]
BHR	0.008	3.1 [a]	14.7 [a]	26519 [a]	113.2 [a]	-14.8 [a]
EGY	0.008	3.3 [a]	18.2 [a]	39263 [a]	87.7 [a]	-17.0 [a]
JOR	0.005	2.4 [a]	7.9 [a]	8953 [a]	72.4 [a]	-13.3 [a]
KWT	0.006	3.2 [a]	16.9 [a]	34284 [a]	126.7 [a]	-12.1 [a]
MAR	0.006	2.3 [a]	9.2 [a]	11039 [a]	34.6 [a]	-12.0 [a]
OMN	0.004	3.7 [a]	23.1 [a]	61921 [a]	201.5 [a]	-14.7 [a]
QAT	0.006	3.4 [a]	21.3 [a]	52354 [a]	64.4 [a]	-30.3 [a]
SAU	0.006	4.1 [a]	31.4 [a]	110243 [a]	59.8 [a]	-14.0 [a]
SUK	0.001	16.6 [a]	414.3 [a]	18113935 [a]	247.7 [a]	-13.3 [a]
MEN	0.006	2.0 [a]	6.3 [a]	5756 [a]	102.3 [a]	-10.0 [a]
WRA	0.006	2.2 [a]	7.7 [a]	8284 [a]	283.9 [a]	-12.3 [a]
SPX	0.006	2.3 [a]	8.5 [a]	9881 [a]	341.4 [a]	-12.5 [a]
WTI	0.015	2.3 [a]	8.6 [a]	9901 [a]	157.6 [a]	-12.5 [a]
XAU	0.007	2.8 [a]	17.1 [a]	34036 [a]	31.2 [a]	-11.4 [a]
USB	0.016	1.7 [a]	4.3 [a]	3168 [a]	139.7 [a]	-13.3 [a]

Figure 3: Descriptive Statistics (Analysis)

S&P Volatility can be hedged significantly, although the effectiveness ranges from 1.68 percent to 75.12%, implying a risk reduction of 1.68 percent to 75.12%. US investors may reduce their overall portfolio risk by 75.12 percent by hedging a $1 long SPX volatility position with 96.53 cents on the Global Islamic market, for example. Volatility in the global Islamic stock market delivers excellent hedging effectiveness values of 18.86% for regional and UAE markets, as well as 4.43 percent for the UK market. To attain the optimum S&P 500 volatility hedge, portfolios of the UK, Oman, and Morocco's stock markets, Kuwait, and Jordan's should be used, according to research.

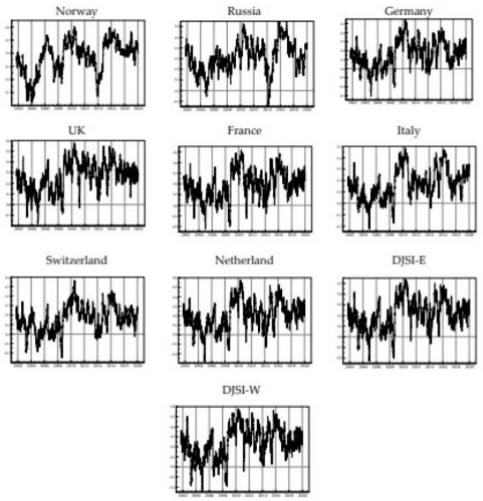

Figure 4: Conditional correlation between International markets and Dow Jones Index

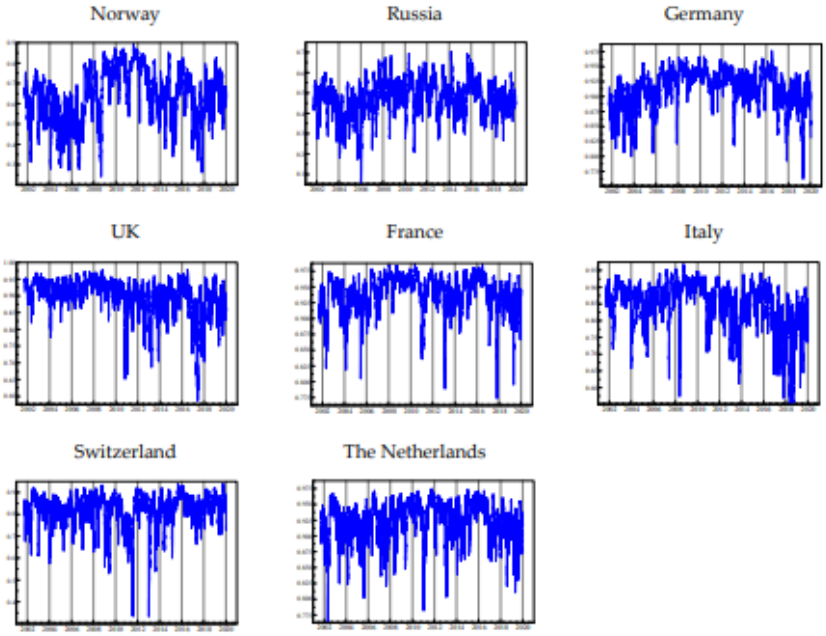

Figure 5: Dynaic Conditional Correlation between Dow Jones Stock Index of Eastern Countries and European countries Stock Index

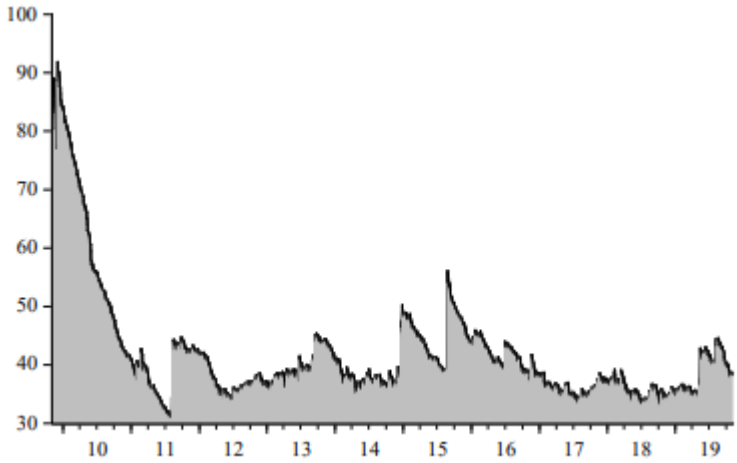

Figure 6: Dynamic Connectedness

4. Results

We study dynamic connectedness to see whether there are any spillovers of volatility from Islamic markets (such as the stock and ukase markets) to other regional or global markets. As shown in Table 3, the TVP-VAR directional connectivity is shown in terms of pairwise, total, and net connection (1). Between WRA and SPX, the pairwise connection is at its highest point (32.2 percent). Because of this, SPX to WRA is the second most related pairwise relationship (30.4 percent). The interconnectedness of the conventional and Islamic stock markets throughout the world means that market volatility is likely to spread from one to the other. There is a spillover of volatility from the global Islamic stock market to the regional Islamic stock market through WRA to MEN (11.5 percent). Another Islamic stock market that we find considerable volatility spillover is ARE; QAT; and SAU. For example, QAT has 8.4 percent of the SAU-ARE linkage, and 8.6 percent of the SAU linkage; ARE has 8.6 percent of the ARE linkage, and QAT has 8.1 percent of the SAU-ARE linkage. Islamic stock markets appear to be well-integrated. ' Islamic markets' pairwise connectivity results are very low; their connection with other markets such as SUK and MEN is also very low; SPX and WRA are also notably separated from the Islamic markets. The results of our research suggest that investors and portfolio managers may benefit from diversifying their assets by making investments in Islamic stock markets. There is a "TO" row in which all the 16 markets' directional ties to each other are summarised. When it comes to the "Too," the overall directional connection ranges from 12.2 percent to 78% while the own-effects range from 42.4 percent to 82.1 percent. From 17.9% to 576.6%, each market's total directional connectedness can be seen in the last column of the table. Volatility in the system is primarily transmitted and received by the Islamic and conventional stock markets worldwide, while US 10-year government bonds and global commodity markets like oil and gold have little impact on the others. However, the U.S. Ukraine market and global risk factors stand out. Because of this, global Islamic and conventional stock markets contribute more to overall volatility than country-based Islamic stock markets. The oil and gold, US Bond, and UK markets have a noteworthy lack of influence on overall volatility.

When looking at all the country-level Islamic stock markets, we found that they were all net volatility receivers after accounting for the regional Islamic stock market. Both the 10-year US Treasury note and gold are net volatility receivers. Market volatility is a major factor in both the global Islamic and conventional stock markets. Net volatility transmitters include the stock markets of Saudi Arabia, the United Arab Emirates, Qatar, and the United Kingdom. In addition, the US crude oil spot market is a significant source of volatility. Kuwaiti and Omani stock exchanges are less affected by the rest of the area than those in other Islamic nations, such as Saudi Arabia. The more specialized markets in the MENA area provide a greater variety of investment opportunities. Saudi Arabia's stock market and the UK market had a higher influence on markets outside of the global Islamic and conventional stock markets than on global markets.

5. Conclusion

This research examines the impact of regional and worldwide market volatility on the Islamic markets. The Islamic stock markets in the Middle East and North Africa are the subject of our investigation (MENA). We are interested in the Middle East and North Africa (MENA) region because of the potential for oil prices to fall sharply. This means that to better understand their interrelationships, we need to look at both the regional political tensions and the market changes adopted to attract foreign capital. UAE, Bahrain, Egypt, Jordan, Kuwait, Morocco, Oman, Qatar, and Saudi Arabia are all major markets for DJ Islamic. Our data is derived from the Tadawul All Shares Index and the DJ ukk Index. In Bahrain, we also utilize DJ Islamic markets. As a benchmark for our regional Islamic stock market index, we look to the West Texas Intermediate crude oil spot price (WTI) and the current price per ounce of gold. The yield on a 10-year US government bond is often used as a proxy for global uncertainty.

Also observed was that the oil market, a volatility transmitter, had a lower influence on national and regional Islamic stock markets than on global Islamic markets." This shows that related asset classes are more interconnected than previously considered, according to the study's conclusions. According to the study, asset allocation is essential for investors and fund managers. As well as providing diversification alternatives for country-level markets, the hedging efficacy data suggest that UK investments may also offer US investors a realistic alternative to reduce their risk. Additionally, investors should know that an optimal portfolio plan may minimize risk more than hedging does. The interconnectedness of Islamic and conventional stock markets, especially during times of political or economic upheaval, is now a critical factor in formulating economic strategies. This study reveals important implications for policymakers. Foreign investors will no longer have the opportunity to diversify their portfolios in MENA countries' marketplaces if Sharia laws are loosened. In the wake of this, Islamic assets will no longer be regarded as a secure place to invest. Another way of saying this is that they must protect the uniqueness of their particular markets.

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