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Are Islamic bonds a safe choice for portfolio diversification in time of crisis? Evidence from volatility-causality analysis of Dubai financial market Here

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Abstract

Despite the popularity and uniqueness of Sukuk as an alternative tradable financing tool, the effectiveness of these products in portfolio allocation and diversification still needs to be improved. This paper employs the multivariate BEKK-GARCH (1,1) model to analyze shocks and volatility based on the daily prices of the Dubai Islamic Capital Market (Sukuk Index) and the conventional stock market (DFM Index). Additionally, it applies Johansen co-integration and Granger causality to investigate the persistence of shocks and volatility in long-term relationships and the leading relationship between Islamic and conventional markets. The results validate the impact of their respective news feeds on both Sukuk and stock market indices and demonstrate the persistence of volatility throughout the studied period from April 2009 to December 2020. The causality test reveals a multidirectional relationship between Sukuk and stocks, each contributing to the other's growth. The study confirms that Sukuk is not a safe haven for portfolio diversification in the Dubai financial market.

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1. Introduction

Considering the global development of the Muslim community and their continuing need for a fully coherent and integrated financial and economic framework that adheres to their beliefs and religion, the world witnessed the incredible growth of the Islamic finance and halal industry in both Muslim and non-Muslim countries (Mustafa et al., 2018). This has led to a growing focus on Islamic finance as an ethical and sustainable financial system guided by a set of rules derived from traditional Islamic sources. The global Sukuk market is one area of Islamic finance that has attracted and continues to attract much interest from the global business community (Seda et al., 2020). *Sukuk* is the plural of *Sakk*, an Arabic term that means certificate; in a financial sense, it refers to a Shari'ah-compliant bond (AAOIFI, 2008).

The global economic uncertainty and subsequent crisis exposed the vulnerability of conventional financial markets (Aracil, 2019); the previous financial and current pandemic crises illuminated the interconnectedness between international and regional markets (Akhtaruzzaman et al., 2020). The recent COVID-19 pandemic has jeopardized the economic growth of both developed and developing countries. In addition to the stimulus programs to counteract the economic shock caused by

the pandemic, policymakers are looking for new ways to rebuild the economy (Hasan et al., 2022). Nevertheless, Islamic financial markets have shown extraordinary performance and sustainable growth during the financial crisis compared to their conventional counterparts (Arif et al., 2021). Given the global expansion of Islamic financial markets and the proven connectedness of international markets (Samitas et al., 2021), it is no surprise that investigating further the nature of the correlation and volatility persistence between these two markets became a must for both economists and investors (Paltrinieri et al., 2018).

Investors, policymakers, and other finance practitioners around the world have become increasingly interested in forecasting financial market correlations and volatility persistence because of the importance of a good modeling process and meticulously drawn guidance for portfolio allocation (Poon & Granger, 2003). As a result, researchers are decorating both conventional and Islamic markets to gain a deeper understanding of their functioning dynamics (Nazlioglu et al., 2015).

Researchers and econometricians find it challenging to study the volatility of a specific asset or market due to its time-varying nature and dependence on market evolution and time series (Engle, 1993). There is considerable literature that examines the relation, similarities, and impact of sukuk and bonds, as well as Islamic stocks and conventional stocks; however, studies about sukuk as Islamic alternative fixed-income securities and conventional stocks still need to be made available.

Therefore, this paper investigates the nature of the interrelationship between Sukuk and stocks, which may have significant implications for the portfolio allocation strategy. It also examines the safe-haven likelihood of Sukuk relative to stocks and the causality directions between both markets. This paper aims to provide significant recommendations to international investors by analyzing the shocks and volatility persistence of both the Islamic and conventional financial markets. Additionally, it seeks to shed light on the nature of this relationship by examining the causality between both markets and addressing the questions of who is driving whom (Haque et al., 2018).

The rest of the paper is structured as follows: Section 2 reviews the existing literature from theoretical and empirical perspectives. Section 3 details the specific methodology used in this study and the findings of the modeling processes. The results and implications are presented in Section 4, while Section 5 offers concluding remarks.

2. Literature review

According to the principles of Shari'ah and *Usul al-Fiqh* (Islamic jurisprudence), a well-integrated and developed Islamic financial system still exposes Islamic financial markets to potential risks (Iqbal, 2007). Scholars and researchers in the field of Islamic finance have extensively explored associated risk types (Shahari & Saifur, 2021; Belkhaoui et al., 2020; El-Massah et al., 2019), as well as risk management in Islamic finance (Elgharbawy, 2020; Asma et al., 2018; Ahmed, 2011). Elgari (2003) defined risk in Arabic as 'Mukhatarah, characterizing it as a situation where deviation from the plan could lead to an unusual or uncommon outcome. "*Mukhatarah*" and "*gharar*" (deception) are often associated with danger or risk. However, *gharar* can also indicate a circumstance in which one party to a contract has information about some aspects of the contract that the other party does not have or in which neither party has control over the subject of the contract. Thus, Elgari (2003) views the prohibition of *gharar* as a risk-mitigation strategy that prevents transactions with high information content inequality. However, the Islamic paradigm does not forbid achieving gains or engaging in financial transactions to establish a prosperous and prosperous industry or company. However, the principle of *al-kharaj bil dhaman* (profit follows responsibility) in Islam, as stated by Qahf and Khan in 1992, dictates that any generated revenue must come with a corresponding obligation to cover potential losses.

2.1. Sukuk and risk management

Financial markets, portfolio management, and investments, both in conventional and Islamic financial markets, are closely associated with the term 'uncertainty.' Indeed, 'doubt' is a powerful emotion, particularly in the finance sector, where investors worldwide strive to reduce this feeling, particularly about their portfolio and investment allocation (Fisher & Statman, 2000). Consequently, doubt and uncertainty arise when deciding which security to include in a portfolio that could potentially incur significant costs. Therefore, risk managers aim to reduce uncertainty or risk exposure while maximizing potential gains from a particular transaction, investment, or allocation.

Sukuk has garnered significant attention in the risk management literature, prompting further research and studies on this particularly significant topic (Muhamed et al., 2022; Saheed & Sikiru, 2022; Balli et al., 2021). Indeed, faith-ethical-based investors constantly seek a safe haven for their portfolio allocation compliant with their religious and/or moral orientation (Naeem et al., 2021; Bugan et al., 2022). However, the study by Lai et al. (2019) finds that sukuk are only a partial safe haven in the extreme market. In this case, sukuk are not an exception, and the appetite for these alternative financial tools shows an increased tendency amid the economic uncertainty; indeed, numbers point out the continuously growing issuing of sukuk during the COVID-19 pandemic (Keshminder et al., 2022). According to global data provider Refinitiv, sukuk issuances internationally set a record in 2020, reaching a total of $172.1 billion, compared to $169.1 billion in 2019 (Refinitiv, 2020).

Sukuk investors possess undivided beneficial ownership of the underlying assets, which entitles the certificate holders to shares of revenues generated from them (Afshar, 2013). Conventional bonds, on the other hand, signify a contractual debt obligation that requires the issuer to pay interest to the debt holder on a designated date (Thomas et al., 2005). Investors place a high value on price changes and volatility movements of various securities and asset classes to create the most viable group of assets that offer the best possible returns versus the least possible risks (Jondeau & Rockinger, 2006). Therefore, in financial markets, it is important to analyze, assess, study, and research all relevant information for investment and decision-making (Virlics, 2013).

Because markets are connected and depend on each other, there is a chance that volatility will spread from major international markets to regional ones (Islam & Volkov, 2021; Gallo and Velluchi, 2009). This is more likely because information can instantly reach markets (Erdogan et al., 2020). Volatility spillover may occur among different topographical locations as well as between different categories of financial markets (Ng, 2000), such as between the bond markets (Abakah et al., 2021), the oil markets (Ahmed et al., 2022), and the Islamic stock markets (Ben Rejeb, 2017).

Previously, Connoly et al. (2005) analyzed the relationship between Islamic and conventional markets. According to their research, the stock-bonds connection decreases as stock market uncertainty increases, implying that bonds may be a superior hedge against stock market downturns. El Khalichi et al. (2014) used variance ratio tests to compare the random walk hypothesis to see how well Islamic indices and their traditional counterparts worked. Their findings reveal that Islamic indices have the same efficiency as conventional indices. El Alaoui et al. (2015) also used wavelet analysis to examine how the returns on the Islamic Dubai Financial Market (DFM-UAE) index changed over time and how they are related to the returns on other regional Islamic indices. The findings reveal that nearby markets tend to have a contagion effect, exhibiting increased correlation and interdependence with a specific time delay.

Furthermore, many other researchers (Naifar, 2015; Sclip et al., 2016) investigated the topic from the volatility perspective. In the context of Saudi Arabia, for instance, Naifar (2015) investigated the structural relationship between Islamic bond yields, stock market returns, and volatility in Saudi Arabia. Gumbel, Clayton, and Frank are three Archimedean copula models used by the author. The

study's findings reveal that the dependency structure between sukuk yields and stock market volatility is symmetric and has the same amplitude. Using the same approach, Sclip et al. (2016) demonstrated that volatility connections between sukuk and regional market indices are stronger during financial crashes. According to the researchers, sukuks have lower volatility than equities, so they could be a valuable and viable diversifier for the investor's portfolio.

Seth and Singhania (2019) analyze frontier markets' cointegration using BEKK and DCC GARCH models. They argue that there needs to be cointegration between the markets in the long run, which opens the door to non-negligible investment opportunities. Thus, long-term investors could make some profits by adding the financial assets from the non-cointegrated frontier markets to their portfolios; however, investors still have to be careful when forming their portfolios and investment strategies; they have to think smart and reflect on the implementation of diversified assets as well as employ adequate risk management strategies during the period of financial crisis in order to protect themselves against any possible financial losses (Rana & Akhter, 2015).

This paper contributes to the literature on comparative analysis of sukuk and conventional bonds by elaborating on the risk elements and challenges of sukuk and bonds in the light of risk management. Considering the extensive literature available, this paper provides insight into the riskiness of sukuk for potential investors as an alternative financial tool.

3. Methodological process and findings

It is critical to analyze and forecast the volatility of securities, assets, indices, or markets before investing. Financial market volatility is the intensity of price changes in financial instruments; the more volatile the assets, the riskier they are on the market (Shiller, 1992). Typically, we evaluate the forecast performance of volatility models using statistical efficiency criteria like mean squared error or net value, considering specific economic applications like value-at-risk or portfolio allocation (Clements & Silvennoinen, 2009). Poon and Granger (2003, 2005) present a comprehensive statistical assessment of forecast performance, whereas Andersen et al. (2006) explore a variety of volatility models based on economic settings. The most straightforward approach to understanding the correlation is to consider it a link between two assets; we refer to the correlation using a coefficient between 1 and -1. In the financial market, a positive correlation coefficient indicates that two assets will move together. A negative coefficient of correlation implies a negative relationship between the two assets, resulting in a rise in one asset price and a fall in the other.

The conditional volatility model is undeniably the best and most commonly used model for time-varying and volatility analysis for high-frequency data extracted daily or even hourly. The literature widely recognizes the fundamental stochastic framework that directly relates to the conditions and regularity stipulations of one of the most famous univariate conditional volatility models, such as GARCH (Nugroho et al., 2019; Zeitlberger & Brauneis, 2016).

However, even if the use of multidimensional or multivariate GARCH (MGARCH) models in financial market studies has been widespread, the latter needs to be better established than the univariate GARCH model. We can mention Bollerslev's early work (1990) on the changing variance structure of the exchange rate regime in the European Monetary System, assuming the correlations to be time-invariant. Lien and Luo (1994) evaluated the multi-period hedge ratios of currency futures in an MGARCH framework. Karolyi (1995) examined the international transmission of stock returns and volatility using different versions of MGARCH models for short-run return and volatility dynamics.

This study employs the bivariate BEKK-GARCH (1,1) model to examine shocks and volatility based on the daily prices of Dubai Islamic Capital Market (Sukuk Index) and conventional stock market (DFM index) prices, extracted from the Thomson Reuters database and investing database,

respectively, from April 1, 2009, to December 29, 2020.

Oil and energy market analysis more widely employs parametric approaches, which provide non-trivial functions of historical values and observable variables. We investigate the most popular methods using the generalized autoregressive conditional heteroskedasticity (GARCH) model to produce volatility estimates at different time scales. Unlike non-parametric techniques, these conditional models fit data using maximum likelihood estimation and may account for exogenous factors (Matar et al., 2013).

Extending our Univariate-GARCH(1.1) allows to estimate the variance-covariance matrix. We specify the mean equation of the SUKUK and stock market return series as follows:

$$Psu = \gamma_{su} + \vartheta_{su}\mathrm{Psu}_{su-1} + \varepsilon_{su} \quad \textit{(Eq. 1)}$$

$$Pst = \gamma_{st} + \vartheta_{st}\mathrm{Psu}_{st-1} + \varepsilon_{st} \quad \textit{(Eq. 2)}$$

where P_{su}, P_{st}: are vectors of definite return of sukuk and stock market series, respectively; ϑPsu_{su-1}, ϑPst_{st-1}: are the autoregressive coefficient in the conditional mean equation for sukuk and stock market returns.;Ysu, YPst: are the long drift coefficient. ε_{su}, ε_{st}: are the residuals.

Baba-Engle-Kraft-Kroner (BEKK) model refers to the specific parameterization of the multivariate GARCH model developed by Engle and Kroner (1995). The most straightforward Bekk representation for the N*N conditional covariance matrix Ω takes the form:

$$\Omega_t = c'c + \sum_{K=1}^{K} B'\Omega_{t-1}B + \sum_{k=1}^{k} A'\varepsilon_{t-1}\varepsilon' t - 1 \quad \textit{(Eq. 3)}$$

where C is an upper triangular N*N matrix, A and B are unrestricted N*N matrices and quadratic representation automatically guarantees that Ω is positive definite.

We can show our diagonal BEKK-GARCH(1.1), N=2 as follow:

$$\begin{pmatrix} \Omega_{su,t} & \Omega_{su\,st,t} \\ \Omega_{st\,su,t} & \Omega_{st,t} \end{pmatrix} = \begin{pmatrix} \alpha_{su,t} & 0 \\ \alpha_{st\,su,t} & \alpha_{st,t} \end{pmatrix}\begin{pmatrix} \alpha_{su,t} & \alpha_{su\,st,t} \\ \alpha_{st\,su,t} & 0 \end{pmatrix} + \begin{pmatrix} \sigma_{su,t} & 0 \\ 0 & \sigma_{st,t} \end{pmatrix}\begin{pmatrix} \Omega_{su,t-1} & \Omega_{su\,st,t-1} \\ \Omega_{st\,su,t-1} & \Omega_{st,t-1} \end{pmatrix}\begin{pmatrix} \sigma_{su,t} & 0 \\ 0 & \sigma_{st,t} \end{pmatrix} + \begin{pmatrix} \beta_{su,t} & 0 \\ 0 & \beta_{st,t} \end{pmatrix}\begin{pmatrix} \epsilon^2_{su,t-1} & \epsilon_{su,t-1}\,\epsilon_{st,t-1} \\ \epsilon_{st,t-1}\,\epsilon_{su,t-1} & \epsilon^2_{st,t-1} \end{pmatrix}\begin{pmatrix} \beta_{su,t} & 0 \\ 0 & \beta_{st,t} \end{pmatrix} \quad \textit{(Eq. 4)}$$

Hence, the diagonal BEKK-GARCH (1.1) is:

$$\Omega_{\mathrm{su,t}} = \alpha^2_{su} + \sigma^{2\Omega_{\mathrm{su,t-1}}}_{su} + \beta^2_{su}\varepsilon^2_{su,t-1} \quad \textit{(Eq. 5)}$$

$$\Omega_{\mathrm{su,t}} = \alpha_{su}\alpha_{st} + \sigma_{su}\Omega_{\mathrm{su,t-1}} + \beta_{\mathrm{su}}\beta_{\mathrm{st}}\varepsilon_{su,t-1}\varepsilon_{st,t-1} \quad \textit{(Eq. 6)}$$

$$\Omega_{\mathrm{st,t}} = \left\{(\alpha\}^2_{st,su} + \alpha^2_{st}\right) + \sigma^{2\Omega_{\mathrm{st,t-1}}}_{st} + \beta^2_{st}\varepsilon^2_{st,t-1} \quad \textit{(Eq. 7)}$$

In addition to the multivariate GARCH model, we have run the Johansen cointegration test, the Granger causality test, and the Impulse response Function to investigate any long-run relationship between our variables and to shed light on the nature of this relationship.

For that reason, we had to select the adequate lag length criterion. A Vector Auto Regressive model VAR has to be specified. Our bivariate VAR model is represented as follows:

$$ST_t = \sum_{I=1}^{P} \alpha_{1i}\, ST_{t-1} + \sum_{i=1}^{p} \beta_{1i} SU_{t-1} + \varepsilon_{t1} \qquad \textit{(Eq. 8)}$$

$$SU_t = \sum_{I=1}^{P} \alpha_{2i}\, SU_{t-1} + \sum_{i=1}^{p} \beta_{2i} ST_{t-1} + \varepsilon_{t2} \qquad \textit{(Eq. 9)}$$

Johansen's cointegration test allows us to determine the long-run cointegration between the time series used in our study.

Two tests in the Johansen method exist, though, in our paper, we rely on the Trace statistic (λ trace) for each rank r.

Our model has two endogenous variables, r being 0 or 1. In this case, the null hypothesis is that the rank is at most r versus the alternative hypothesis, which is that the rank is firmly larger than this r (Johansen, 1992).

Which implies that H_0: r =0 against H_1: r>0, if the (λ trace) is higher than the critical value of the Johansen-Juselius, we reject H0 and accept H1, that there exists a long-run relationship between our variables.

Granger Causality test and Impulse response functions will be used to examine the inter-relationship between Islamic and Conventional markets and whether Sukuk and Stocks are useful for studying, predicting, and forecasting each other.

We consider the following assumptions for Granger test:

H1. ST = f(SU)
H2. SU=f(ST)

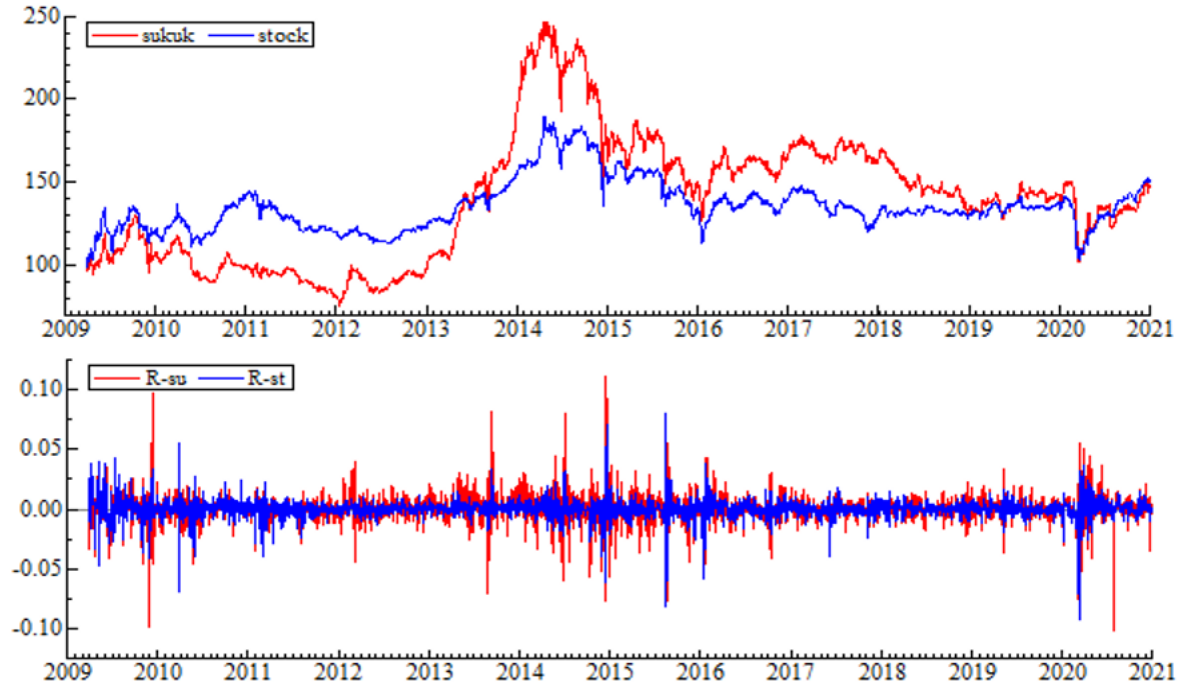
The ***Figure 1*** below shows the prices of stocks and sukuk, respectively, for the selected period, and it is clear that both time series are evolving. From 2012 to 2014, both sukuk and stocks experienced a significant price increase, with sukuk reaching nearly 250 points and stocks reaching nearly 190.

The graphs indicate a slight decrease in prices from mid-2015 to the beginning of 2019, with sukuk prices remaining between 150 and 160 points and stock prices fluctuating between 120 and 150 points, indicating that stock prices are more volatile than sukuk. In 2019, we observed a significant decline in both sukuk and stock prices, reaching a low of 100 points before they rose again.

According to global data source Refinitiv, total sukuk issuances worldwide established a new record in 2020, reaching $172.1 billion, up from $169.1 billion in 2019.

Sukuk issuances improved significantly during the first nine months of 2020, as COVID-19 lockdown actions and a drop in oil prices encouraged a flow in sovereign issuance in key sukuk markets. This is intended to fund large-scale incentive plans to modify the epidemic's economic impacts.

Figure 1: Stock, sukuk prices and returns



Source: Authors's own.

3.1. Reliability tests

In general, time series have a unit root, which refers to a random walk with drift. To check the stationarity of our variables, we use two of the most popular unit root tests, as shown in ***Table 1***.

Table 1: Unit root test statistics

Variables	Philips Peron test with constant and trend (1%)			Augmented Dickey Fuller test with constant and trend (1%)		
	level	1st dif	result	level	1st dif	result
R_su	0.0000	0.0000	I(0)	0.0000	0.0001	I(0)
R_st	0.0000	0.0000	I(0)	0.0000	0.0000	I(0)

Source: Authors's own.

The results of both PP and ADF tests show that the variables are stationary at level and do not have unit root because their probability is lower than the critical value.

The co-integration (trace test) results shown in ***Table 3*** imply that there is a co-integrating equation at the 0.05 level. Hence, there is a long-run equilibrium relationship between the Sukuk and the stock market in the Dubai financial market.

3.2. Empirical results for BEKK

Table 2 represents Fascia 1 and 2, which show the conditional mean and variance-covariance results, respectively. First, panel 1 illustrates that one period-lagged sukuk price ϑ_{su} describes the changes in the current sukuk price Υ_{su}, the same for the stock market index. This means that historical prices are denoted by actual prices, which are in accordance with an efficient market hypothesis (Timmermann & Granger, 2004).

Table 2: BEKK GARCH estimation mode

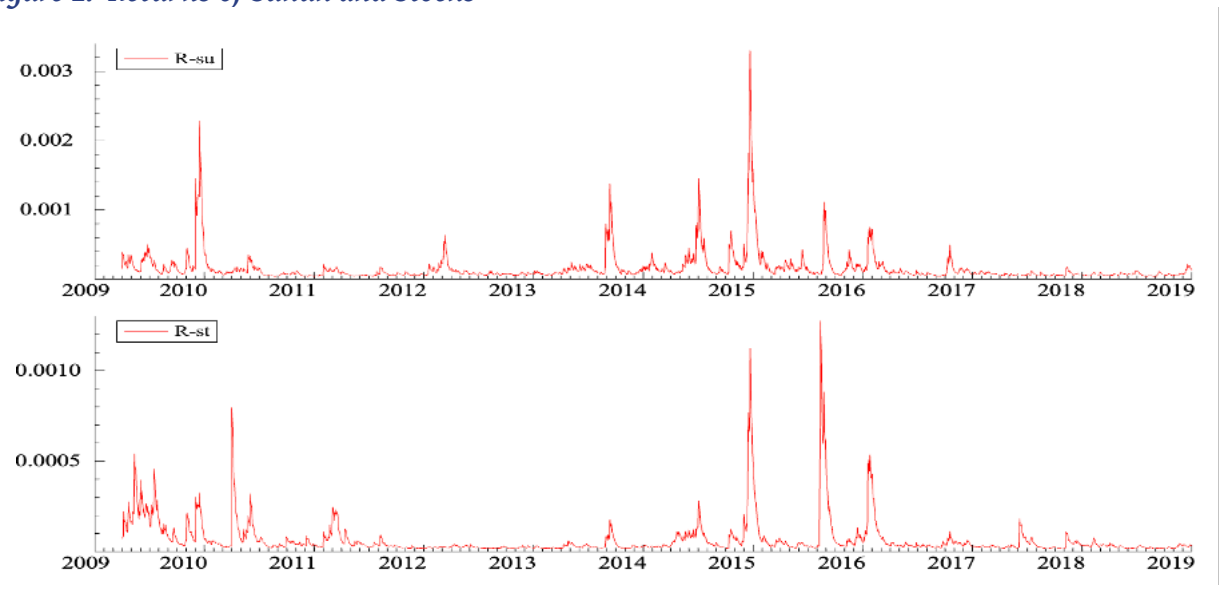
Variables	Coefficients	Std. error	z-stat	p-value
panel 1				
Υ_{su}	0.044149	0.083780	0.526959	0.0000
O_{su}	0.167594	0.057975	2.890783	0.0000
Υ_{st}	0.038879	0.082842	0.469322	0.0000
O_{st}	0.201221	0.055467	3.627757	0.0000
panel 2				
α_{su}	1.261919	0.072957	17.29674	0.0000
$\alpha_{su,st}$	1.705330	0.074915	22.76340	0.0000
α_{st}	2.150441	0.088538	24.28821	0.0000
βsu	-0.372512	0.014059	-26.49601	0.0000
βst	-0.390124	0.017449	-22.35771	0.0000
σsu	0.832046	0.010755	77.36389	0.0000
σst	0.655270	0.018029	36.34463	0.0000

Source: Authors' own.

Second, the panel 2 part of the table shows that ARCH (β) and GARCH (σ) derive positive estimations that are statistically meaningful at the 1% level. We may claim that the conditional variance of both sukuk and the stock market is sensitive to prior shocks, and their volatility is persistent and varies gradually over time.

Additionally, the volatility of sukuk has been proven to be primarily driven by the estimated variance (GARCH term) rather than past shocks or news (ARCH term), which is consistent with Rahman et al. (2013). This result suggests that any news will significantly affect the price variation of both the sukuk and stock markets of the Dubai financial market and will take some time before the prices gradually return to balance.

Figure 2: Returns of Sukuk and Stocks



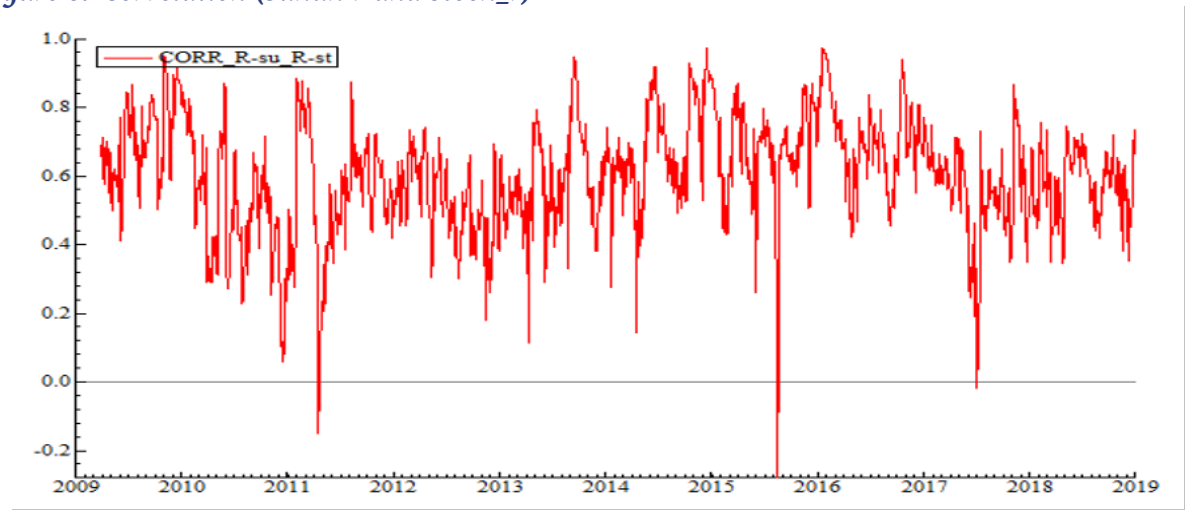
Source: Thomson Reuters

The volatility of the Dubai stock market can be attributed to the Dubai debt crisis. In fact, the

government borrowed 80 billion dollars in a very short delay (four years) to overcome the incredible challenge of being the new global hub for tourism and real estate investments. However, this incredible contest was not without consequences. The Dubai real estate sector suffered from a high property depression on a global scale, and without any surprise, this event severely impacted the stock market.

The ***Figure 3*** below illustrates the correlation between sukuk and stock returns. This correlation fluctuates over time, with a range of -1 to +0.95. This correlation was positive for most of the study, indicating that sukuk and stocks moved in the same direction most of the time, particularly during the COVID-19 pandemic. However, the result reveals a strictly negative correlation of -1 during the Dubai debt crisis period. This remarkable observation highlights the distinct impact of the debt/financial crisis and the global pandemic on the dynamic correlation between sukuk and stocks. Therefore, Dubai's financial market investors should consider the external environment and uncertainty factors that significantly influence the financial market before formulating their portfolio allocation strategy.

Figure 3: Correlation (Sukuk-r and stock_r)



Source: Thomson Reuters

3.3. Granger Causality and impulse response function

To avoid any spurious regression analysis, we identify the existence of a cointegration between our variables. First, we estimated a VAR equation to select the adequate lag length for our model; based on our output and Akaike information criterion (Appendix 1), we chose 12 lag lengths and hence, we could run the Johansen cointegration analysis, the results of which are shown in ***Table 3***.

Table 3: Johansen test

Hypothesized	Eigenvalue	Trace statistics	Probabilities
None	0.076750	451.3497	0.0000
At most one	0.065587	207.3106	0.0000

Source: Authors' own.

The co-integration (trace test) results in ***Table 3*** imply a co-integrating equation at the 0.05 level. Hence, there is a long-term equilibrium relationship between the Sukuk and stock markets in the Dubai financial market. Based on the cointegration test results, we had to estimate a vector error correction model (VECM) based on the cointegration test results and then run the Granger causality

and impulse response functions.

Granger argues that causality is defined based on two main assumptions: Firstly, the cause occurs before the effect. Secondly, the cause has unique information about the future value of its effect (Granger, 1980). Starting with these assumptions and referring to our causality test results (Appendix 2), we observe probabilities that we reject the null hypothesis and that a causality relationship exists in two directions. This suggests that higher sukuk returns lead to higher stock returns and vice versa.

Furthermore, the impulse response function figures (Appendix 3) demonstrate that both stocks and sukuk returns respond to their news, albeit with distinct reactions to each other. On the one hand, stock returns significantly influence sukuk returns, revealing a slight but positive and significant reaction to stock shocks. On the other hand, stock returns exhibit a strong positive reaction to the news about sukuk returns. The results from the impulse response functions add robustness to both the GRAGER and BEKK-GARCH results.

4. Results and implications

Both sukuk and stock market indices are influenced by their respective news and exhibit volatility constancy across the study period. The environmental situation of the Dubai financial market advocates that the variation and sensitivity of researched equities are connected to the market's nature as a fast-growing emerging market, but not only the financial and political event changes have a significant impact on the financial market's behavior as well, with Dubai's financial debt as the primary cause of the market crash.

The correlation analysis between sukuk and stock returns shows a positive linkage between both assets, which means that the two properties are expected to move in the same direction for most of the study period, which supports the argument that sukuk are hybrid instruments from a structural point of view and have some similarities to stocks, which is coherent with Sclip et al. (2016). Moreover, the bi-directional causality relationship between sukuk and stocks proves that both assets mutually influence each other and can help predict each other's future behavior.

For Muslim or other non-Muslim investors who have been out of the financial market due to their beliefs and moral orientations, Islamic financial tools such as Islamic stocks or the more famous Islamic Sukuk are supposed to be "the" perfect alternative to the conventional tools available in the market. Such tools are supposed to bring the missed "embeddedness" to the real economy, therefore backing the development and enhancement of the economy, which is coherent with the aspirations of the Islamic economic paradigm, and therefore contributing to a bigger goal, which is empowering the Muslim community and supporting a human-centric framework where the financial system is a tool to link finance to economic development. Indeed, ***Figure 2*** strongly supports this argument and shows similar trends in sukuk and stock returns.

Further, the macroeconomic environment of the Dubai financial market has a non-negligible impact on the dynamic linkage between sukuk and stocks. Indeed, previous research has proved that macroeconomic variables influence the dynamic co-movement and interdependency relations between stocks and sukuks. Piljak (2013) discovered that macroeconomic factors, particularly inflation, are crucial in explaining the stock-bond connection. Inflation, he said, is a vital driver of the stock-sukuk link. When there is much inflation, the cash-flow expectations result in a positive connection between the two asset classes. Additionally, during times of crisis, we can notice a lower correlation between sukuk and stocks, which is consistent with the reviewed literature.

The current Shariah-compliance stock climate includes specific concessions from a Shari'ah

compliance perspective. For instance, disclosing the impermissible elements is a crucial step in ensuring the continuity of the efficient operations of the markets, considering that the tolerance limits in the screening processes are tailored to a particular market need. With that in mind, the evidence shows that the variations in Shari'ah screening processes at times made a negative impact on the sukuk market regarding the level of market confidence (Htay et al., 2013), as well as in the specific matters of portfolio diversification (Zaidi et al., 2013). Therefore, standardization in Shari'ah screening processes is of utmost importance, and following AAOIFI and IFSB standards would ensure the unification of the process across the board.

5. Conclusion

This study uses many statistical tests, such as a bivariate BEKK-GARCH (1,1) model, Granger causality, and impulse response functions, to examine the shocks and volatility persistence of both sukuk and stocks. We also look at the causality link between the two, using daily prices from the Dubai Islamic Capital Market (Sukuk Index) and the conventional stock market (DFM index).

Our main findings are that the conditional variance of both sukuk and the stock market is sensitive to prior shocks, and their volatility is persistent and varies gradually over time.

Rahman et al. (2013) confirm that the estimate variance (GARCH term) primarily drives the volatility of sukuk, not past shocks or news (ARCH term). This result suggests that any innovation will have a meaningful effect on the price variation of both the sukuk and stock markets of the Dubai financial market and that it will take some time before the prices gradually return to Our study reveals a positive correlation between sukuk and stocks, likely due to their hybrid nature and similarities; however, we have observed a decrease in this correlation during the debt crisis.t crisis.

This study holds significance as it aims to provide investors in the Dubai financial market with significant results for their portfolio allocation strategy. Investors should not rely on sukuk as a safe haven for diversification purposes in times of crisis. The results show a strong interdependence between sukuk and stocks and bi-directional causality.

Stakeholders in the Islamic financial system, such as Shari'ah boards and regulators, are likely to benefit from the results of this study. The findings can potentially add value to further scholarly discussions and serve as a platform for a better understanding of the Islamic capital markets, particularly sukuk. The paper also sheds light on the critical Shari'ah-compliance screening element in the context of sukuk.

Future researchers could provide more evidence by identifying the time dependence relationship, using more statistical approaches such as wavelet analysis to enhance the robustness of both the Granger and M-GARCH models, and identifying the significant external macro-political factors influencing this correlation.

Declarations

The author has no relevant financial or non-financial interests to disclose. The data are available upon a reasonable request from the author.

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Appendix A1

Var Lag order Selection Criteria
Endogenous variables: R ST R SU
Exogenous variables: C
Included observations: 3049

Lag	LogL	LR	FPE	AIC	SC	HQ
0	20307.66	NA	5.63e-09	-13.31955	-13.31560	-13.31813
1	20353.33	91.226538	5.48e-09	-13.34689	-13.33504*	-13.34263
2	20357.84	8.990803	5.48e-09	-13.34722	-13.32747	-13.34012
3	20364.25	12.79011	5.47e-09	-13.34880	-13.32115	-13.33886
4	20365.70	2.895022	5.48e-09	-13.34713	-13.31157	-13.33435
5	20372.46	13.48250	5.47e-09	-13.34894	-13.30549	-13.33333
6	20376.11	7.263172	5.47e-09	-13.34871	-13.29763	-13.33025
7	20379.04	5.836412	5.47e-09	-13.34801	-13.28875	-13.32671
8	20385.59	13.02519	5.46e-09	-13.34968	-13.28253	-13.32555
9	20387.73	4.249980	5.47e-09	-13.34846	-13.27340	-13.32149
10	20396.40	17.22526	5.45e-09	-13.35153	-13.26857	-13.32171
11	20399.69	6.522607	5.45e-09	-13.35106	-13.26020	-13.31840
12	20404.60	9.744367*	5.45e-09	-13.35166*	-13.25289	-13.31616
13	20407.92	6.573582	5.45e-09	-13.35121	-13.24455	-13.31287
14	20409.72	3.574629	5.46e-09	-13.34977	-13.23520	-13.30859
15	20412.34	5.173860	5.47e-09	-13.34886	-13.22639	-13.30485
16	20415.76	6.781172	5.47e-09	-13.34848	-13.21812	-13.30163
17	20417.11	2.667001	5.48e-09	-13.34675	-13.20848	-13.29705
18	20420.05	5.806283	5.48e-09	-13.34605	-13.19988	-13.29352
19	20422.31	4.467398	5.49e-09	-13.34491	-13.19084	-13.28954
20	20423.77	2.872679	5.50e-09	-13.34324	-13.18127	-13.28503

*indicates lag order select by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Source: Authors' own.

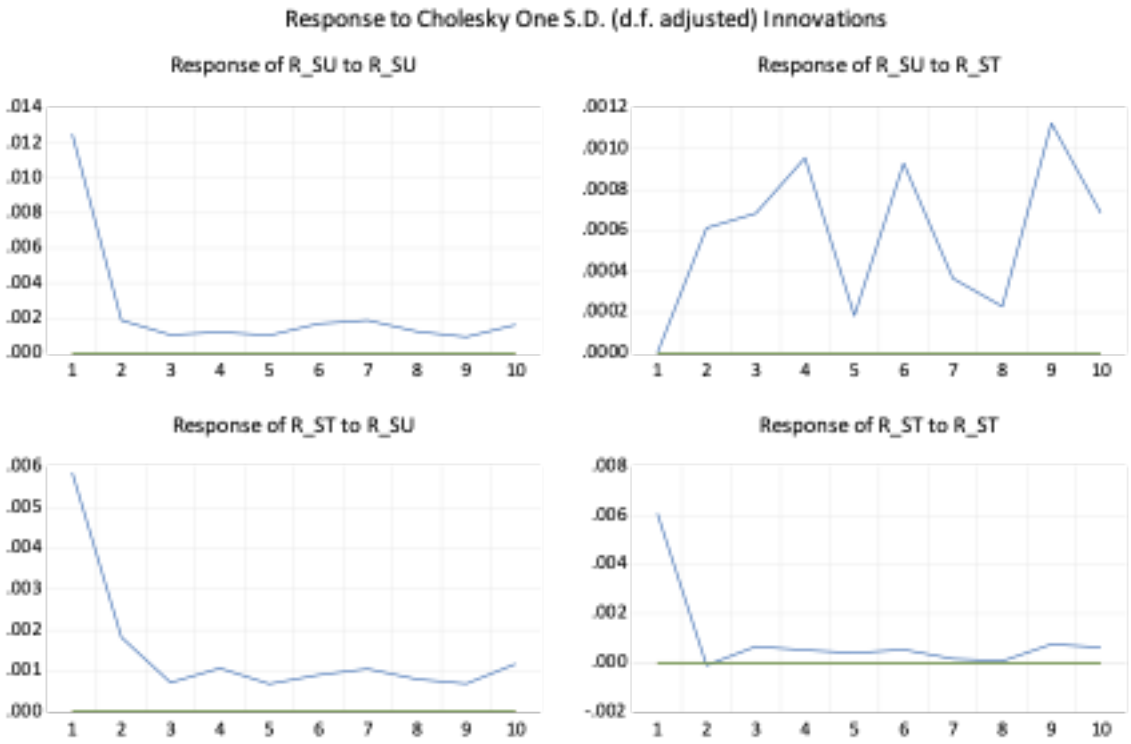
Appendix A2

VEC Granger Causality/Block Exogeneity Wald Tests
Included observations: 3049

Dependant variable D(R ST)			
Excluded	Chi-sq	df	Prob.
D(R SU)	40.68712	12	0.0001
All	40.66712	12	0.0001
Dependant variable D(R SU)			
Excluded	Chi-sq	df	Prob.
D(R ST)	49.90588	12	0.0000
All	49.90588	12	0.0000

Source: Authors' own.

Appendix A3



Source: Authors' own.

A3. Abbreviations:

AAOIFI: Accounting and Auditing Organization of Islamic Financial Institutions.
ISFB: Islamic financial board.
IIFM: International Islamic financial market
IME: Islamic moral economy