

Determinants of Spillovers between Islamic and Conventional Financial Markets: Exploring the Safe Haven Assets during the COVID-19 Pandemic

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Abstract

We analyse the impact of the COVID-19 pandemic on the spillovers between conventional and Islamic stock and bond markets. We further analyse comparatively whether gold, oil, and Bitcoin prices, and VIX and EPU indexes affect the relationships between these markets during the COVID-19 pandemic outbreak. The results show that the Islamic bonds (Sukuk) demonstrate safe haven properties during this pandemic crisis, while the spillovers between conventional and Islamic stock markets become stronger during the pandemic outbreak. COVID-19, Oil and gold are strong predictors of the conventional-Islamic markets spillovers, while Bitcoin is not a significant determinant of these relationships.

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1. Introduction

The COVID-19 pandemic has pushed the world's economies and financial markets to the deepest recession since 2008. In the United States, for example, the unemployment rate jumped from 3.7% to 14.8% in less than two months of the incidence of the pandemic, while the growth rate is expected to drop by more than 4% in 2020 down from a positive 2.2% in 2019. In the literature, the severe economic and social costs of the quarantine measures have been compared with the high costs of the Global Financial Crisis of 2007-2009 (Goodell, 2020; Yarovaya et al., 2020). Finance scholars have also assessed the diverse financial effects of the COVID-19 pandemics (e.g., Akhtaruzzaman et al., 2020; Corbet et al., 2020; Sharif et al., 2020).

During periods of increased uncertainty, investors look effortlessly for portfolio diversifiers and safe havens to protect their assets and investments. In the 2008 global financial crisis, Islamic markets demonstrated their safe haven properties in comparison to their conventional counterparts (Aloui et al., 2018). Researchers showed that Islamic markets are relatively stable and outperform their conventional counterparts, particularly during financial stress and turbulent periods (Almanaseer, 2014; Akhtar & Jahromi, 2017; Ahmed & Elsayed, 2019). This is due to the key features of Islamic financial contracts such as risk-sharing, direct linkages with the real economy, low leverage and not dealing with toxic instruments and derivatives (Ahmed, 2009; Ajmi, et al., 2014). Noteworthy, the Islamic finance industry and institutions received much attention following the global financial crisis in 2007/2008. Islamic finance has developed and grown rapidly to have become a global phenomenon since then, as the overall size of the Islamic financial industry is estimated at USD 2.19 trillion (IFSB, 2019).

Interestingly, early evidence from COVID-19 suggests that neither gold nor cryptocurrencies have acted as safe havens in portfolios (Corbet et al., 2020; Conlon & McGee, 2020). As indicated, Islamic markets had demonstrated this property during the 2008 Great Recession, which has motivated to do this research. Therefore, it is particularly interesting to test the decoupling hypothesis for Islamic stocks and Islamic bonds (Sukuk) from their conventional counterparts during the studied COVID-19 period.

The objectives of this paper are twofold: (i) to analyse the dynamics of spillovers between the conventional and Islamic stock and bond markets during the COVID pandemic,

and (ii) to investigate the impact of well-known risk-related determinants on the spillovers between these markets.

While a comprehensive review of the COVID-19 pandemic literature is provided by Yarovaya et al. (2020), there are several other newer studies that additionally motivate our research and data selection. Sharif et al. (2020) demonstrate that the COVID-19 affected both the geopolitical risk and economic policy uncertainty indexes, highlighting that this pandemic is one of the main sources of systematic risk for financial markets. However, their results argue that the more recent oil price crash has affected the US financial markets more strongly than the COVID-19 pandemic has done. Corbet et al. (2020) analyse the flight-to-safety behaviour of investors during the COVID-19, and report that the relationships between the Chinese stock markets and the Bitcoin market have evolved during the pandemic, but neither Bitcoin nor gold offers significant hedging properties for investors. By analysing the reaction and the recovery of equity, bonds, precious metals and cryptocurrency markets to the COVID-19 crisis shock, Yarovaya et al. (2020a) report a heterogeneous response of the markets to this black swan event. Specifically, the evidence for gold suggests that this shiny metal has a weak ability to bounce back to the pre-COVID level and shows limited safe haven properties, while cryptocurrencies, as a group, seem to disappoint in terms of providing an assurance of recovery from this significant shock.

To contribute to this literature, we focus on the Islamic bond and stock markets by accounting for several key factors that can act as determinants of the relationship between these markets and their conventional counterparts during the pandemic. To our knowledge, this is the first paper that investigates the impact of COVID-19 on volatility spillovers between the Islamic and conventional markets using their relevant determinants. First, we use gold and Bitcoin known as common safe haven markets as well as the oil prices as covariates since the observation period covers one of the largest oil price falls in the recent history. Second, we utilise both the VIX and EPU Indexes to account for the role of uncertainty.

This study initially uses the VARMA-BEKK-AGARCH approach in which the conditional mean equations are quantified as a Vector Autoregressive Moving Average (VARMA) model, while the conditional variance equations are specified using a multivariate Asymmetric Generalized Autoregressive Conditional Heteroscedasticity (AGARCH) process. It further examines the determinants of the conditional correlations and the volatility spillover

transmission across the financial markets under consideration, using the daily oil, gold, Bitcoin prices and EPU and VIX indexes

In summary, the results demonstrate that there are significant and positive return spillovers running from the conventional to the Islamic stock markets over the three periods. The COVID-19 pandemic has a negative impact on the returns of both conventional and Islamic stocks but has no effect on the bond or Sukuk markets. Finally, the sukuk are a portfolio diversifier and could serve as a hedge and a safe haven during the COVID-19 subperiod.

Following the introduction, the remainder of the paper is organised as follows. Section 2 outlines data sources and variables under consideration, while Section 3 explains the research methodology. Empirical findings are then presented and discussed in Section 4. Finally, Section 5 provides the conclusion.

2. Data

The dataset comprises of daily observations of the Dow Jones world stock market index, the Dow Jones Islamic stock market index, the ICE BofA world Bond Market Index and the Dow Jones World Sukuk Index over the sample period from the 1st of April 2019 to the 4th of May 2020. We further divide this sample in two sub-samples: the pre COVID-19 pandemic (1st of April 2019 – 30th of December 2019) subperiod, and during the COVID-19 (31st of December 2019 – 4th of May 2020) subperiod¹. To investigate the determinants of spillovers, we collected data for the Global gold price index, Bitcoin, oil price, CBOE volatility index (VIX) and US-Economic Policy Uncertainty index (EPU) to account for the global factors that influence the spillover effects². The COVID-19 pandemic is proxied by the daily data on the world's new COVID-19 cases per million people³.

3. Methodology

¹ According to the World Health Organization website (WHO), the first few COVID-19 cases globally were recorded by the Wuhan Municipal Health Commission of China on the 31st of December 2019: <https://www.who.int/news-room/detail/27-04-2020-who-timeline---covid-19>

² Data on the global financial markets has been derived from the Thomson Reuters EIKON database, whereas the global factors data was collected from the DataStream database.

³ COVID-19 data was retrieved from the World Health Organization website (WHO): <https://covid19.who.int/>

This study employs the VARMA-BEKK-AGARCH approach where the conditional mean equations are specified using a Vector Autoregressive Moving Average (VARMA) model, while the conditional variance equations are estimated following a multivariate Asymmetric Generalized Autoregressive Conditional Heteroscedasticity (AGARCH) process (McAleer et al., 2009). In addition, the mean equations are modified to account for the impact of the COVID-19 pandemic. Consequently, a bivariate VARMA(1,1) mean equation could be defined as follows:

$$R_t = \Phi + \psi R_{t-1} + \varphi COVID + \varepsilon_t + \gamma \varepsilon_{t-1} \quad (1)$$

where R_t represents the returns of both the conventional and Islamic financial markets and Φ is a (2×1) vector of constant terms. Moreover, ψ denotes a (2×2) coefficient matrix of the lagged returns, φ is a (2×1) vector of coefficients which represents the impact of COVID-19 on the returns of both conventional and Islamic financial markets and ε_t represents the residuals. Consequently, γ is a (2×2) square matrix that captures the impact of lagged residuals and hence explains the return spillovers across both conventional and Islamic financial markets.

On the other hand, the conditional variance equation could be written as follows:

$$H_t = \omega' \omega + A' \varepsilon_{t-1} \varepsilon_{t-1}' A + C' I_{t-1} \varepsilon_{t-1} \varepsilon_{t-1}' C + B' H_{t-1} B \quad (2)$$

where H_t is the conditional variance-covariance matrix with ω is a lower triangular matrix in the form of $\begin{pmatrix} \omega_{11} & 0 \\ \omega_{21} & \omega_{22} \end{pmatrix}$ to ensure the positive definiteness of H_t . The matrices A, B and C are square matrices that represent the effects of short-term shocks (ARCH effects), long-run volatility persistence (GARCH terms), and asymmetric volatility, respectively. That is,

$$A = \begin{pmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{pmatrix}, \quad B = \begin{pmatrix} b_{11} & b_{12} \\ b_{21} & b_{22} \end{pmatrix}, \quad C = \begin{pmatrix} c_{11} & c_{12} \\ c_{21} & c_{22} \end{pmatrix}$$

Despite the fact that the results from the VARMA-BEKK AGARCH model are very informative and provide very interesting results, they might mask important information such as the dynamic evolution of the relationships and spillovers between different markets overtime. To this end, this paper utilises the Asymmetric Dynamic Conditional Correlation (ADCC-GARCH) technique to examine the determinants and the development of the time-

varying correlations and spillovers between the considered conventional and Islamic markets over the sample period.⁴

4. Empirical results

4.1 Dynamics of spillover effect

Summary statistics in Table 1 display that the Islamic stock returns on average outpaced their conventional counterpart during the full period and the two subperiods and were significantly less volatile during all those three periods. The kurtosis data show that the conventional stock index has much greater fat tails than its Islamic counterpart, i.e. has more outliers than the Islamic stock market, and thus is riskier.

Table 1. Summary Statistics

Panel A: Full sample (April 1, 2019-May 4, 2020)				
	CSTOCK	BOND	ISTOCK	SUKUK
Mean	-0.0237	0.0163	0.0088	0.0091
Median	0.0902	0.0228	0.0681	0.0293
Maximum	25.452	0.7427	7.9133	0.7209
Minimum	-25.578	-1.6782	-9.6527	-1.3533
Std. Dev.	2.6488	0.2402	1.5442	0.1994
Skewness	-0.3331	-1.8478	-1.2032	-2.3267
Kurtosis	62.932	13.779	16.491	16.677
Jarque-Bera	42658***	1542.1***	2230.2***	2478.5***
ADF	-25.47***	-13.04***	-5.161***	-6.45***
PP	-25.76***	-13.19***	-20.82***	-12.50***
Panel B: First sub-sample (April 1, 2019-December 30, 2019)				
	CSTOCK	BOND	ISTOCK	SUKUK
Mean	0.0463	0.0132	0.0589	0.0209
Median	0.0925	0.0171	0.0688	0.0237
Maximum	25.452	0.4291	1.7921	0.3227
Minimum	-25.578	-0.5574	-2.8134	-0.3156
Std. Dev.	2.6784	0.1773	0.6519	0.1065
Skewness	-0.1142	-0.3803	-0.8363	0.0122
Kurtosis	85.383	3.5321	5.4189	3.4705
Jarque-Bera	55144***	7.0023**	70.276***	1.8037
ADF	-12.78***	-13.76***	-12.39***	-14.91***
PP	-43.56***	-13.84***	-12.31***	-15.14***
Panel C: Second sub-sample (December 31 2019-May 4, 2020)				
	CSTOCK	BOND	ISTOCK	SUKUK
Mean	-0.1755	0.0229	-0.0996	-0.0167
Median	0.0605	0.0523	0.0464	0.0381
Maximum	7.9637	0.7427	7.9133	0.7209
Minimum	-9.9691	-1.6782	-9.6527	-1.3533
Std. Dev.	2.5916	0.3399	2.5818	0.3181

⁴ For additional details on the ADCC-GARCH model, please refer to the original paper by Cappiello et al. (2006).

Skewness	-0.8767	-2.0148	-0.6765	-1.6205
Kurtosis	6.9895	10.636	6.6158	7.6185
Jarque-Bera	71.218***	279.59***	55.895***	119.38***
ADF	-5.379***	-6.168***	-5.769***	-3.21**
PP	-11.31***	-6.243***	-12.07***	-5.632***

Note: This table reports the descriptive statistics for the main four variables used in the analysis over the sample period starting from the 1st of April 2019 to the 4th of May 2020. C STOCK, BOND, I STOCK and SUKUK represent the log returns of the conventional stock, Islamic stock, bond and SUKUK indices. ADF and PP are the Augmented Dickey-Fuller and Phillips-Perron tests for unit roots, respectively. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

The conventional bond market on average indicates a higher return and a higher volatility in the full period and the second sub-period. This suggests that the selection preference between those assets hinge on the risk tolerance of investors. The bonds' kurtosis is mixed but the differences are more muted in these markets than in the case of the stock markets as expected. Both the ADF and PP unit root tests show that all the returns of all the four markets are stationary and the variables are I(1). This implies that their indices go up to the trend aftershocks hit, which paves the way for checking for cointegration.

Table 2 below presents the cross-market spillover effects for all the three analysed period/subperiods.

Table 2. Cross-market spillover effect for the Conventional and Islamic stocks

VARMA-BEKK-AGARCH model for Conventional and Islamic stock markets			
	Full sample	Pre COVID-19	During COVID-19
Mean equation			
Φ_{10}	-0.077	-0.126***	-0.066
ψ_{11}	-0.022	-0.846***	-1.232***
ψ_{12}	0.209**	0.742***	1.122***
γ_{11}	-0.001***	0.005***	-0.013***
γ_{12}	0.009***	0.028***	-0.461***
φ_{10}	-0.310		
Φ_{20}	0.049	0.011	0.026
ψ_{21}	0.0126*	0.013	-1.042***
ψ_{22}	0.126**	0.178**	0.856***
γ_{21}	0.007***	0.046***	0.017***
γ_{22}	-0.014***	-0.044***	0.010***
φ_{20}	-0.294***		
Variance equation			
ω_{11}	1.575***	0.196***	0.198
ω_{21}	0.011	0.179***	0.324**
ω_{22}	0.182***	-0.12e-06	0.39e-06
a_{11}	-0.002	-5.715***	1.135**
a_{12}	0.001	-0.029	0.901*
a_{21}	-0.145	4.250***	-0.381
a_{22}	-0.148	0.119	-0.319
b_{11}	-0.004	0.004	2.415***

b_{12}	-0.003	0.004	2.373***
b_{21}	-0.783***	-0.732***	-2.327***
b_{22}	-0.785***	-0.834***	-2.255***
c_{11}	0.591***	0.073	0.987
c_{12}	-0.006	-0.002	1.120
c_{21}	0.301	0.576	0.453
c_{22}	0.913***	0.728***	0.523

Model diagnostics

AIC	6.309	4.546	4.616
SBC	6.656	4.967	5.320
Log-L	-868.9	-415.9	-178.1

Residual diagnostics for the independent series

	RCSTOCK	RISTOCK	RCSTOCK	RISTOCK	RCSTOCK	RISTOCK
Ljung-Box (20)	8.995	21.726	14.513	18.409	22.876	17.091
Ljung-Box (40)	13.381	50.340	30.123	53.538*	53.941*	51.998
McLeod-Li (20)	0.122	32.505**	0.426	18.535	40.368***	25.029
McLeod-Li (40)	0.293	55.941**	1.007	47.522	75.242***	58.619**

Note: The coefficients in both the mean and variance equations are defined and discussed in the methodology section. RCSTOCK and RISTOCK are the conventional and Islamic stocks returns, respectively, and denoted as (1) and (2) across the models. The Ljung-Box and McLeod-Li tests are estimated to test for the autocorrelation and ARCH effects with the null hypotheses of no autocorrelation and no Arch effects for both the Ljung-box and McLeod-Li tests, respectively. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

Starting with the mean equation, the coefficient of ψ_{12} indicates a positive and significant return spillover effect from the conventional to the Islamic stock markets over the three periods analysed. Notably, this return spillover effect increased dramatically during the COVID subperiod (1.12), compared with the pre COVID-19 period (0.74). On contrary, the results reveal that the return of the conventional stock market in the current subperiod is not influenced by the past returns of the Islamic stock markets, except during the current COVID-19 subperiod. This is evident by the negative and significant coefficient for ψ_{21} , thus suggesting a negative return spillover from the Islamic to the conventional stocks during the current COVID-19 subperiod only. Meanwhile, the moving average part of the equations shows that in the full and pre-COVID19 periods γ_{12} and γ_{21} were significant and positive, which implies bi-directional shock spillovers between the markets. However, during the current COVID subperiod γ_{12} coefficient becomes negative.

We can observe several substantial differences in terms of the sign and magnitude of the conventional-Islamic stock market relationships in the pre- and during-COVID19 periods suggesting increased interconnectedness and spillover effects during the pandemic subperiod, compared with the other two periods. Furthermore, the negative COVID coefficients of φ_{10} and φ_{20} underscore a negative effect of COVID-19 on both the

conventional and Islamic stocks. However, the effect is insignificant in the case of the conventional stock market.

As to the conditional variance equations, the current conditional volatility of the conventional stocks is determined by its own shocks (a_{11}^2) as well as by both the conditional variance and lagged shocks of the Islamic market (b_{21}^2, a_{21}^2) during the pre-COVID-19 subperiod. However, the lagged shocks of the Islamic market become insignificant and are replaced by their own lagged conditional variance (b_{11}^2) during the pandemic. On the other hand, the current conditional variance of the Islamic stocks is influenced by its own asymmetric shocks and own lagged variance (c_{22}^2, b_{22}^2), respectively, before the pandemic hit. However, the coefficient (b_{12}^2) becomes significant during the crisis, thus indicating a large volatility spillover from the conventional markets to the Islamic market.

Table 3 reports the cross-market spillovers between the conventional and Islamic bond markets. In the mean equations, both coefficients ψ_{12} and ψ_{21} are insignificant in all the periods analysed, which indicates an absence of return spillovers between the conventional bond and the Sukuk markets. This suggests that those markets should be used to hedge against each other, underscoring some kind of a safe haven property. In the moving average part, γ_{12} and γ_{21} are significant and positive, which implies the presence of a bi-directional return spillover between the two markets in all periods. Meanwhile, the pandemic coefficients ($\varphi_{10}, \varphi_{20}$) are insignificant, indicating an insignificant effect on the returns of the conventional bond and Sukuk markets. Taken together, these findings (including the results in Tables 2.A and 3.A) show that the COVID-19 pandemic has a negative impact on the returns of both conventional and Islamic stocks but has no effect on the bond or Sukuk markets. This is not surprising due to the fact that stocks are more likely to be affected by the business cycles than bonds in general and Sukuk in particular due to their intrinsic characteristics with different sectors⁵.

⁵ Sukuk are defined as Islamic investment certificates representing ‘*shares and rights in tangible assets, usufructs and services, or equity of a given project or equity of a special investment activity*’ (AAOIFI 2003: 298). Sukuk holders bear the risks that these instruments represent and could have fixed or variable returns, depending on the contractual basis. According to the AAOIFI standards, there are 14 different types of Sukuk that could be classified into four main categories: assets, debt, equity and investment agency (AAOIFI 2003). However, in practice, they can be classified as either asset-backed or asset-based sukuk (Ahmed, 2010).

Turning to the variance equations, in the full sample we can see that the volatility of the conventional bond markets is characterized by the lagged shocks of the Islamic market (a_{21}^2), the conditional variance of Islamic market (b_{21}^2) as well as the own and Islamic asymmetric shocks (c_{11}^2, c_{21}^2). At the same time, the Islamic bond (Sukuk) markets are also significantly affected by their own lagged conditional variance (b_{22}^2), own asymmetric shocks (c_{22}^2) and conventional asymmetric shocks (c_{12}^2) in all the periods analysed, in addition to the Islamic bond markets shocks (a_{12}^2) with the exception of the pre-COVID sub-period. Generally speaking, there is evidence of short-term volatility, long-run volatility persistence, and asymmetric volatility spillovers across the two markets since ($a_{12}^2, a_{21}^2, b_{12}^2, b_{21}^2, c_{12}^2, c_{21}^2$) are statistically different from zero.

Table 3. Cross-market spillover effects for the Conventional bonds and Islamic bonds (Sukuk)

The VARMA-BEKK-AGARCH model for the bond and Islamic Sukuk markets			
	Full sample	Pre COVID-19	Post COVID-19
Mean equation			
Φ_{10}	-0.001	0.014	0.033*
ψ_{11}	0.075**	0.061	0.213**
ψ_{12}	0.052	-0.105	0.142
γ_{11}	0.025***	0.023***	-0.314***
γ_{12}	-0.006***	0.008***	0.304***
Φ_{20}	0.046		
Φ_{20}	0.014**	0.023***	0.046***
ψ_{21}	0.037	0.064	0.003
ψ_{22}	-0.011	-0.183*	0.215**
γ_{21}	0.012***	0.031***	0.103***
γ_{22}	-0.015***	-0.002***	0.007***
φ_{20}	0.013		
Variance equation			
ω_{11}	0.153***	0.016	0.139***
ω_{21}	0.056***	-0.061***	0.023
ω_{22}	0.29e-05	-0.10e-05	-0.33e-05
a_{11}	0.055	-0.534***	-0.204*
a_{12}	0.166**	-0.077	-0.442***
a_{21}	-0.474**	1.171***	0.561**
a_{22}	0.017	0.477***	0.062
b_{11}	-0.327	0.659**	-0.271
b_{12}	-0.367**	0.391***	-0.189
b_{21}	0.421**	-1.823***	0.058
b_{22}	1.014***	-0.928***	-0.682***
c_{11}	-0.908***	0.635**	0.835***
c_{12}	-0.433***	0.302**	0.437**
c_{21}	1.091***	-0.400	-1.102***
c_{22}	0.672***	-0.513*	-0.593*
Model diagnostics			

AIC	-2.069	-2.799	-0.527
SBC	-1.722	-2.378	0.177
Log-L	320.7	296.5	48.18

Residual diagnostics for the independent series						
	RBOND	RSUKUK	RBOND	RSUKUK	RBOND	RSUKUK
Ljung-Box (20)	22.701	30.644*	21.461	34.701**	25.253	16.298
Ljung-Box (40)	33.068	59.962**	37.082	57.176**	49.756	60.489**
McLeod-Li (20)	17.186	30.096*	22.213	17.140	8.923	32.514**
McLeod-Li (40)	32.890	56.891**	55.750	60.267**	29.235	73.716***

Note: The coefficients in both the mean and variance equations are defined and discussed in the methodology section. RBOND and RSUKUK denote the conventional bonds and Islamic SUKUK represented as (1) and (2), respectively, across the models. The Ljung-Box and McLeod-Li tests are estimated to check for the autocorrelation and ARCH effects with the null hypotheses of no autocorrelation and no Arch effects for both the Ljung-box and McLeod-Li tests, respectively. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

The results regarding the inter-asset spillovers are available in the appendix due to space consideration (see Table 2.A and Table 3.A) which can be interpreted in a similar manner. We can observe that the bidirectional return and shock spillovers weakened in the COVID-19 subperiod.

4.2. Determinants of spillover effects

We further analyse the determinants of the conditional correlations and the volatility spillover transmission across the considered financial markets, using the daily gold, oil, Bitcoin prices and VIX and EPU indexes. On the one hand, oil is used as an input in producing almost all goods and services. This is why it is considered a strategic commodity. On the other hand, gold is considered as a safe haven during the inflation times of the booms and the recessionary of the slumps, and also uncertain times since it has a negative correlation with stocks.

Our paper is motivated by the previous safe haven literature where gold is traditionally considered as a safe haven asset. More recently, the oil price crash has been an additional major shock during the COVID-19 pandemic, and therefore it was important to add oil prices to our analysis to test whether oil prices changed the spillover effect between Islamic and conventional indexes. Finally, Bitcoin has a scalability problem due to the limited rate at which its network can process transactions. Governments are also afraid of bitcoin which is also bad to the environment. However, Bitcoin is often compared to gold, and many papers claim that Bitcoin has the same (or stronger) safe haven properties as gold. Therefore, to test this hypothesis we added Bitcoin in our analysis.

Table 4. Summary statistics for the Asymmetric Dynamic Conditional Correlation series and determinants

Panel (A): Asymmetric Dynamic Conditional Correlation series						
	CSTOCK-ISTOCK	CSTOCK-SUKUK	ISTOCK-BOND	BOND-SUKUK		
Mean	0.6493	-0.1123	-0.2621	0.6061		
Median	0.6500	-0.1120	-0.2645	0.6098		
Maximum	0.6955	0.0817	-0.0767	0.6518		
Minimum	0.6047	-0.3011	-0.3853	0.5009		
Std. Dev.	0.0127	0.0449	0.0418	0.0209		
Skewness	-0.2188	0.1860	0.6710	-1.9073		
Kurtosis	4.4566	6.2308	5.7911	9.3051		
Jarque-Bera	27.47***	125.61***	113.89***	644.88***		
ADF	-4.73***	-4.41***	-4.41***	-4.99***		
PP	-4.72***	-4.46***	-4.33***	-4.87***		

Panel (B): long-run determinant						
	COVID-19	GOLD	BITCOIN	OIL	VIX	US_EPU
Mean	1.0656	0.0017	0.0026	-0.0031	0.0034	156.47
Median	0.0000	0.0020	0.0017	0.0000	-0.0043	103.41
Maximum	11.165	0.1229	0.2080	0.1714	0.3821	737.37
Minimum	0.0000	-0.0964	-0.4939	-0.2528	-0.2662	19.850
Std. Dev.	2.8671	0.0220	0.0552	0.0363	0.0910	149.15
Skewness	2.6196	0.0956	-2.2778	-2.1867	1.1447	2.0706
Kurtosis	8.1774	10.657	26.138	21.042	6.0969	6.2338
Jarque-Bera	646.56***	696.66***	6604.1***	4092.9***	176.14***	329.01***
ADF	-1.032	-13.41***	-19.11***	-18.97***	-19.45***	-0.663
PP	-0.421	-13.37***	-19.03***	-18.94***	-19.29***	-2.222
ADF- 1 st Diff	-3.664***	-	-	-	-	-14.38***
PP- 1 st Diff	-19.65***	-	-	-	-	-28.93***

Note: This table shows the descriptive statistics for the Asymmetric Dynamic Conditional Correlation series between each of the two related assets obtained from the ADCC-EGARCH (1, 1) model. For example, CSTOCK-ISTOCK represents asymmetric dynamic conditional correlation series between the returns of the Conventional and Islamic stocks. COVID_19, Gold, Bitcoin, Oil, VIX, and US_EPU indicate respectively the daily new COVID-19 cases per million people, the returns of gold, Bitcoin, Oil, VIX index, and the Economic Policy Uncertainty index for the US economy. ADF and PP are the Augmented Dickey-Fuller and Phillips-Perron tests for the unit root tests, respectively. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

Table 4 displays the descriptive statistics for the ADCC estimates of the Islamic and conventional markets and the selected determinants, while Figure 1 presents the ADCC-GARCH results for the selected market pairs. We can observe that the correlations between the conventional stock markets and both Islamic stock and Sukuk markets are stronger than between the conventional bond markets and Islamic markets. Furthermore, the correlation between conventional bond and sukuk markets is decreasing over the COVID subperiod indicating that sukuk are a portfolio diversifier and could serve as a hedge and a safe haven during the pandemic subperiod.

Figure 1 ADCC-GARCH Results in the pre- and during COVID-19 periods.

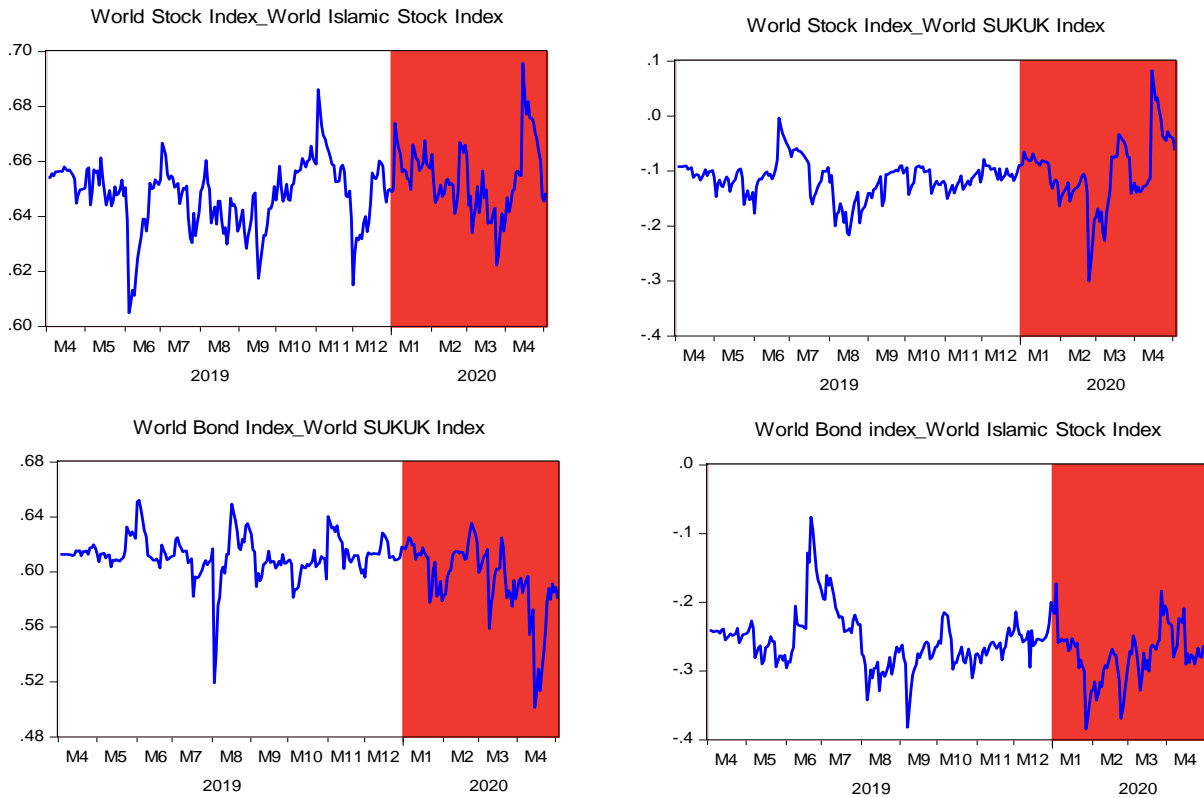


Table 5 displays the F-statistic testing cointegration between the markets and the selected factors. As demonstrated in Table 5, in all the models analysed there are strong and significant cointegration relationships between the ADCC estimates and selected factors, which suggests a strong explanatory power of the determinants in explaining the dynamics of asymmetric relationships between the conventional and Islamic markets.

Table 5. Bounds Cointegration test results

Cointegration hypotheses	F Stat.
$F(CSTOCK - ISTOCK_t, COVID_{19_t}, Gold_t, Bitcoin_t, Oil_t, VIX_t, US_EPU_t)$	5.932***
$F(CSTOCK - SUKUK_t, COVID_{19_t}, Gold_t, Bitcoin_t, Oil_t, VIX_t, US_EPU_t)$	8.114***
$F(ISTOCK - BOND_t, COVID_{19_t}, Gold_t, Bitcoin_t, Oil_t, VIX_t, US_EPU_t)$	3.642**
$F(BOND - SUKUK_t, COVID_{19_t}, Gold_t, Bitcoin_t, Oil_t, VIX_t, US_EPU_t)$	5.547***

Note: This table presents the results of the Bounds-Cointegration tests. For the ARDL models, the dependent variables are the Asymmetric Dynamic Conditional Correlation series between each of two related assets, respectively. For example, $CSTOCK - ISTOCK_t$ represents the asymmetric dynamic conditional correlation series between the returns of the Conventional and Islamic stocks. $COVID_{19}$, Gold, Bitcoin, Oil, VIX, and US_EPU indicate the daily new COVID-19 cases per one million people, the returns of gold, Bitcoin, Oil, VIX index, and the Economic Policy Uncertainty index for the US economy. The ARDL critical values are 2.088–3.103, 2.431–3.518 and 3.173–4.485 for the 10%, 5%, and 1% significance levels, respectively. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

The analysis of the long-run determinants of the ADCCs between each of two related assets shows that the COVID-19 is a significant determinant of the spillovers between the Conventional-Islamic stocks and Conventional bond-sukuk markets (Table 6). However, these markets cannot influence the spillover effects between the Conventional stock – Sukuk and the Islamic stock-Sukuk market pairs. Further, VIX and gold prices are strong predictors of the ADCCs of the conventional stock and both Islamic asset markets, but they are not significant for the conventional bond market and Islamic markets' ADCCs. Additionally, the US EPU Index which captures uncertainty in economic activity is a significant determinant of the ADCCs only for the conventional – Islamic stock market pair, which is opposite to the results reported for the oil prices. Finally, Bitcoin which is often compared to gold, cannot predict any of the ADCCs in our sample.

Table 6. Determinants of the conditional correlations and volatility transmission across the financial markets

Explanatory variables	CSTOCK-ISTOCK	CSTOCK-SUKUK	ISTOCK-BOND	BOND-SUKUK
COVID_19	0.006216***	0.005978	-0.006155	-0.004697**
Gold	-0.219239**	-0.980261**	0.651962	-0.135557
Bitcoin	0.034328	-0.547382	-0.457598	-0.057478
Oil	-0.031687	0.705039**	0.444384*	0.204581**
VIX	0.150606***	-0.597174***	-0.304051	-0.031704
US_EPU	-0.000101***	0.000141	0.000111	7.62E-06
C	0.657548***	-0.126960***	-0.272345***	0.610936***

Notes: This table shows the long-run determinants of the Asymmetric Dynamic Conditional Correlation series between each of two related assets using the Newey and West autocorrelation and the heteroskedasticity robust standard errors (HAC) method. For example, $CSTOCK - ISTOCK_t$ represents the asymmetric dynamic conditional correlation series between the returns of the Conventional and Islamic stocks. COVID_19, Gold, Bitcoin, Oil, VIX, and US_EPU indicate daily new COVID-19 cases per million people, returns of gold, Bitcoin, Oil, VIX index, and Economic Policy Uncertainty index for the US economy. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

5. Conclusion

This paper provides novel empirical evidence on the safe haven properties of Islamic stocks and Islamic bonds (Sukuk) during the COVID-19 pandemic outbreak. First, we show that only Sukuk can be used as a hedge of conventional bond markets during the COVID-19, while the spillover effect between the conventional and Islamic stocks is amplified by the pandemic⁶. Second, the results reveal a strong cointegration between the ADCC estimates of

⁶ As a robustness check, we test the sensitivity of our results to the selection of sub-sample periods. Our main conclusion remains valid even after controlling for the selection of the sub-period. In particular, we re-run the empirical models using consistent sub-periods with the same number of trading days (a total of 126 calendar days for each subperiod). Hence, the new first sub-sample runs from August 27, 2019 to December 30, 2019 where the second sub-sample period spans from December 31, 2019 to May 4, 2020. Results are available upon request.

the considered markets and all selected predictors. However, the robustness tests display that only a few factors can determine the spillover effects between the Islamic and Conventional assets, with gold and oil prices are still most influential, while Bitcoin is unable to explain the Islamic-Conventional markets relationships.

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Appendix A.

Table 2A. Cross-market spillover effects for the Conventional stocks and (Islamic) SUKUK

The VARMA-BEKK-AGARCH model for Conventional stock and Islamic SUKUK						
	Full sample	Pre COVID-19		Post COVID-19		
Mean equation						
Φ_{10}	0.071	-0.013	0.101			
ψ_{11}	0.134**	0.168*	0.075			
ψ_{12}	-0.463	0.446	-1.139*			
γ_{11}	0.0144***	0.038***	-0.008***			
γ_{12}	-0.004***	0.037***	0.0243***			
φ_{10}	-0.413***					
Φ_{20}	0.025***	0.021***	0.033***			
ψ_{21}	0.006	0.007	0.033***			
ψ_{22}	-0.252***	-0.445***	0.284***			
γ_{21}	-0.006***	-0.001***	0.001***			
γ_{22}	0.005***	0.001***	-0.003***			
φ_{20}	0.026					
Variance equation						
ω_{11}	0.097	0.151	-0.306***			
ω_{21}	-0.08***	-0.093***	0.051***			
ω_{22}	-0.382e-06	-0.1e-05	-0.12e-06			
a_{11}	-0.233*	0.124	-0.553***			
a_{12}	0.072***	-0.005	0.035*			
a_{21}	0.304	2.452***	0.619			
a_{22}	-0.124	0.504***	-0.219**			
b_{11}	0.459***	0.419***	0.725***			
b_{12}	-0.009	0.019**	0.038***			
b_{21}	5.081***	-3.233***	-0.659			
b_{22}	0.021	0.114	0.674***			
c_{11}	-1.047***	1.057***	0.791***			
c_{12}	-0.067**	-0.002	0.31e-03			
c_{21}	7.239***	-16.605***	-0.752			
c_{22}	1.367***	0.332	0.119			
Model diagnostics						
AIC	2.140	1.366	3.502			
SBC	2.487	1.787	4.206			
Log-L	-276.9	-107.5	-129.1			
Residual diagnostics for the independent series						
	RCSTOCK	RSUKUK	RCSTOCK	RSUKUK	RCSTOCK	RSUKUK
Ljung-Box (20)	19.981	64.081***	25.300	60.396***	17.046	18.392
Ljung-Box (40)	40.756	86.276***	52.141	82.424***	42.388	60.181**
McLeod-Li (20)	2.832	16.753	5.285	16.943	28.753*	17.628
McLeod-Li (40)	5.074	37.924	14.592	59.140**	63.004**	51.339

Note: The coefficients in both the mean and variance equations are defined and discussed in the methodology section. RCSTOCK and RSUKUK are the Conventional stock and Islamic SUKUK returns, respectively, denoted as (1) and (2) across the models. Ljung-Box and McLeod-Li tests are estimated to test for autocorrelation and ARCH effects with the null hypotheses of no autocorrelation and no Arch effects for both the Ljung-box and McLeod-Li tests, respectively. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.

Table 3A. Cross-market spillover effect for Islamic stock and (Islamic) SUKUK

VARMA-BEKK-AGARCH model for Islamic stock and bond						
	Full sample		Pre COVID-19		Post COVID-19	
Mean equation						
Φ_{10}	0.049		0.041		0.018	
ψ_{11}	0.139**		0.185***		0.272***	
ψ_{12}	0.376*		0.312		1.193**	
γ_{11}	0.047***		0.004***		-0.053***	
γ_{12}	-0.005***		0.062***		-0.032***	
φ_{10}	-0.316***					
Φ_{20}	0.022**		0.017		0.041***	
ψ_{21}	-0.001		-0.028		-0.006	
ψ_{22}	0.079		-0.009		0.133	
γ_{21}	-0.010***		0.009***		-0.021***	
γ_{22}	-0.021***		0.022***		-0.004***	
φ_{20}	0.021					
Variance equation						
ω_{11}	0.185***		0.162***		0.163*	
ω_{21}	-0.044		0.026		-0.077***	
ω_{22}	0.095***		-0.46e-06		-0.15e-06	
a_{11}	0.187		0.156		0.549***	
a_{12}	0.065***		0.029		-0.075***	
a_{21}	0.053		0.224		0.523	
a_{22}	0.218		0.080		0.087	
b_{11}	0.808***		0.828***		-0.669***	
b_{12}	-0.008		-0.001		0.019	
b_{21}	0.181		-0.099		-1.751	
b_{22}	0.652***		0.947***		0.606***	
c_{11}	0.843***		0.670***		1.147***	
c_{12}	-0.062***		-0.058**		-0.017	
c_{21}	-0.258		-0.049		1.629	
c_{22}	0.383***		-0.243		-0.521**	
Model diagnostics						
AIC	1.948		1.095		3.788	
SBC	2.295		1.517		4.492	
Log-L	-249.672		-81.254		-141.6	
Residual diagnostics for the independent series						
	RISTOCK	RBOND	RISTOCK	RBOND	RISTOCK	RBOND
Ljung-Box (20)	23.469	24.313	18.198	21.853	22.195	33.417**
Ljung-Box (40)	50.651	34.201	49.838	39.944	62.0907**	58.824**
McLeod-Li (20)	34.619**	23.243	24.009	15.638	15.105	16.669
McLeod-Li (40)	58.833**	48.889	52.545*	42.454	61.707**	71.953***

Note: The coefficients in both the mean and variance equations are defined and discussed in the methodology section. RISTOCK and RBOND are Islamic stocks and bonds returns, respectively, denoted as (1) and (2) across the models. The Ljung-Box and McLeod-Li tests are estimated to test for autocorrelation and ARCH effects with the null hypotheses of no autocorrelation and no Arch effect for both the Ljung-box and McLeod-Li tests, respectively. ***, ** and * represent significance at the 1%, 5% and 10% levels, respectively.