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COVID-19 Pandemic and Dependence Structures Among Oil, Islamic and Conventional Stock Markets Indexes*

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Abstract

The popularity of Islamic financial instruments among Muslims is not surprising. The Islamic capital market is where sharia-compliant financial assets are transacted. It works parallel to the conventional market and helps investors find sharia-compliant investment opportunities. At a time of collective confusion when the COVID-19 epidemic is contributing to unprecedented change, this paper is keen to understand how attractive conventional and Islamic stock markets have been to investors recently. Second, this paper takes advantage of the time-scale decomposition property of the wavelet to simultaneously capture risk exposure and distinguish the risks faced by short- and long-term investors. To this end, this research conducted a two-step investigation of the daily closing equity market price indices for three Islamic stock markets and their conventional counterparts. Given that different financial decisions occur with greater or less frequency, the paper examines the connectedness of stock markets operating at heterogeneous rates and identifies the timescales using wavelet-DCC-GARCH analysis to take account of both the time and the frequency domains of stock market connectedness. The paper findings highlight the strong evidence of contagion that can be seen in nearly all conventional stock markets in the COVID-19 pandemic; they reach a high level of dependency in such health crises. Furthermore, Islamic stock markets prove to be a rich ground for global diversification.

Keywords: International Diversification, Time and Frequency Domains Dependency, Wavelet-DCC-GARCH, Stock Market Connectedness, Financial Economics

JEL Classification Code: G11, G15, G14

1. Introduction

The novel coronavirus pandemic has created havoc in the world economy. According to the World Health Organization (WHO), this global health crisis has already affected more than 45 million people in over 200 countries and has killed a million people. It is widely accepted that such extremely infectious diseases do not occur in isolation; this one has severely affected the real economy, with a negative impact on almost all sectors (Mukherjee & Bardhan, 2020). A comprehensive literature survey concerning the economic impact of the COVID-19 pandemic, and other natural disasters, can be seen in the pioneer study of Goodell (2020).

COVID-19 has generated significant instability and high volatility in global capital markets. While the full impact is yet to be determined, it's expected that the adverse impact is likely to continue from the virus's knock-on effects. The financial sector has been one of the most affected, with bank valuations dropping in all countries around the world. Besides, the novel coronavirus has particularly affected financial markets all over the world. It created an unprecedented level of risk, causing investors to suffer significant losses in a few days. For one thing, when COVID-19 was declared to be a global pandemic, the major international stocks fell by around 30% percent or more. Globally, stock markets continued to exhibit a high degree of volatility, with a cumulative loss of more than $9 trillion

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since the outbreak of the infection. Likewise, the oil price market has witnessed its highest losses since the Gulf War of 1991 (Mukherjee & Bardhan, 2020).

Historically, the literature on the financial markets emphasizes that stock markets move up or down with every item of news related to a pandemic and the investors' reaction is characterized by unprecedented volatility (Tetlock, 2007). Moreover, studies have ascertained that oil prices can also contribute to the volatility of stock prices through their impact on future cash flows and/or through the interest rate. It is a commonly held belief that high oil prices directly and negatively impact the. economy and the stock market (Henriques & Sadorsky, 2008).

From the investment standpoint, the transmission of stock markets across boundaries reflects investors' desire to move capital away from "risky" and toward "safer" investment (Bhatia et al., 2020). Theoretically, "safer" investment and an optimal portfolio can be built using low correlated equities. However, such diversification is not easy to undertake in practice, because the correlations between several equity markets not only vary over time but also intensify due to spillover effects (Arezki et al., 2013).

In theory, Islamic equities are less susceptible to shock owing to their lower leverage, the smaller size of firms, and the under-diversification of the market (Rizvi et al., 2015). Ashraf and Mohammad (2014) noted that Islamic stocks in market downturns perform better than conventional indices. It has also been observed that Islamic finance investment fared better in the immediate aftermath of the Global Financial Crisis of 2007 (Zhang et al., 2020).

The COVID-19 pandemic has resulted in the shutting down of large parts of the real economy which in turn has affected both Islamic and conventional investments. The decline in financial markets following the onset of this pandemic resembles that in the 2007 financial crisis. However, the question is whether in the present crisis Islamic investments will show the resilience or hedging benefits that it showed then. Consequently, the issue of the hedging benefits of Islamic stock has received considerable critical attention. To mention a few writers, Ashraf and Mohammad (2014) used a logistic smooth autoregression model to reveal that Islamic equity investments provide hedging benefits in severe market downfalls. Yarovaya et al. (2020) addressed the spillover between conventional and Islamic stock and bond markets. The authors showed that Islamic bonds (Sukuk) have demonstrated haven properties in this pandemic, while the spillovers between conventional and Islamic stock markets have concurrently become stronger (Herwany et al., 2021).

There is a strong possibility, therefore, that the continuing spread of this pandemic will escalate interest in the Islamic stock markets as potential safe havens, which has called for greater research effort in this area. Against this backdrop, the main objective in the present study is to offer some important insights into the possible existence of lead-lag relationships between Islamic indices and their conventional counterparts in and around episodes of the COVID-19 pandemic. In particular, this paper contributes to the ongoing debate in several ways. First, the paper complements the literature on the response of the stock market to different crises by examining the extent to which conventional and Islamic stock markets have attracted investors in these troubled times. Second, the paper gives an account of the tussle between Russia and Saudi Arabia over oil supplies and prices[1]. The price war erupted between Saudi Arabia and Russia in early March when Riyadh failed to persuade Moscow that deep supply cutbacks were needed to deal with the loss of demand from the pandemic. The OPEC+ alliance they had led for three years, aimed at coordinating output to prevent surpluses, fell apart (Smith, 2020). The ongoing stalemate between them has resulted in additional uncertainty which has increased the risk for the financial markets.

2. Literature Review

From the investment standpoint, oil prices and stock markets interact implicitly through the interest rate channel which is used to discount future cash flows (Bondia et al., 2016). In fact, the motivation for linking stock markets (both Islamic and conventional) to oil price and vice versa is drawn from the quest for portfolio diversification for safe-haven during the period of financial turmoil (Yarovaya et al., 2020). Yet any consensus on which type of stock indices (Islamic or conventional) to include in the portfolio analysis remains a fertile ground for research.

Recent literature in this regard has suggested that Islamic investment might be considered, for global investors, among the most important factors in international diversification. The Islamic stock indices are less prone to the leverage effect given the upper limit of debt financing imposed by Shariah (quantitative) screening (Hussein & Omran, 2005). Hussein and Omran (2005) suggested that Islamic indices yielded even negative returns with a bear market and exhibited significant abnormal returns with a bull market. The profits in the Islamic market arise as compensation for risk, not as a result of mispricing since the higher rise in Shariah-based investments encourages investors' participation in buying rather than selling. The Islamic stock markets are more efficient than the conventional counterpart since their stock prices do not have common information on their stochastic trends (Rizvi et al., 2015). One further key argument is the connectedness during the time of financial uncertainty and major events that have affected stock market returns. Seminal studies in this area have been conducted in the literature, in which the authors examine this connectedness due to political events and economic conditions (Bash & Alsaifi, 2019, Sharif et al., 2020).

From the modeling perspective, almost all literature mentioned thus far typically adopts GARCH type models, Vector autoregressive (VAR) model, cointegration to analyze the relationship between crude oil and stock markets. Recently, Mensi et al. (2017) suggested using a multivariate spillover framework to identify the risk of spillover between crude oil, Islamic and conventional stocks in the multiscale domain. Anas et al. (2020) investigated the decoupling and integration between the region-wise (Asia, Europe, Africa and the Americas) developed and emerging market's equity pairs of Islamic and conventional stock returns with the focus on multi-horizons. In doing so, daily wavelet and ADCC-based stock returns correlations are estimated to capture the dynamics of time-frequency and the time-domain-based correlations, respectively. The findings of this study indicated that at the short-term horizon, all selected emerging and developed Islamic and conventional equity markets across all regions depict a high positive correlation, suggesting a rejection of the decoupling hypothesis.

The present paper argues that what has been called 'financial contagion' by the related literature can at most define a correlation feature of the data, while the modeling issue is still questionable, despite the use of GARCH-type models, which are most capable of tackling the question: Can the correlation between different stock market returns be considered evidence of contagion or safe haven? However, the primary interest of this investigation is to answer two other, more challenging, questions: How do we model this kind of correlation in both the time and the frequency domain? and, how can we simultaneously capture risk exposure and distinguish the risks faced by short- and long-term investors?

Accordingly, this paper takes advantage of the time-scale decomposition property of the wavelet to decompose the considered return series into different periodicity series, ranging from the shortest-periodicity series to the longest-periodicity series. This paper begins by arguing that the adverse effect of crises in international financial markets appears quickly, during the first two weeks or even sooner. Next, it treats decomposed series as input in a best-fitting nonlinear GARCH model to measure the dependence between two market returns.

3. The Empirical Methodology

Wavelets are mathematical functions that cut up data into different frequency components, and then study each component with a resolution matched to its scale. Wavelets refer to a well-established technique for decomposing a time series into small waves which begin at a certain point in time and end later. A significant advantage of this approach is that frequency information can be obtained without losing the timescale dimension. Another advantage of wavelet analysis is that it needs to make no assumptions concerning the data generating process for the return series under investigation (an insightful development of the theory and use of wavelets can be found in Percival and Walde (2000).

The co-movement between two-time series can be examined using the Maximal Overlap Transformation (MOTWT). In this regard, for a defined stochastic process $\tilde{W}_{j,t} \simeq \sum_{l=0}^{L_j-1} h_{j,l} X_{t-1}$, the variation of the univariate time series. To decompose the sample covariance into different time scales, the wavelet correlation at scale (λ_j) can be estimated as follows:

$$\tilde{\rho}_{XY}(\lambda_J) \equiv \frac{\sigma_{X,t}(\lambda_j)}{\sigma_X(\lambda_j)\sigma_Y(\lambda_j)} \quad (1)$$

For the purpose of this study, this paper assumes a compact Daubechies function of minimal asymmetry filter of length eight [LA(8), hereafter]. To generate uncorrelated coefficients across scales. Following the seminal work in the field, this level of decomposition leads to six levels of wavelet scales $D_i, \forall i = 1, \ldots, 6$ representing the variations caused by shocks occurring on a timescale of 2^i days. Moreover, S_6 is the residue of the original signal after subtracting D1, D2, D3, D4, D5, and D6 in turn?

Having discussed the wavelet function, this research is in a position to model the changes of the dependency structure in the volatility occurring on the short-runtime scale D1 and D2. Suppose that the stock market return R_t can be written as

$$R_t = \mu + \varepsilon_t; \quad \varepsilon_t = Z_t\sqrt{h_t} \quad (2)$$

Assume that each series Y_{it} follows the GJR GARCH $(1, 1)^2$ model introduced by Glosten et al. (1993), represented by the expression.

$$\zeta_t^2 = \delta + \alpha\varepsilon_t^2 + \gamma\varepsilon_{t-1}^2 d_{t-1} + \beta h_{t-1} \quad (3)$$

where (α) and (β) measure the size effect and persistence of the shocks on volatility, while the sign effect is given by (γ). The impact of the shocks (news) is determined by the dummy such that $d_t = 1$ if $\varepsilon_t < 0$ (bad news) and $d_t = 1$ otherwise.

The marginal distribution function for each index is, therefore, defined as $F_i(X_i) = F_{\varepsilon i}\left(\frac{Y_i}{\sqrt{h_i}}\right)$. Further, the joint density, $f(Y_t)$, is then specified in terms of marginal

distributions for the error terms, ε_t, combined with a copula function in Equation 5, which is

$$f\left(Y_1, \ldots, Y_p\right) = C\left(x_1, \ldots, x_p; \rho\right)\prod_1^p \frac{1}{\sqrt{h_i}} F_i(X_i) \quad (4)$$

The distribution function, as well as the correlation matrix, can then be obtained in the process of building a model by solving the maximum likelihood estimator of the parameter vector of each market return.

4. Empirical Results

The data in this study are drawn from the daily closing equity market price indices for three Islamic stock markets and their conventional counterpart, specifically the Jakarta Islamic Index (JKII), Jakarta Composite Index (JKSE), FTSE Bursa Malaysia (KLSE), the Dow Jones Islamic Market Malaysia (MYETF), Dow Jones Islamic Market Index (DLW1DOWA), and Dow Jones U.S. Completion Total (DWCPF). Furthermore, crude oil prices are included to indicate the continuing conflict between Russia and Saudi Arabia over oil supply and prices, which adds to the uncertainty and risk.

The summary statistics of the return series are reported in Table 1. Broadly speaking, the returns are skewed to the left because the skewness is negative for all series. Moreover, excess kurtosis statistics indicate that all the series display fatter tails. The Jarque–Bera statistic of normality corroborates this finding. (See Table 1).

In this section, the paper presents the results of estimating the correlation through the DCC-GJR-GARCH (1, 1) model. However, it is worth noting that, because they are limited to the extent that stock markets have been affected by the COVID-19 crisis over the frequency and time domains, the results and discussion of wavelet and univariate GARCH specification are beyond the scope of this study[3]. Another important point to note is that the U.S. stock market is adopted as a numeraire for the correlations. Therefore, what this research considers here is the co-movements between DLW1DOWA and DWCPF and other listed markets.

Before giving our interpretation of these results, an important question still has to be addressed; it concerns the number of days that the change in correlation between two stock markets should last for them to be classified as affected by contagion or a safe haven. The EMH is a hypothesis in financial economics that states that asset prices reflect all available information. A direct implication is that it is impossible to "beat the market" consistently on a risk-adjusted basis since market prices should only react to new information. Theoretically, EMH states that the transmission of shocks due to contagion (safe haven) in international financial markets should not exist in the long run. Moreover, several papers suggest that a change of correlation should generally not exceed one week (Fama, 1970). Accordingly, this paper takes the advantage of the time-scale decomposition property of the wavelet to decompose the considered return series into different periodicity series, ranging from the shortest- to the longest-periodicity series. Then the paper argues that the adverse effect of crises in international financial markets appears quickly, by the second week or even sooner.

Presented in Table 2 is the correlation of DLW1DOWA and DWCPF as a potential safe haven (or contagion), comparing the return from the Islamic indices under study and their conventional counterparts with that from the oil markets before the COVID-19 outbreaks. Notable in panels A and B of Table 3 is the negative tail dependence for oil, KLSE, JKSE, and DWCPF, suggesting that DLW1DOWA is accepted as a strong safe haven asset for investors. Unlike the latter markets, the others in the rest of the sample have relatively weak tail dependence (around zero) and thus DLW1DOWA acts as a weak safe haven for these assets. Moreover, this research has evidence of contagion for DWCPF against oil, KLSE, and JKSE since a positive co-movement of these three can be seen.

The results of the correlational analysis between the considered indices in COVID-19 outbreaks are presented in Table 3. Generally, nearly all the assets reached a new level of tail dependency up to scale D2 in the health crises. A look at panels A and B of Table 3 show the significant impact of the COVID-19 pandemic. In detail, DLW1DOWA is seen as a strong haven against almost all the rest of the sample, with around 10% negative tail dependence.

Table 1: Descriptive Statistics

	JKII	JKSE	KLSE	MYETF	DLW1DOWA	DWCPF	Oil
St. Deviation	0.044	0.085	0.104	0.055	0.066	0.096	0.064
Kurtosis	5.317	6.298	8.78	2.522	7.245	5.635	5.337
Skewness	–2	–1.117	–1.199	–0.342	–1.186	–0.139	–1.98
Jarque-Bera	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]

P-value in square brackets.

Table 2: DCC-GJR-GARCH (1, 1)-Wavelets Correlation Among the Markets under Review BEFORE the COVID-19 Outbreaks

Correlation	JKII	DLW1DOWA	JKSE	MYETF	KLSE	Oil	DWCPF
Panel A: Correlation at High Frequency Over the 2−4 Days							
JKII	1.000	0.066	−0.046	−0.028	−0.100	0.102	−0.293
DLW1DOWA	0.016	1.000	−0.100	−0.003	−0.111	−0.104	−0.089
JKSE	−0.046	−0.100	1.000	0.028	−0.013	−0.064	0.150
MYETF	−0.028	−0.003	0.028	1.000	0.054	−0.063	−0.138
KLSE	−0.100	−0.111	−0.013	0.054	1.000	−0.001	0.180
Oil	0.102	−0.104	−0.064	−0.063	−0.001	1.000	0.211
DWCPF	−0.293	−0.089	0.150	−0.138	0.180	0.211	1.000
Panel B: Correlation at High Frequency Over the 4−8 Days							
JKII	1.000	0.061	−0.038	−0.029	−0.121	0.106	−0.091
DLW1DOWA	0.026	1.000	−0.236	−0.012	−0.125	−0.111	−0.116
JKSE	−0.038	−0.236	1.000	0.021	−0.029	−0.045	0.266
MYETF	−0.029	−0.012	0.021	1.000	0.059	−0.059	−0.130
KLSE	−0.121	−0.125	−0.029	0.059	1.000	0.015	0.259
Oil	0.106	−0.111	−0.045	−0.059	0.015	1.000	0.180
DWCPF	−0.091	−0.116	0.266	−0.130	0.259	0.180	1.000

Table 3: DCC-GJR-GARCH (1, 1)-Wavelets Correlation Among the Considered Markets DURING Outbreaks of COVID-19

Correlation	JKII	DLW1DOWA	JKSE	MYETF	KLSE	Oil	DWCPF
Panel A: Correlation at High Frequency Over the 2−4 Days							
JKII	1	0.071	0.704	−0.018	−0.012	−0.042	0.015
DLW1DOWA	−0.071	1.000	−0.150	−0.126	−0.115	−0.096	−0.065
JKSE	0.704	−0.150	1.000	−0.081	0.011	−0.008	0.148
MYETF	−0.018	−0.126	−0.081	1.000	0.058	−0.025	0.152
KLSE	−0.012	−0.115	0.011	0.058	1.000	−0.036	0.281
Oil	−0.042	−0.096	−0.008	−0.025	−0.036	1.000	0.314
DWCPF	0.015	−0.065	0.148	0.152	0.281	0.314	1.000
Panel B: Correlation at High Frequency Over the 4−8 Days							
JKII	1.000	0.061	−0.040	−0.024	−0.065	0.081	−0.084
DLW1DOWA	−0.061	1.000	−0.116	−0.147	−0.116	−0.118	−0.102
JKSE	−0.040	−0.116	1.000	0.023	−0.012	−0.065	0.144
MYETF	−0.024	−0.147	0.023	1.000	0.060	−0.046	0.133
KLSE	−0.065	−0.116	−0.012	0.060	1.000	0.010	0.183
Oil	0.081	−0.118	−0.065	−0.046	0.010	1.000	0.331
DWCPF	−0.084	−0.102	0.144	0.133	0.183	0.331	1.000

The more interesting correlation is with the DWCPF, where the correlation becomes positive: around 15% in the case of JKSE and MYETF and exceeding 25% in the case of oil and KLSE, where evidence of contagion can be seen.

Taken together, these results provide some support for the potential benefits of portfolio diversification. In tranquil times, short-run time horizon investors seek to invest in Islamic stock markets for safe haven purposes. Moreover, these results suggest that the COVID-19 pandemic was a source of contagion not linked to any observed changes in macroeconomic fundamentals but mainly the result of the behavior of investors or other financial agents since the estimated correlation coefficients in almost all of the pair-wise stock market indices are greater than those in tranquil times.

5. Conclusion

Contagion-affected financial markets show erratic behavior and overreact to unexpected events in a crisis-induced region. The COVID-19 outbreak has recently hit the world with immediate and tangible consequences for economic and financial markets.

The current paper explores the level of attractiveness of the traditional and Islamic capital markets to investors during times of crisis. To do so, this research conducted a two-step investigation of the daily closing equity market price indices for three Islamic stock markets and their conventional counterparts, namely, the Jakarta Islamic Index (JKII), Jakarta Composite Index (JKSE), FTSE Bursa Malaysia (KLSE), the Dow Jones Islamic Market Malaysia (MYETF), Dow Jones Islamic Market Index (DLW1DOWA), and Dow Jones U.S. Completion Total (DWCPF).

The findings reported here reveal the importance of time- and frequency-varying properties for potential portfolio diversification benefits in turbulent and quiet times. In our case, the benefits for the conventional markets of diversification were almost lost. But at the same time, Islamic stock markets still provide a fruitful ground for international diversification.

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Endnotes

[1]On 6th March 2020, Russia refused to comply with the decision to cut oil supplies made by the OPEC summit in Vienna on March 5. In response, Saudi Arabia made announcements on 8th March regarding oil production increases and price discounts ranging from $6 to $8 per barrel for European and Asian customers.

[2]This paper refers to GJR-GARCD due to its capacity to capture the long-lasting impact of a negative shock that might cause asymmetric leverage volatility.

[3]The results will be made available upon request.