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Impact of the COVID-19 outbreak and its related announcements on the Chinese conventional and Islamic stocks’ connectedness

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ABSTRACT

In this paper, we assess the impacts of the COVID-19 counts (infected cases, deaths and recovered) and related announcements on the Islamic and conventional stocks interplays in the Chinese market. We test whether Islamic stocks are perceived as assets providing diversification benefits in time of COVID-19 pandemic. Doing so, we implement a multivariate GJR-GARCH model under dynamic conditional correlation (DCC) as well as multiple and partial wavelet coherence methods to recent Chinese daily data ranging from 2 December 2019 to 8 May 2020 and COVID-19 related announcement for the period. Our results from multivariate GJR-GARCH models reveal that COVID-19 infected cases and deaths do impact mean DCCs between Islamic and conventional stocks, number of recovered do not have such impact, while none of the above have any significant impact on the DCCs fluctuations. However, when we analyze the impact of COVID-19 related announcement on the variation of conditional correlation between two stocks (i.e. DCC volatility) our findings show that 7 out of 10 such announcements (mainly those with serious health treats or economic implications) do effect those volatilities in Chinese equity market. The empirical findings from partial and multiple wavelet coherences provide robust evidence of instability in the co-movement between Islamic and conventional indexes for different scales and over dissimilar sub-periods. Indeed, the weakening of co-movements is especially notable in the very short and short-run where operating the short-term investors. Our empirical findings offer several key propositions for policy makers and portfolio managers in China with broad implications applicable to other markets.

1. Introduction

The end of December 2019 and the early months of 2020 have witnessed the outbreak of the novel Coronavirus disease (COVID-19) globally and as a result, stock markets around the world suffered historic losses amid massive selloffs tied to the pandemic. The drop came as a result of the halt imposed by authorities to most activities in an effort to slowdown the spread of the virus, the huge selloffs from panicked investors and the ambiguity of impact and duration of the pandemic. Economists have warned that the economic impact of the pandemic is likely to be worse than the 2008 sub-prime mortgage crisis (BBC, 2020). Most governments have pledged massive funds to rescue their economies from falling into a recession, which has helped to lift share prices to some extent. Despite these
monetary and financial stimuli, stocks’ volatilities are still expected to remain high, while the duration and effect of COVID-19 remains unknown. A research paper by Ma et al. (2020) suggests that previous episodes of pandemics and epidemics observed in the 21st century have negative impact on economic growth and stock prices, fall in corporate profitability and employment, an increase in corporate debt and higher sovereign credit default spreads (CDS). Those effects are expected to be only stronger for the case of COVID-19 due to its scale and influence on economy.

During crisis situations it becomes vital for portfolio managers to search for diversification benefits and safe haven assets. Although there is no previous stock market experience where an epidemic had such a strong impact analogous to the COVID-19 shock, stock markets have witnessed other crisis situations, the 2008 global financial crisis (GFC) being the latest. For the 2008 GFC, some researchers have demonstrated that Islamic stocks provide a diversification benefit for portfolio managers due to their decoupling from their conventional counterparts (see, among others, Kenourgios et al., 2016; and Saadaoui et al., 2017).

Thus, it is interesting to examine whether Islamic indexes will also provide similar diversification benefits during the current COVID-19 crisis as well, more specifically in case of China. In this study, we investigate how the COVID-19 is affecting the Islamic and conventional stocks’ interplay in China, whether Islamic assets are a safe haven during the crisis and how the COVID-19 cases (infected, deaths and recovered counts) and other related announcements are affecting the time varying correlations between the two assets. We answer these questions by combining two distinct methods of multivariate DCC-GARCH as well as multiple and partial wavelets to understand the impact of COVID-19 cases and related announcements on co-movements between Islamic and conventional stocks in China. While multivariate DCC-GARCH can assist us in analyzing the impact of COVID-19 cases and related announcements on time-varying co-movement between Islamic and conventional stocks in China, the methods of multiple and partial wavelets are used due to their ability to visualize the relationship between the time series variables across time-scales and frequency bands.

To conduct our analysis, we use daily returns of the conventional and Islamic Large and Mid-Cap. indexes in China. Variables used are four indexes representing Large and Mid-Cap. conventional and Islamic stocks in China provided by MSCI for the time period starting from 31 December 2019 until 8th May 2020. China has been chosen as it is the first country in which the Coronavirus has spread and the first to impose countrywide closures, which means that daily data is available for a longer period compared to other countries still combating the virus. Moreover, whereas as of 8 May 2020 (the last date included in this study), from total of almost 4 million COVID-19 cases globally more than 60% was still active, while China has nearly 99.7% of its COVID-19 cases closed. Thus, China can be considered an almost complete case that can be used as inference for other countries.

The rest of the paper is organized as follows. Section 2 provides review of literature related to the impact of COVID-19 on stock market volatility while also diving into relationship between Islamic and conventional stock and Chinese stock market. Section 3 gives general summary of used data and methods employed in the study. The empirical results are produced and discussed in Section 4, while Section 5 concludes the paper and provides some policy recommendations.

2. Literature review

Talking about the impact of COVID-19 cases on stock markets, we observe mixed findings in the economic literature. Some researchers have found no impact on countries such as the U.S. (Onali, 2020) while others found that the pandemic had a strong impact when accommodated with oil volatility shocks (Sharif et al., 2020). Yan et al. (2020) studied the effect of COVID-19 outbreak on the different industries, namely, travel, entertainment, technology and gold mining in the stock market. They concluded that in the short run, all of the industries are affected by the outbreak due to the short-term panic selloff, however, in the long run, the markets will correct themselves and will get back to normal.

In line with the above findings, Vermaelen (2020) suggests that the stock market downturn due to COVID-19 is less severe in the U.S than previous crises and outbreak mainly due to the increased knowledge about the value of companies and the US government initiatives to revive the economy. Moreover, Liu et al. (2020b) argues that the Asian stock market reacted faster to the pandemic and the markets recovered slightly in the later stage of the outbreak. The fast effect of the pandemic is due to the fear sentiment of investors. Interestingly, Pagano et al. (2020) found that more resilient companies greatly outperformed less resilient companies. They define pandemic resilience as robust social distancing that rely on technologies and/or organizational structures. The amount of resilient firms’ cumulative return differential in 2014 to 2019 is the same magnitude as during the pandemic. The authors perceived that investors increase their awareness of the potential risk due to outbreaks well in advance of its realization. Moreover, markets perceive a new risk factor, namely pandemic risk, as a part of price exposure.

Baker et al. (2020) have an opposite conjecture. The authors stated that the effect of the pandemic is more powerful than the previous outbreaks, namely Spanish flu. They proposed three explanations. First, the current outbreak has serious implications for public health and the economy due to the severity of the pandemic, ease of the disease spread, and the non-negligible rate of mortality. Second, the speed of information spread is much faster now than a century earlier. Consequently, it triggers daily stock market jumps and high market volatility. Third, the modern economy is connected throughout the world. It is very unlikely that a country is immune to the crisis. As suggested by He et al. (2020) that there is an evidence of bidirectional spillover effects between different countries. In addition, the structure economies have moved towards service industry making them much involved with face-to-face interactions. The social distancing policies taken by governments in attempt of combating the outbreaks reduce the flow of labor in the business, which leads to a massive decline in the goods and services output. The voluntary practices of social distancing also play an important role in this process.

Sansa (2020) studied the impact of COVID-19 in both China and USA markets. There is evidence of strong positive significant association between the confirmed cases of COVID-19 and both China and US markets from 1st of March to 25th of March 2020. Furthermore, Ngwakwe (2020) analyzed the impact of COVID-19 by using paired t-test of difference in mean stock prices fifty days
before and fifty days during COVID-19 pandemic for China, Europe and the US markets. The mean stock values of Chinese stock index increased during pandemic to a level higher than they were before pandemic. However, the mean stock value of Dow Jones Industrial Average decreased significantly during the period of pandemic. Surprisingly, there are no differences in the mean stock value before and during the COVID-19 pandemic for both S&P 500 and Euronext 100 indexes.

A number of studies investigated whether Islamic and conventional indexes were cointegrated during 2008 GFC and whether Islamic stocks served as safe haven assets. Hkiri et al. (2017) found that Islamic indexes decoupled from their conventional counterparts during times of uncertainly and their results confirmed that Islamic financial indexes are a safe haven for investors during financial crisis. Saadaoui et al., (2017) investigated the connectedness between Islamic and conventional stock markets, their empirical results demonstrate strong dependence between conventional and Islamic indexes. However, their finding also revealed that the association between two assets were different in the period of crisis compared to non-crisis periods. In emerging markets, the two types of indexes were not cointegrated, especially for short-term horizons, offering investors portfolio diversification opportunities.

The contagion effects of the global financial crisis and European sovereign debt crisis on various equity and bond markets were studied by Kenourgios et al. (2016) by taking sample of Islamic and conventional stock and bond (sukuk) indices at country and global levels. Their results could not find strong evidence of contagion between conventional and Islamic equity and bond indices, and thus providing support the decoupling hypothesis of Islamic assets. This suggests that Islamic assets may serve as a diversification instrument especially during turbulent times.

To begin with, we need to understand what Islamic stocks are and how they differ from conventional ones. For its shares to qualify as an Islamic stock a company should satisfy some screening criteria which have been derived by qualified Islamic jurists and they are divided into two broad categories. First are qualitative criteria where the business of the company must be acceptable (halal) according to Islamic principles. Some business activities such as the production of liquors, pork, or involvement in activities such as gambling, discos, prostitution, night club, pornography, pubs etc. are unacceptable (haram) in Islam. Second are the quantitative criteria which are related to interest (riba) based dealing of the company either directly or indirectly. Shares of companies which mainly deal with interest-based activities such as conventional banks, insurance companies, finance and leasing companies do not qualify as Islamic. However, in practice many companies are complex and it’s very difficult to avoid interest-based transactions in many instances. Therefore, Islamic scholars have permitted investment in stocks of companies who have less than 5% of income coming from interest-based activities and which have the ratio of the company’s interest-based debt less than 33% of its value.

Theoretically, there are two theories that argue for co-integration between Islamic and conventional stocks. According to the fundamental theory, because news about aggregate demand is the only source of price movements, markets for Islamic and conventional securities often react. For example, a news which result into a trading activity of conventional stocks will also affects the price of Islamic stocks since it conveys information which concerns both. Thus, according to the habitat view of co-movement, since amongst all securities available in the market investors only chose to trade in a subset, generally there will be a common factor affecting all subsets’ returns. Since Islamic stocks are a subset of the conventional market, there will be a common factor affecting both Islamic and conventional securities alike (Hoque et al., 2016).

According to an alternate view, the application of screening methodologies to Islamic stocks changes their fundamental structure compared to conventional ones which may render them decoupled. Islamic principles (Shariah) forbid interest, restrict investment to Shariah compliant economic activities and forbids investment in firms with high level of interest-based debt (i.e., 33% or more) and impose some other restriction on Islamic stocks as mentioned earlier. Because of these specificities, Islamic stocks are theoretically considered safer than conventional ones in general and more stable during turbulent periods in particular.

Practically, results regarding the co-movement between Islamic and conventional stocks are mixed. Some studies find the two markets to be co-integrated (Ajmi et al., 2014; Hammoudéh et al., 2014; Hoque et al., 2016; Jebran et al., 2017; Majdoub et al., 2016; and Saadaoui et al., 2017). More recent studies, on the other hand, including Abu-Alkheil et al. (2017), Guyot (2011), Hkiri et al. (2017), Kenourgios et al. (2016) and Saadaoui et al. (2017) have documented a decoupling of Islamic stock from their conventional counterparts, especially during periods of market instability. These findings suggest that at turbulent times Islamic assets can serve as a safe haven for investors. Thus, one can assume that although conventional and Islamic stocks are affected by the same common factor, namely the COVID-19 crisis, the special nature of Islamic stocks will cause a decoupling from their conventional counterparts. Based on the aforementioned arguments, it is very useful to check whether the Islamic assets behave differently from their conventional counterparts during periods market turmoil. Such understanding will help market agents to allocate their portfolios assets based on the time-varying behaviour of the Islamic asset correlations.

As an early evidence, a paper by Ramelli and Wagner (2020) analyzing the relationship between COVID-19 and stock prices suggested that high level of corporate debt and liquidity issues are the main drivers of volatility in the stock market. Since Islamic stocks have lower leverage due to Shariah screening requirements they are expected to be more immune to market risks during turbulent periods compared to their conventional counterparts. Another paper by Yarovaya et al. (2020) looks at resilience of Islamic equity funds during COVID-19 pandemic. The study discovered that Islamic funds outperformed their conventional counterpart during the peak months of the pandemic and thus proving to be more resilient to COVID-19 shock. Even if this finding proves Islamic equity funds as safe haven, it not necessarily be due to the property Islamic stocks but rather because of the investment style of the fund as the paper also reveals.

More recent work by Yarovaya et al. (2021) looks into issue of spillover between Islamic and conventional stock and bond markets.

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1 The quantitative criteria slightly vary from one Islamic index to another even though principles are the same. For more detailed specification of Shariah screening of Islamic stocks see Alam et al. (2017) or Appendix A in Ashraf et al. (2020).
during the COVID-19 pandemic outbreak. In the study author also consider impact of other investments alternatives such as gold, oil, cryptos and other indexes on the relationships between these different markets. Study revealed that while decoupling took place for the Islamic bonds (Sukuk) during the COVID-19 pandemic, there were no such safe haven properties present for Islamic stocks. In fact, if found that the pandemic increased spillovers between Islamic and conventional stock markets. Yet another paper by Hasan et al. (2021) which looked at co-movement between Islamic and conventional stocks during 2020 from a global perspective has also found no evidence of decoupling between two stocks due to Covid-19 pandemic. The number of Covid-19 deaths was the variable used to represent severity of pandemic in wavelet-based analysis covering data from 21 January to 27 November 2020. Based on its findings, the paper concluded that both Islamic and conventional stocks moved closely together during the study period and therefore Islamic stocks did not display the safe haven properties during pandemic crisis.

Looking at the impact of media coverage of COVID-19 pandemic on volatility of Islamic stock indexes work by Umar & Gubareva (2021) obtained some interesting findings. Their study utilized wavelet-based analysis to examine the coherence between the Media Coverage Index (MCI) and the moves of the Islamic stocks. Even though the coherence between MCI and most sectors where medium to high, the study was able to identify the low coherence in some sectors and attribute them to the diversification potential of Islamic equity investments. This highlights importance of including COVID-19 related media coverage to single of distinct attribute of Shariah complaint investments.

However, if we want to look at the impact of COVID-19 on relationship between conventional and Islamic stocks in a country level, China can be a good country of choice. China has been hit in early 2003 by the severe acute respiratory syndrome (SARS) but according to Avalos and Zakrajsek (2020) the current COVID-19 outbreak had an early and more noticeable adverse impact on the Chinese stock market compared to 2003 SARS outbreak. After only the 10th day following the “news” of the COVID-19 outbreak, Chinese equity valuations were down by 5%, while it took 20 trading days for SARS crisis to have a similar impact on the Chinese equity market. Although China’s GDP is expected to be depressed in the first quarter of 2020, analysts expect a V-shaped rebound. However, there is also the risk of a U-shaped recovery due to some factors which markets have not priced in (Morris, 2020).

Previous studies have shown that the efficiency of stock markets in China is improving over the years. Liu et al. (2020a) have shown that despite the average public information in the Chinese market being slightly lower than in the U.S., from 2002 to 2014 its efficiency has significantly increased indicating the effectiveness of the securities laws passed during 1990s and 2000s. For instance, Chen and Chiang (2020) found that uncertainties related to economic policy and political relationship with U.S. have quickly reflected on the

![Fig. 1. Time movements of the conventional and Islamic Large and Mid-Cap. indexes in China](image1.png)
![Fig. 1b. Time movements of Mid-Cap conventional and Islamic indexes in China](image2.png)

**Fig. 1.** Time movements of the conventional and Islamic Large and Mid-Cap. indexes in China
Chinese stock market in form of a decline in stock returns and increase in its volatility. Thus, we hypothesis that conventional as well as Islamic stock indexes in China will react to count of COVID-19 cases and other related announcements.

Therefore, this study will try to answer some important research questions to fill the literature gap. First one is related to the effect of COVID-19 on Islamic and conventional stocks’ interplay in China and whether Islamic assets can be considered as safe haven. It will also look into how the COVID-19 cases (infected, deaths and recovered counts) and related announcements are affecting the time varying correlations between the two assets. Finally, it will analyze how COVID-19 counts are affecting relationship between Islamic and conventional stocks across time-scales and frequency bands (i.e., investment horizons) in China.

3. Data and methodology

We will combine two distinct methods of multivariate DCC-GARCH as well as multiple and partial wavelets to understand the impact of COVID-19 cases and related announcement on co-movements between Islamic and conventional stocks in China. While multivariate DCC-GARCH can assists us in analysis impact of COVID-19 cases and related announcements on time-varying co-movement between Islamic and conventional stocks in China, the methods of multiple and partial wavelets are used due to their ability to visualize the relationship between the time series variables across time-scales and frequency bands. More specifically, they can provide information to investors with different investment horizons, where short-term investors will be concerned with short-term co-movement localized at low scales whereas long-term investors are more interested to high scales impact of COVID-19.

3.1. Data

To conduct our analysis, we use daily returns of the conventional and Islamic Large and Mid-Cap. indexes in China. Variables used are four indexes representing Large and Mid-Cap. conventional and Islamic stocks provided by MSCI for time period starting from 2 December 2019 till 8 May 2020. Data are sourced from DataStream and yielding 115 daily observations. In addition, we collect data on COVID-19 related announcements in China from various sources such as Corbet et al. (2020), Kamps & Hoffmann (2020) and World Health Organization (WHO) (2020).

Fig. 1 below shows time movements of the conventional and Islamic Large and Mid-Cap. indexes in China. If we look at the Fig. 1a and 1b, we can see that in China both Islamic and conventional stocks are correlated with each other both at Large and Mid-Cap levels. This is apparent from similar path followed among Large-Cap. Islamic and conventional indices (i.e. Fig. 1a) as well as Mid-Cap. ones (i.e. Fig. 1b). However more important question is to understand how this correlation is affected by incidents of COVID-19 and related announcements in China and whether their volatilities are impacted by those events.

Fig. 2 shows COVID-19 cases in China dividing them to active infected cases, recovered and deaths for period of 31 December 2019 to 8 May 2020. When we look at Fig. 2 and compare it to the behavior of stock indexes in Fig. 1 we can observe that all of the stock indices were growing until mid-January 2020. Afterwards, stock prices started to decline probably due to significant number of COVID-19 cases in China started influencing investor sentiment and decline continued till late March 2020 when only small fraction of active COVID-19 cases remained in China. Since then, all of the four stock indexes showed trajectory of general growth.

For our empirical analysis we need to estimate stock returns for both type of stocks. We compute the daily logarithmic returns as follows: \( r_{ijt} = 100\times \log(P_{ijt}/P_{ijt-1}) \), where \( (i) \) refers to Islamic stocks and \( (j) \) to conventional stocks. \( P_t \) and \( P_{t-1} \) are the stock index prices at time \( t \) and \( (t-1) \), respectively. Table 1 reports the descriptive statistics for the used variables. Fig. 3 below presents time movements of the estimated daily returns \( (r_{ijt}) \) for both conventional and Islamic Large and Mid-Cap. indexes. From the visual inspection of daily returns for all four indexes, we perceive that clear pattern of interim heteroscedasticity visible in all of them. Furthermore, volatility clustering where large volatilities are followed by similar large ones and small volatilities are followed by similar small ones is apparent in all four subfigures. Similar to what we have observed from Fig. 1, in Fig. 3 we can more clearly see strong correlation between two Large and Mid-Cap. index pairs from similarity of patterns followed by each pair.

Table 1 reports the stochastic properties of the Chinese Islamic and conventional stock returns. As we can see, the mean values of

![Fig. 2. COVID-19 in China: active cases, recovered and deaths.](image-url)
returns for stocks are slightly positive, Islamic stocks having relatively lower returns relative to their conventional counterparts. Meanwhile, the standard deviations of Islamic stocks are slightly higher compared to conventional ones. All of the series are negatively skewed which corresponds to a slightly longer left tail, probably due to some outliers with low returns. They also depart from a normal distribution curve which is confirmed by results of Jarque-Bera test results. Kurtosis shows that all series have substantial outliers, i.e., leptokurtic. Moreover, both Islamic and conventional indexes have shown significant autocorrelation, except for Mid. Cap. Islamic stocks.

However, looking at risk profiles of Islamic vs conventional as well as Large and Mid-Cap. stocks by comparing respective coefficients of variation (C.V.) and other descriptive statistics some interesting observations can be drawn. At first comparing C.V.s we can notice that Islamic assets seem to be riskier than conventional ones both for Large Cap. (198.07 vs 62.48) and Mid. Cap. (49.29 vs 30.21) stocks. In terms of skewness and kurtosis of Large-Cap. indexes are about the same for Islamic and conventional stocks (i.e. -0.66678 vs -0.65390 and 1.6942 vs 1.9440 respectively). As for Mid. Cap. ones, the Islamic stocks appear to be less negatively skewed and leptokurtic, compared to the conventional ones (i.e. -0.57060 vs -0.95199 and 0.84762 vs 2.4809 respectively). Overall, from initial observations it can noticed that all four stock indexes have distinct risk profiles which can provide some diversification benefits while used in an investment portfolio.

Table 1
Stochastic properties of the Islamic and conventional Chinese stock returns.

|                  | Islamic stocks | Conventional stocks |
|------------------|----------------|---------------------|
|                  | Large Cap.     | Mid. Cap.           | Large Cap.     | Mid. Cap.     |
| Mean             | 0.0040056      | 0.015986            | 0.01154        | 0.024261      |
| Max.             | 2.2031         | 1.9374              | 2.1783         | 1.8141        |
| Min.             | -2.9236        | -2.1825             | -2.6268        | -2.8903       |
| S.D.             | 0.7934         | 0.78797             | 0.72107        | 0.73281       |
| C.V.             | 198.07         | 49.29               | 62.48          | 30.21         |
| Skewness         | -0.66678***    | -0.57060**          | -0.65390***    | -0.95199***   |
| Kurtosis         | 1.6942***      | 0.84762*            | 1.9440***      | 2.4809***     |
| J-B              | 22.081***      | 9.5987***           | 26.076***      | 46.456***     |
| Q(20)            | 2.6490**       | 1.4857              | 3.0965**       | 3.1256**      |
| ADF              | -4.91919***    | -5.15202***         | -4.5765***     | -4.29113***   |

Notes: S.D. and C.V. refer to the standard deviation and coefficient of variation, respectively. ADF is the unit root tests of the Augmented Dickey-Fuller (1979). *** and ** designate the significance at the 1%, 5% and 10% levels, respectively. Q(20) is the Ljung-Box statistic of the squared standardized returns. Asymptotic critical values of Kwiatkowski et al. (1992), JoE, 54,1, p. 159–178

Fig. 3. Time movements of the conventional and Islamic Large and Mid-Cap. daily returns.
3.2. The multivariate GARCH-type models

For the purposes of this research, the multivariate GJR-GARCH of Glosten-Jagannathan-Runkle (1993) under DCC is used to capture the time-varying pattern of the co-movement between Islamic and conventional stock indexes (Lawrence et al., 1993). The GJR-GARCH has the benefit of capturing the “leverage effect” compared to a standard GARCH model, in which the lagged negative shocks tend to have stronger effects on the variance than positive shocks. The GJR-GARCH is basically an extension of the standard GARCH model in which a large negative change in the financial time series is mostly followed by another negative shock rather than a positive shock. Recently, studies have shown the superiority of the GJR-GARCH model compared to other ones. Formally, we assume that returns are governed by the following mean equation:

\[ r_t = \mu + \psi r_{t-1} + \epsilon_t = z \epsilon_t \sim N(0,1) \]  

(1)

Where \( r_t \) refers to a \((n \times 1)\) vector of the stock returns and bond yields, \( \mu \) is a vector of constant with \( n \) as length, \( \psi \) is a vector representing the autoregressive coefficients, while \( \epsilon_t = [\epsilon_{t1}, \ldots, \epsilon_{tn}] \) is a vector of the residual errors. Formally, the conditional variance of the GJR-GARCH (1,1) model \( \{h_{t}\} \) has following equation:

\[ h_{t} = \omega + \alpha \epsilon_{t-1}^2 + \beta h_{t-1} + \gamma \epsilon_{t-1}^2 h_{t-1} \]  

(2)

To allow for asymmetric effects of negative and positive volatility shocks, we define a multivariate indicator vector along a line with Lawrence et al. (1993) as follows:

\[ I_{t-1} = \begin{cases} 
1, & \text{if } \epsilon_{t-1} < 0 \\
0, & \text{otherwise} 
\end{cases} \]

In the above Eq., the estimated parameter \( \gamma \) captures the leverage effect (i.e. impact of positive and negative volatility shocks). Specifically, a positive value indicates that compared to positive shocks negative ones have larger impact. With reference to Lawrence et al. (1993) the positivity and stationarity conditions the volatility process as shown in equation (2) are satisfied when the parameters guarantee the following constraints: \( \omega, \beta \gamma^2 \geq 0 \), \( \alpha > 0 \), and \( \gamma + \frac{\omega - \epsilon}{2} < 1 \).

Using the Dynamic Condition Correlation (DCC) of Engle (1982), and assuming \( E_{t-1} = 0 \) and \( E_{t-1} [\epsilon_{t}, \epsilon_{t}] = H_t \), where \( E \) refers to the conditional expectations based on the available information set. The conditional variance covariance matrix can be expressed as in Eq. (3):

\[ H_t = D_t^{1/2} R_t D_t^{1/2} \]

(3)

where \( R_t \) is the \((n \times n)\) time varying correlation matrix, while \( D_t = \text{diag}(h_{t1}, \ldots, h_{tn}) \) is a diagonal matrix of the conditional variances. Engle (1982) suggests the following structure of the time-varying correlation:

\[ R_t = \text{diag}(Q_{t})^{-1/2} Q_{t} \text{diag}(Q_{t})^{-1/2} \]

(4)

\[ Q_t = (1-a-b)S_t \text{diag}(Q_{t-1})^{-1/2} \tilde{\epsilon}_{t1}, \ldots, \tilde{\epsilon}_{tn} \text{diag}(Q_{t-1})^{-1/2} + b Q_{t-1} \]

(5)

where \( a \) and \( b \) are two non-negative scalars assuring \( +b < 1 \), while \( S_t \) is a \((n \times n)\) unconditional covariance matrix of the estimated errors. Eq. (5) refers to the DCC model.

4. Results and discussions

4.1. The multivariate GJR GARCH estimations

As noted earlier, we implement a multivariate GJR-GARCH model with DCCs for all four analyzed asset correlations. The estimation results are reported in Table 2a and 2b. From Table 2a panel A, we observe that the estimated parameters related to ARCH and GARCH components are significant for all specifications. The GJR estimated parameter is positive and significant for all specifications except for Islamic Mid. Cap., implying the absence of asymmetric response of the selected variables to volatility shocks. However, Islamic Mid. Cap. stocks seem to have a symmetric response to volatility shocks. Furthermore, the estimated scalars \( a \) and \( b \) (panel B) are positive, significant and meet the \( a + b < 1 \) condition. Results from panel C show the appropriate choice of the GJR specification. Indeed, the hypothesis of serial correlation of the squared standardized residuals is rejected by the Ljung-Box statistic, and the multivariate of Hosking and Li-McLeod reject the null hypothesis of serial correlations.

4.2. The Islamic and conventional stocks dynamic correlations

In this sub-section we discuss the dynamic conditional correlations extracted from the multivariate GJR-GARCH model. The DCCs averages are conveyed in Table 2b. Several observations can emerge from these averages. First, there is noticeable positive and significant correlation between all asset classes being studied with all of them having a positive value over 0.7 and significant at 1%. Especially, strongest correlation existing between Islamic and conventional stock indexes which have same level of market...
capitalization. The DCCs between Islamic and conventional Large Cap. stocks is equal to 0.930 and between Islamic and conventional Mid. Cap. stocks is equal to 0.905. Second, the next strongest DCCs seems to be between Conventional Large Cap. stocks with both Islamic and conventional Mid. Cap. stocks with average DCC values of 0.839 and 0.835, respectively. Third, the weakest DCCs seems to be between Islamic Large-Cap stocks with both Islamic and conventional Mid. Cap. stocks with average DCC values of 0.707 and 0.718, respectively. Finally, when we look at the DCCs between Islamic and conventional stocks, benefit of diversification is maximized when we mix level of market capitalization, i.e. when we combined Large Cap Islamic stocks with Mid cap conventional ones or vice-versa. However, when with combine same cap stocks, i.e. two Large-Caps or two Mid-Caps the benefits of diversification are minimized as DCCs get very high.

Average DCCs give us some idea about relations between different asset pairs, however we cannot see full picture from those averages. To have a better idea about dynamics of the relationships and specially to relate them to external events such as COVID-19 pandemic in this case we should better graphical representation of DCCs. Fig. 4 shows the different combinations of DCCs of conventional and Islamic stocks estimated using GJR-GARCH method over the COVID-19 pandemic. There are two subfigures which are interesting to observe on their own. While Fig. 4a shows separate plots of 6 different asset pairs, Fig. 4b showing them combined in one plot.

There are some interesting observations that come up from Fig. 4, especially when we look at subfigure 4b, i.e. combined plots. There seems to be three distinct pairs of assets which behave similarly and have very close DCCs when conditions are stable, in this case before and after COVID-19 pandemic peak times. This has been also mentioned earlier when we commented on average values of DCCs in Table 2b. The first correlation pairs are Cap. vise pairs that consist of two Large-Caps and two Mid-Caps stocks which have DCC values of little above 0.9 when times are stable. The second correlation pairs are those of Conventional Large-Cap with both Islamic and conventional Mid. Cap. stocks which have DCC values of little above 0.8 when times are stable. The third pairs are those of Islamic Large-Cap with both Islamic and conventional Mid. Cap. stocks that has value of little above 0.7 when times are stable.

However, at times of turbulent such as when there are spikes of new case of COVID-19 (see Fig. 5), as happened between 31 December 2019 and mid-March 2020 the relationship gets destabilized. Also, after another stable period of mid-March to mid-April 2020, the relation again destabilizes between mid to late April 2020 until it gets back to its normal level in early May 2020.

### Table 2
(a) Estimation results of the multivariate GJR-GARCH-DCC for conventional and Islamic stocks. (b) The GJR-GARCH average DCCs.

| Panel A: GJR-GARCH estimates | Large Cap. | Mid. Cap. | Conv. Large Cap. | Mid. Cap. |
|------------------------------|------------|-----------|------------------|-----------|
| Cat (m)                      | 0.157**    | 0.120*    | 0.147***         | 0.074     |
| (2.59)                       | (1.76)     | (0.10)    | (2.82)           | (0.76)    |
| AR(1)                        | -0.078     | 0.054     | 0.011            | -0.075    |
| (-0.71)                      | (0.54)     | (0.10)    | (0.66)           |          |
| ARCH(1)                      | 0.115*     | 0.306**   | 0.043***         | 0.316**   |
| (1.71)                       | (2.40)     | (2.78)    | (2.19)           |          |
| GARCH(1)                     | 0.779***   | 0.795***  | 0.787***         | 0.742***  |
| (11.5)                       | (17.5)     | (15.0)    | (8.95)           |          |
| GJR(y)                       | 0.095**    | -0.062*** | 0.421**          | 0.150**   |
| (2.45)                       | (-2.40)    | (2.13)    | (2.02)           |          |

| Panel B: DCC estimates       |           |           |                 |           |
|------------------------------|-----------|-----------|-----------------|-----------|
| a                            | 0.098***  |           |                 |           |
| (3.37)                       |           |           |                 |           |
| b                            | 0.867***  |           |                 |           |
| (22.03)                      |           |           |                 |           |

| Panel C: Test diagnostics    |伊斯兰Large Cap. |伊斯兰Mid. Cap. |Conv. Large Cap. |
|------------------------------|------------------|-----------------|-----------------|
| Q(20)                        | 1.00             | 1.00             |                 |
| [0.96]                       | [0.99]           |                 |                 |
| Hosking(20)                  | 51.33            |                 |                 |
| [0.97]                       | [0.98]           |                 |                 |
| Li – McLeod(20)              | 67.63            |                 |                 |
| [0.93]                       | [0.94]           |                 |                 |

### Notes:
- Q(20) refers to the Ljung-Box test statistic of the squared residuals at length (20). Hosking(20) and Li–McLeod(20) designate the multivariate Portmanteau serial correlation tests, respectively. ***, **, * indicate the significance levels of 1%, 5%, and 10%, respectively. Figures between parentheses are the t-student statistics, while those between brackets refer to the p-values.
- Figures between parentheses are the t-student statistics, and (***) refers to the significance at the 1% level.
When we look at the separate correlation plots (Fig. 4a), we can notice that DCCs between Large-cap Islamic and two mid-cap indexes get much weaker than other pairs at times of turbulence. The DCC of Large Cap. Islamic and mid-cap conventional stocks even gets negative in late December, which coincides with first official announce of COVID-19 case in China.

4.3. Impact of the COVID-19 counts on the time-varying correlations

In this sub-section, we extend our previous multivariate GARCH analysis, and we check the COVID-19 counts effects (infected cases, deaths and recovered) and related announcements on the Islamic –conventional stock correlation strength and volatility using a standard GARCH (1,1) framework. Doing so, we proceed within two steps. In this first one, we include the COVID-19 daily counts in the mean equation of the DCCs to test its actual and/or lagged effect on the time-path of the DCCs. This allows us to test the impact of the

![Graphs showing time-varying correlations between different stock types over the COVID-19 pandemic.](image-url)

**Fig. 4.** The GJR-GARCH-DCCs of conventional and Islamic stocks over the COVID-19 pandemic. Notes: CORR – dynamic conditional correlation, L - large cap, M - mid cap, Ism – Islamic index, Con – conventional index.

When we look at the separate correlation plots (Fig. 4a), we can notice that DCCs between Large-cap Islamic and two mid-cap indexes get much weaker than other pairs at times of turbulence. The DCC of Large Cap. Islamic and mid-cap conventional stocks even gets negative in late December, which coincides with first official announce of COVID-19 case in China.

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COVID-19 counts on the strength of the time varying connectedness between the Islamic-conventional stocks. Thus, the DCCs mean equation is as follows:

$$DCC_{ij,t} = \alpha_0 + \beta_1 DCC_{ij,t-1} + \gamma_1 \text{Infected}_t + \gamma_2 \text{Deaths}_t + \gamma_3 \text{Recovered}_t + \varepsilon_{ij,t}$$

(6)

where $DCC_{ij,t}$ refers to the lagged value of the DCCs between Large Cap., Mid. Cap. Islamic and Conventional stocks. $\text{Infected}_t$, $\text{Deaths}_t$, $\text{Recovered}_t$ refer to the COVID-19 infected, the deaths and the recovered cases at time(t). Based on that, we estimate one GARCH model for each Islamic and conventional stocks couple. The variance Eq. is written as follows:

$$h_{ij,t} = c + a \varepsilon_{ij,t}^2 + bh_{ij,t-1}$$

(7)

In Table 3, we report the estimation outcomes of the GARCH model of DCCs between different combination of Islamic and conventional stocks while included additional variable of interest related to COVID-19 counts (such as infected cases, deaths and recovered) in DCCs mean equation. Panel A displays the estimations of the DCCs mean equation, while panel B displays the conditional variance estimations.

There are four different GARCH models estimated for combinations of Islamic and conventional stocks. As to our results, it is visible that in the DCCs mean equation coefficients (Panel A of Table 3) for the lagged correlation of DCCs ($\beta_1$) are very close to 1 and highly significant for all the estimated models which means that the current DCCs are strongly related to their past values. There are also several interesting findings spotted for each model. For the Islamic Large Cap. - conventional Large Cap. correlations (model 1), we found that impact of COVID-19 infected cases coefficient is positively signed and significant, while the COVID-19 deaths’ estimated coefficient has a significant negative impact. However, the recovered patients count have no significant impact on mean of the DCCs. Which tell that the dynamic conditional correlation between Large Cap. Islamic stocks and their conventional counterparts increases with number of COVID-19 infected cases but decreases with related death counts, but not influenced by the number of recovered patients.

From a financial perspective, this result implies that “bad news” related to infected cases and deaths are influencing the dependence structure between the Islamic Large Cap. stocks and their conventional counterparts in the Chinese stock market. This may be explained by behavior of local and international investors who are concerned with sharia compliant stocks. As stressed by Alqaralleh and Canepa (2021), it is worth noting that the contagion effect related to the cross-market interactions spawned by shocks on financial markets are not mainly related to changes in macroeconomic fundamentals, but mostly resulting from the investors’ behavior. The unexpected spread of the Coronavirus epidemic and the ensuing lockdown of most countries has given investors tiny time to review and replace their investment portfolios. More precisely, in times of uncertainties due to information need and investor attention as well as anxiety and distress, investors will consider alternative markets such as Islamic indexes as a safe haven for their investments. Precisely, these investors will switch their portfolio allocation moving from Islamic stocks to conventional or vice-versa according to their risk short- and long-term risk perception as well to their risk level tolerance. Such short-term investment strategy may contribute to a substantial risk reduction of their Islamic assets’ portfolios during COVID-19 time. Sherif (2020) revealed that Islamic asset allocation is better during pandemics and economic periods and distress. In model 2 (Panel A of Table 3), representing DCC mean equation for large cap Islamic and mid cap conventional stocks, we can observe that impact of all variables except for the lagged values of the DCCs are insignificant. In other words, the mean of DCCs between large cap Islamic and mid cap conventional stocks is not affected by COVID-19 related counts (i.e. infected cases, deaths or recovered). This is rather strange considering very volatile movement of the DCCs between those two assets observed in Fig. 4 and their overlap with spikes of new COVID-19 infected cases and related deaths shown in Fig. 5.

However, it considering that DCCs of this pair mostly going back to its average level in other times, it may be the case that some specific COVID-19 related events or announcements are causing that increase in volatility of conditional correlation. In model 3 (Panel A of Table 3), representing DCCs mean equation for Mid. Cap. Islamic and large cap conventional stocks, we found that impact of COVID-19 infected cases is negative and significant, while COVID-19 related deaths have a significant positive impact. However, number of recovered patients have no significant impact on mean of the DCCs. Intriguingly, our results roughly corroborate the findings of Trichilli et al. (2020) as well as those of Ben Rejeb and Arfaoui (2019). In their studies, the authors found that Islamic indices are moderately immune from speculative shock waves. Mainly, they pointed out that while the Islamic stock market indices perform much better throughout tranquil periods, they behave moderately during times of disaster. If we look at figures, coefficients tell us that the DCCs between Mid. Cap. Islamic and large cap conventional stocks decreases by 0.012 percent for each 1% increase in
out be statistically insignificant. This result implies that the DCCs volatility is not affected by the Chinese COVID-19 counts
COVID-19 deaths. When we look at coefficients, they tell us that the DCCs between mid-cap Islamic and mid-cap conventional stocks
slower in this case.

number of COVID-19 cases), but reversal of that weakening due to casualties (such as increasing number of related deaths) is much
weakened at times of uncertainty (such as increase in number of COVID-19 cases), but that weakening is reverted as casualties start to
impact everyone (such as increase in number of related deaths).

Financial speaking, we can assume that co-movement between Mid-Cap Islamic and Large Cap. conventional stocks is
increased at times of uncertainty (such as increase in number of COVID-19 related deaths). Financial speaking, we can assume that co-movement between Mid-Cap Islamic and Large Cap. conventional stocks is weakened at times of uncertainty (such as increase in number of COVID-19 cases), but that weakening is reverted as casualties start to
impact everyone (such as increase in number of related deaths).

Finally, similar to model 3, in the model 4 representing correlation between mid-cap Islamic and mid-cap conventional stocks, we
found that impact of COVID-19 related cases is negative and significant, while that of COVID-19 deaths is positive and significant on the mean of DCCs. However, number of recovered patients have no significant impact on mean of the DCCs. This tell that the DCCs between Mid-cap Islamic and Mid cap conventional stocks decreases with number of infected cases but increases with number of COVID-19 deaths. When we look at coefficients, they tell us that the DCCs between mid-cap Islamic and mid-cap conventional stocks decreases by 0.012 percent for each 1 percent increase in the number of infected cases, but the correlation increases by 0.013 percent for each 1 percent increase in number of COVID-19 related deaths (Panel A of Table 3). Financial speaking, here also we can assume that co-movement between mid-cap Islamic and mid-cap conventional stocks is weakened at times of uncertainty (such as increase in number of COVID-19 cases), but reversal of that weakening due to casualties (such as increasing number of related deaths) is much slower in this case.

Its worthily noting, that when we included the COVID-19 counts in the variance equation of the DCCs, the estimated coefficient turn out be statistically insignificant. This result implies that the DCCs volatility is not affected by the Chinese COVID-19 counts\(^2\). However, in some papers such as one by Baig et al. (2020) that analyses the U.S. results show that rises in COVID-19 cases and deaths are correlated with rise in illiquidity and volatility in the market. Also, they found that other source that contributed to a decline in market liquidity and increased instability were the dipping of investment sentiment and the imposing of various travel restrictions and lockdowns. Even though we did not come across any work which analysis direct impact of COVID-19 on correlation between Islamic and conventional stocks, but above paper suggest that variance of correlation between two can be influenced by COVID-19 related events or announcements.

### 4.4. Impact of the COVID-19 related announcements on the time-varying correlations

For the second step, we analyze the behavior of the conditional correlation volatility of Islamic and conventional stocks (Large and Mid-Cap.) around COVID-19 related announcements. Doing so, we re-estimate the standard GARCH model for the DCCs and include some dummy variables corresponding to the some selected COVID-19 related announcements in China. Here, we conjecture that the volatility of the conditional correlations is well-described by a standard GARCH process since we detected significant ARCH effects\(^3\). In the present study, we refer to some selected key announcements which we believe can have impact on Chinese stock market. These selected announcements were mainly sourced from Corbet et al. (2020), World Health Organization (WHO) (2020) and Kamps

\(^2\) The estimation outcomes are not reported here but are available upon request addressed to the corresponding author.

\(^3\) For space scarcity, the descriptive statistics of the DCCs are not reported here, but are available upon request.
Hoffmann (2020) but also confirmed by other sources listed in the footnote of Table 4 that provide details of those announcements.

Empirically, we suggest the following specification for the DCC conditional variance:

\[ h_{ij,t} = c + ae_{ij,t}^2 + bh_{ij,t-1} + \sum_{k=1}^{M} \text{COVID} - \text{news} - \text{dum}_{k,t} \]  

(8)

where \( \text{COVID} - \text{news} - \text{dum}_{k,t} \) is the dummy variable corresponding to selected COVID-19 related announcement dates. A significant and positive estimated coefficient indicates that the broadcast of the particular announcement increases the volatility of the Islamic and conventional stock correlations. Conversely, a negative coefficient implies that COVID-19 related announcements lower the Islamic and conventional stocks’ DCCs. It is worth noting that our sample period stretches from 2 December 2019 to 8 May 2020 and covers several COVID-19 related announcements in China, first of which being some cases pneumonia from an unknown virus detected in Wuhan city in China and reported to the WHO on 31 December 2019. In the present study, we have selected ten COVID-19 related announcements which we believe was most relevant for Chinese stock market. The date, symbol and some details related to each of those announcements are conveyed in Table 4.

Table 5 reports the estimation outcomes of the DCCs variance equation with dummy variables. Panel A related the mean equation estimation where only a lagged value of the DCC is included, while Panel B displays the variance equation estimations. The results obtained with DCC models when COVID-19 announcements are added as dummies as shown in Table 5 provide use were interesting information. Among ten (10) announcements chosen seven (7) of them appear to have some influence on studied DCCs, while remaining three (3) does not have any significant impact. If we start with Panel A, we can notice that as it was observed for previous DCC models with COVID-19 counts (Table 3, Panel A), lagged correlation of DCCs (\( \beta_i \)) are very close to 1 and highly significant for all the estimated models which means that the current DCCs are strongly related to their past values. When it comes to the variance equation estimations (Table 5, Panel B), we have only shown models where some of the selected announcements are found to be significant.

From our examination of DCCs variance equation results, we come across some interesting observations. Firstly, when looking at the announcements and their impact on the variance equations we found that only announcement that carry some serious health treats or economic implication (\( \text{dum}_4 \) and \( \text{dum}_5 \)) seem to impact of the DCCs variance equations. On the other hand, announcements that have a descriptive nature (\( \text{dum}_6 \) and \( \text{dum}_7 \)) or only a numerical characteristic (\( \text{dum}_8 \) or \( \text{dum}_9 \)) are found to have very little or no impact on variance of DCCs.

Secondly, the same announcements seem to have different impacts on variance of different pairs Islamic-conventional stock DCCs. In general, while an announcement increases variance of DCCs for same cap Islamic-conventional stock pairs it reduces the variance of DCCs for the mixed-cap pairs. For instance, when the first case of COVID-19 was announced on 31 December 2019 (\( \text{dum}_1 \)), it increased the variance of Large Cap. and Mid. Cap. pairs, while the same announcement reduced the variance of DCCs for Islamic Large Cap. and Conventional Mid. Cap pair and had no effect on DDCs variance of Islamic mid-cap and Conventional Large. Cap. pair.

On the other hand, when Chinese authorities place the city of Wuhan under quarantine (\( \text{dum}_{12} \)) the variance of DCCs for both Islamic Large. Cap. and Conventional Mid. Cap. pair and Islamic Mid-cap and Conventional Large Cap. pair have increased, while that of Islamic-conventional mid-cap pair has reduced while that of Islamic-conventional Large Cap. pair was not affected. Thirdly, besides having different impact on different cap combinations COVID-19 related announcements move the DCCs variances of cap-vise pairs in the same direction even if the same for the mixed-cap pairs are not affected (see impact of \( \text{dum}_{5} \) in Panel B). Similarly, some other announcements move the DCCs variances of mixed-cap pair in same direction even if the same for the cap-vise pairs are not affected (see impact of \( \text{dum}_{8} \) in Panel B). That relation is observed in all situations in Panel B and holds true even if the DCCs variance of some other pairs are significantly affected (see impact of \( \text{dum}_{1} \) and \( \text{dum}_{4} \) in Panel B).

To summarize our findings on impact of COVID-19 related announcements on variance of DCCs between Islamic and conventional stocks we can tell that only announcement which carry serious health treats or economic implications do affect the variance of correlations. Even when an announcement impacts the variance of correlation, the impact is not uniform among different combinations of Islamic and conventional stocks, with same-cap stock pairs being affected in one direction and mixed-cap stocks being affected in the opposite direction. Which give us important implications that mixing of Islamic-conventional stocks of different levels of capitalization bring more benefit in terms of diversification rather than holding same caps of Islamic and conventional stocks or opposite caps of each. These results are broadly comparable to the findings of Sherif (2020) who recognized that Islamic indices are less risky than conventional indices. He explained that this evidence is ascribable to the profit and loss allocation principle in Islamic finance.

4. Islamic-conventional stock interplays and investment horizons

4.5. Brief note on the multiple and partial wavelets

Different wavelet methods have been used to scrutinize the association between COVID-19 and Chinese Islamic and conventional indexes. The reasons behind using different wavelets are due to their capacity to spot and follow time scale varying outlines. The wavelet tool evaluates time series’ spectral features as time function and elucidates how time series’ periodic constituents differ with time. As well, the wavelet technique allows to visualize the relationship between the time series variables across scales band and over time. More specifically, short term investors will be concerned with short-term co-movement localized at low scales (i.e., high

4 Due to scarcity of space the other estimation outcomes are not reported here but are available upon request addressed to the corresponding author.
The announcement included are mainly chosen from Corbet et al. (2020), WHO (2020) and Kamps frequencies) whereas long-term investors are more interested to high scales (i.e., low frequencies). We have chosen partial and * indicate the significance levels of 1%, 5% and 10%, respectively.

### Table 4
The Key COVID-19 related announcements in China

| Date               | Symbol | Announcement                                                                                                                                 |
|--------------------|--------|---------------------------------------------------------------------------------------------------------------------------------------------|
| December 31, 2019  | dum1   | Some cases pneumonias for an unknown virus are detected in Wuhan, China and reported to the WHO on 31 December 2019.                           |
| January 7, 2020    | dum2   | Chinese authorities confirm that they have identified the virus as a novel coronavirus, initially named 2019-nCoV by the WHO.               |
| January 11, 2020   | dum3   | The Wuhan Municipal Health Commission announces the first death caused by the coronavirus.                                                   |
| January 23, 2020   | dum4   | Chinese authorities place the city of Wuhan under quarantine in an attempt to halt the spread of the disease.                               |
| January 30, 2020   | dum5   | WHO declares 2019-nCoV to be a “Public Health Emergency of International Concern”.                                                          |
| February 11, 2020  | dum6   | WHO announces a new name for the virus, COVID-19.                                                                                           |
| March 11, 2020     | dum7   | WHO declares COVID-19 to be a Pandemic.                                                                                                     |
| March 19, 2020     | dum8   | For the first time since the beginning of the coronavirus outbreak, there have been no new cases in Wuhan and in the Hubei province.        |
| April 6, 2020      | dum9   | In Wuhan people are allowed to travel for the first time and lockdown of the city is lifted.                                                |
| April 17, 2020     | dum10  | The prevention and control taskforce in Wuhan, China, revises the death toll in the city up 50%, from initial 2,579 to updated 3,869 deaths. |

Sources: Corbet et al. (2020), WHO (2020) and Kamps & Hoffmann (2020).

The announcement included are mainly chosen from Corbet et al. (2020), WHO (2020) and Kamps & Hoffmann (2020), and verified by some other sources which list similar events. Those sources are include websites of World Economic Forum (https://www.weforum.org/), Hudson Institute (https://www.hudson.org/) and U.S. Naval Institute (https://www.usni.org/) among many other international organizations and news agencies.

### Table 5
DCC model with COVID-19 announcements.

|                      | Islamic L - Conv. L | Islamic L - Conv. M | Islamic M - Conv. L | Islamic M - Conv. M |
|----------------------|---------------------|---------------------|---------------------|---------------------|
|                      | (Model 1)           | (Model 2)           | (Model 3)           | (Model 4)           |
| **Panel A. DCCs mean equation:** DCC\(_{t}\) = \(a_0 + \beta_1\epsilon_{t-1} + \epsilon_{t}\) |                      |                     |                     |
| \(a_{0}\)            | 0.0121***           | 0.0115***           | 0.0091**            | 0.0062***           |
| (2.12)               | (3.01)              | (2.04)              | (4.01)              |
| \(\beta_1\)          | 1.0004***           | 1.0028***           | 0.9912***           | 1.009***            |
| (1589.1)             | (100.7)             | (165.3)             | (589.2)             |
| **Panel B. DCCs variance equation:** \(h_{t} = \alpha_{1} + \epsilon_{t} + b_{t} + \sum_{k=1}^{M} \epsilon_{t-k}Covid - news - dum_{k}\) |                      |                     |
| \(c_{st}\)           | 0.000002            | 0.0081***           | 0.0018**            | 0.0002***           |
| (0.19)               | (2.76)              | (2.38)              | (6.68)              |
| \(a\)                | 1.2617***           | 0.1719**            | -0.0640***          | 1.3428***           |
| (6.60)               | (2.04)              | (-7.76)             | (4.09)              |
| \(b\)                | 0.4406***           | 0.6501***           | 0.6334***           | -0.0263***          |
| (5.60)               | (3.79)              | (3.79)              | (-3.22)             |
| dum1                 | 0.0015***           | -0.0127***          | -0.0018**           | 0.0098***           |
| (2.85)               | (-3.38)             | (-2.44)             | (6.52)              |
| dum2                 | -0.0104***          | -                     | -                    | -                    |
| (-9.95)              |                     |                     |                     |                     |
| dum3                 | 0.0089***           | -0.0018**           | -                    | -                    |
| (7.11)               | (-2.44)             | (-2.44)             |                     |                     |
| dum4                 | -                   | 0.0076***           | 0.0026***           | -0.0944***          |
|                     | (3.30)              | (2.58)              | (5.62)              |
| dum5                 | -                   | -0.0025*            | -0.0027***          | -0.0003             |
|                     | (-1.87)             | (-2.81)             | (-1.27)             |
| dum6                 | -                   | -                    | 0.0006**            | -                    |
|                     |                     | (2.42)              |                     |                     |
| dum7                 | -                   | -                    | -                    | -                    |
| dum8                 | -                   | -                    | -                    | -                    |
| dum9                 | -0.00004*           | -                    | -0.0002**           | -                    |
|                     | (-1.76)             | (-2.09)             |                     |                     |
| dum10                | -                   | -                    | -                    | -                    |
| LB(20)               | 5.84                | 5.78                | 30.11               | 31.31               |
|                      | (0.999)             | (0.99)              | (0.949)             | (0.96)              |

Notes: Figures between parentheses correspond to the t-student while LB(20) is the Ljung-Box statistic test for the 20th squared residuals, and ***, **, * indicate the significance levels of 1%, 5% and 10%, respectively.

The key is expressed as "The Coefficient of the Equation = \(a_0 + \beta_1\epsilon_{t-1} + \epsilon_{t}\)". The model is followed by the significance levels of 1%, 5% and 10%, respectively. The significance levels are indicated by ***, **, and * respectively.

For the DCC model, the mean equation is expressed as: \(DCC_{t} = a_0 + \beta_1\epsilon_{t-1} + \epsilon_{t}\). The variance equation is expressed as: \(h_{t} = \alpha_{1} + \epsilon_{t} + b_{t} + \sum_{k=1}^{M} \epsilon_{t-k}Covid - news - dum_{k}\). The significance levels are indicated by ***, **, and * respectively.

The table lists the key COVID-19 related announcements in China and includes the date, symbol, and announcement. The announcements are sourced from Corbet et al. (2020), WHO (2020) and Kamps & Hoffmann (2020), and verified by some other sources which list similar events. The sources include websites of World Economic Forum, Hudson Institute, and U.S. Naval Institute among many other international organizations and news agencies.

### Model 2
Model 2 is followed by the significance levels of 1%, 5% and 10%, respectively. The significance levels are indicated by ***, **, and * respectively.

The table lists the key COVID-19 related announcements in China and includes the date, symbol, and announcement. The announcements are sourced from Corbet et al. (2020), WHO (2020) and Kamps & Hoffmann (2020), and verified by some other sources which list similar events. The sources include websites of World Economic Forum, Hudson Institute, and U.S. Naval Institute among many other international organizations and news agencies.

### Notes
- Figures between parentheses correspond to the t-student while LB(20) is the Ljung-Box statistic test for the 20th squared residuals, and ***, **, * indicate the significance levels of 1%, 5% and 10%, respectively.
- Long-term investors are more interested in high scales (i.e., low frequencies).
- The method of cross-wavelets has the ability to decompose initially and then restructure x(t) function (Rua & Nunes, 2009) as followed in Eq. (9):

\[
\text{Panel A. DCCs mean equation: } DCC_{t} = a_0 + \beta_1\epsilon_{t-1} + \epsilon_{t}
\]

\[
\text{Panel B. DCCs variance equation: } h_{t} = \alpha_{1} + \epsilon_{t} + b_{t} + \sum_{k=1}^{M} \epsilon_{t-k}Covid - news - dum_{k}
\]
\[ x(t) = \frac{1}{C} \int_0^\infty \int_{-\infty}^{\infty} w_s(u, s) \Psi_{n_s}(t) du \, ds, \quad s > 0 \]  

(9)

Across series in a domain of time frequency, the approach of wavelet coherence is effective in enumerating the coefficients of local correlation. The absolute smoothed cross wavelet value is used to measure wavelet coherence, standardized by the product of each series smoothed individual wavelet power spectrum.

**a. PWC between Islamic Large Cap. and Conventional Large indexes | COVID infected cases announcement**

**b. MWC Islamic Large Cap. | Conventional Large and COVID infected cases announcement**

**c. PWC between Islamic Large Cap. and Conventional Large indexes | COVID recovered cases announcement**

**d. MWC Islamic Large Cap. | Conventional Large and COVID recovered cases announcement**

**e. PWC between Islamic Large Cap. and Conventional Large indexes | COVID death cases announcement**

**f. MWC between Islamic Large Cap. and Conventional Large indexes | COVID death cases announcement**

Fig. 6. Partial and Multiple Wavelet coherence between Large-Cap Islamic, Conventional Indexes and COVID-19 related announcements.
In this study we employed partial and multiple techniques of wavelet (PWC and MWC, respectively). These both techniques in a multivariate framework let to include control variables, which does not allow in other approaches of wavelets such as cross-wavelet coherence and wavelet coherence. In this way, we can gain insight into the influence of Large and Mid-Cap. Conventional indexes and COVID-19 on Large and Mid-Cap. Islamic indexes. Even in the framework of bivariate wavelet, the application of multiple wavelet coherence techniques also supports to circumvent comparison of various series. By employing the multiple wavelets, the low frequency oscillations’ biasness is eliminated which is apparently seemed in estimates of power spectrum of wavelet (see Y. Liu et al., 2007; and Veleda et al., 2012). Lastly, these multivariate wavelets permit the enclosure of another (third) variable termed as conditioning factor, which is ignored in methods of bivariate wavelet. Likewise, the two variables’ common effects on a third variable are not identified by the technique of bivariate wavelet coherence; but Partial Wavelet Coherence (PWC) is analogous to a simple correlation. The principle of this tool consists of identifying the wavelet coherence between two-time series after eliminating the power of a third one. According to Mihanović et al. (2009), similarly to the partial correlation squared, the partial wavelet coherence squared will be expressed as:

$$R^2(u,s) = \frac{|S(s^{-1}W_u(u,s))|^2}{S(s^{-1}|W_u(u,s)|)^2}$$  \hspace{1cm} (10)

Multiple Wavelet Coherence (MWC) and multiple correlations are more analogous, which is worthwhile to explore the multiple explanatory variables’ effects on an explained variable. By following the wavelet coherence application, multiple wavelet coherence specified in below equation is used, which is alike to multiple correlations. The multiple wavelet coherence has the feature that it is able to assess the multiple variables’ coherence on particular dependent variable.

$$RP^2(y,x_1,x_2) = \frac{|R(y,x_1) - R(y,x_2)R(y,x_1)^*|^2}{[1 - R(y,x_1)][1 - R(x_2,x_1)]}$$  \hspace{1cm} (11)

$$RM^2(y,x_2|x_1) = \frac{R^2(y,x_1) + R^2(y,x_2) - 2R_x[R(y,x_1)R(y,x_2)^*] - R^2(y,x_2|x_1)}{1 - R(x_1,x_2)}$$  \hspace{1cm} (12)

4.5.2. The multiple and partial wavelet coherence results

The followings graphs (Fig. 6) depict the partial and multiple wavelet coherencies between Large Cap. Islamic and conventional indexes into the COVID-19 infected cases announcement. More precisely, whereas PWC plot (Fig. 6a) identify the resulting wavelet coherency between Large-Cap. Islamic and conventional indexes after cancelling out the effect of the COVID-19 infected cases announcement across frequencies and over the sample period, MWC is useful in seeking the resulting wavelet coherence of Large-Cap. conventional index and COVID-19 infected cases announcement jointly on the Large Cap. Islamic index. Our findings reveal that, when cancelling out the effect of COVID-19 infected cases, the two indexes reveal strong coherency both at short and long-term horizons.

More implicitly, looking at the PWC plot, when eliminating the COVID-19 infected cases, the strongest coherency is scattered in the very short term (2–4) band of scales over two sub-periods ranging from 12/26/2019 to 2/6/2020 (corresponding to the first infected case announcement in China) and from 3/5/2020 (starting to identify the virus) to the end of the sample period with the correlation ranging from 0.8 to 1. During the period between these two sub-periods no correlation is revealed for the investigated stock pairs. Nevertheless, during the sub-period covering 12/12/2019 to 26/12/2019 corresponding to the pre-infected first cases announcement there is no coherency between the Large-Cap. indexes.

However, a strong co-movement between Large Cap. Islamic and conventional indexes is pronounced in the short-run (4–8) days of scale. In the medium run (8–16 band of scales), a strong coherency between the two indexes underway from 2/20/2020 and spend the rest of the period. Before this date, no coherency is perceived between the same cap Islamic-conventional stock pairs. In long-run frequency band corresponding to 16–32 days’ cycle, a strong coherency is similarly perceived during the period ranging from 12/2/2019 to 4/30/2020. Overall, cancelling out the effect of COVID-infected cases have no impact on the correlation between Large-Cap. indexes in the very short and medium horizons after the announcement of first infected case in China.

In tandem with the last graph, we plot the MWC between Large Cap. conventional index and COVID-19 infected cases on the Large-Cap. Islamic index (Fig. 6b). The MWC plot reveal the synchronized contribution of conventional Large-Cap index and COVID infected cases in explaining the Islamic Large-Cap index movement. As well, the combined effect of the two independent variables is remarkably perceived across-frequencies and over the whole period. The contribution of the Large-Cap. conventional index and infected cases jointly on Islamic index is viewed both at high and low frequencies and mostly displayed at low frequencies indicating that the jointly impact is perceived in long-term covering mostly the period from 12/26/2019 to 4/2/2020. In another word, long-term investors are more interested to Islamic index when taken in consideration the infected case declaration and the growing number of China’s COVID-19 cases. The long-term investors are required to feed their management decision process by updated information concerning the COVID-19 related bad announcement to make a fast decision whenever number of infected cases is growing.

The PWC plot (Fig. 6c) displays the coherency between the Large-Cap. Islamic and Conventional indexes when cancelling out the recovered cases. The correlation between the two indexes is fluctuating from 0.5 to 0.6 at the very short run corresponding to the frequency band 2–4 days of scale, especially over the sub-periods ranging from 12/12/2019 to 12/26/2019 and from 2/20/2020 to 4/2/2020. During these sub-periods this correlation is viewed moderately strong. Noting that during the first sub-period no recovered cases announced yet, whereas the second sub-period is characterized by a very important number of recovered cases. This indicate no significant effect of recovered cases on the co-movement between the Large-Cap. indexes. It is worth to note that this output corroborates our findings in section 4.3. As well, after this period, strong coherency between the indexes is detected with the formation of
a big red color area bearing correlation coefficient in the range of 0.8–1, indicating thus that the co-movement between these indexes is perfectly linear when cancelling out the effect of recovered cases announcement. While in the medium term there is no correlation between the aforesaid indexes from the beginning of the sample period until 2/6/2020, this correlation becomes interestingly strong from this date to the end of period indicative of a strong co-movement between the indexes starting from the date of declaration of 1476 recovered cases in China. Furthermore, when the recovered cases announcement is considered in investigating the association between the Islamic and conventional indexes in the long-term horizon, the coherency between them can be split into two phases where the first one shows a strong correlation covering the period 12/26/2019 to 4/16/2020 followed by a second phase of lack or moderate correlation ranging from 0.4 to 0.7 starting from the mid of January to the end of March 2020. Noting that during this period, the number of recovered cases start to increase much. Cancelling out the effect of the recovered cases have therefore no interesting impact on the co-movement between the Large-Cap. Islamic and conventional indexes.

Looking now at the MWC between Large Cap. conventional index and recovered cases on the Large-Cap. Islamic index (Fig. 6d). The figure shows a strong jointly impact especially localized in the high frequencies corresponding to 4–8 days of scale. The combined

![PWC and MWC between Mid. Cap. Islamic, Conventional indexes and the COVID-19 related announcements.](image-url)
effect of conventional index and recovered cases is also evidently pounced on the Islamic index fluctuation in the medium and long-run horizons starting from the end of January 2020 to the end of the sample period after a clear show lack of impact from December 2019 to the beginning of January 2020. Noting that the declaration of the first recovered cases started exactly by the end of January. The announcement of first recovered cases combined with the conventional index have stimulated the Islamic index variation. The slightly level of effect perceived in long-term horizon can be due to the efficiency of Islamic market when the announcement is already integrated in the index price. The death cases announcement effect on Islamic and conventional indexes is perceived in the PWC plot (Fig. 6e). A simple view to this plot indicates the existence of small islands of green/and or color dispersed over the sample period across the high frequencies. Eliminating the effect of death cases allows us to recognize a moderate coherency between Islamic and conventional indexes in the very short run. The first date of death case disclosure was corresponding to 1/9/2020. From this date, the combined effect of conventional and death cases is visually perceived in the short term where the correlation is ranging from 0.9 to 1 indicating a strong jointly impact of conventional index and death cases on the Islamic index. Although this correlation decreases slightly in the medium term it remains strong especially from 1/23/2020 to the end of the sample period where the correlation is ranging from 0.7 to 0.8.

All the following plots (Fig. 7) depict the PWC and MWC plots between the Mid. Cap. Islamic and conventional indexes and COVID-19 linked announcements. From these graphs interesting conclusion emerged. When cancelling out the effect of the infected cases, the strongest correlation area closed to the unity is scattered in the long-run (Fig. 7a) and covering the period from 12/26/2019 to 4/16/2020. In the short- and medium-term horizons, the correlation is generally ranging from 0 to 0.4 (no correlation between the two indexes) and from 0.4 to 0.6 (low correlation between the indexes). It is thus perceived that, during these scales, eliminating the effect of infected cases have no impact on the co-movement of the Islamic and conventional indexes while this co-movement is highly pronounced in the long-term horizon.

Three degrees of the jointly impact (low, moderate, strong), depicted in MWC plot (Fig. 7b) are well perceived. First, no interesting combined effect is revealed in the short run in the frequency bands (2–4) and (4–8) days of scale particularly during the sub-period 12/12/2019–2/20/2020. After this date, together the conventional index and infected cases strongly affect the movement of the Islamic index. Second, in the medium run corresponding to the frequency band of (8–16) day of scales a moderate impact is perceived during the period starting from 12/26/2020 to the middle of January from where the effect is much stronger. Third, a substantial collective impact is depicted over the whole period in the long-run frequency band (16–32) day of scales. As well, in the same vein of idea, we study the co-movement between the Mid. Cap.

Islamic and Conventional indexes in the time–frequency space when controlling the effect of COVID-19 recovered cases announcements. The PWC (Fig. 7c) and MWC (Fig. 7d) depict interesting findings. Explicitly, we recognize that the association between Mid. Cap. Islamic and Conventional indexes is homogenous across frequency and over time. While monitoring the modifications in recovered cases, the co-movement between the Mid. Cap. indexes is highly perceived at very short-run (2–4 day of scales), and long-run (16–32 day of scales) over the sample period. More precisely, in the very short-run when controlling the effect of recovered cases, the Mid. Cap. indexes experience high mutual fluctuation over the sub-periods 1/9/2020 to 2/6/2020 and 2/20/2020 to 4/2/2020. In the short-run and mid-run, however, there is no significant co-movement between the two indexes implying that cancelling out the effect of recovery cases have no-significant influence on the indexes changes whereas a strong co-movement between the two indexes is extremely seeming in the long-run when cancelling out the effect of recovered cases. When we look for MWC plot (Fig. 7d), we show that the combined effect of Conventional index and recovered cases is more notable in the long-term. In the very short-run, the short-run and the mid-run, the findings are mitigated. Whereas in the very short and short runs the strong effect is shown during January 2020 and over the sub-period starting from March 2020 to the end of the sample period, in the mid-term the jointly strong effect on the Islamic index started from the end of January to the end of the sample period.

While considering the effect of death cases in the relationship between Mid. Cap. Islamic and conventional indexes, we notice a remarkable different situation across frequencies and over time. A strong co-movement between the Mid. Cap. indexes when controlling out the impact of COVID-death cases is recognized for both low and high frequency bands during different sub-periods. The PWC plot (Fig. 7e) reports that the strongest co-movement between the same Cap index pairs when cancelling out the death cases effect is localized in the long-term and cover the whole sample period. No-significant relationship between the indexes is shown in the very short and short-terms expect during the period covering January 2020 where the number of deaths exceed 200 cases. As well, the combined effect of the Mid. Cap. Conventional index and death cases on Islamic index is reported in (Fig. 7f). It is shown that a strong jointly impact is formed over the whole period in the low frequency band (16–32 day of scale). In the short-term, no interesting influence of COVID-19 and Mid. Cap. conventional on counterpart index especially over the period starting from December 2019 to the end of January 2020.

In summary, the PWC and MWC investigation allow us to assess simultaneously the co-movements and interrelationships between same Cap Islamic and conventional stock pairs (Large Cap. and Mid-cap) and COVID-19 related announcements (infected, recovered and death cases announcements) across different frequencies and over time. Our empirical findings provide robust evidence of destabilization in the co-movement and correlation between Islamic and conventional indexes for different scales and over dissimilar sub-periods. Indeed, the weakening of co-movements is especially notable in the very short and short scales where the short-term investors operate. This result is important as the stock market is dominant by short-term investors who are seeking capital gains. Furthermore, investors have heterogenous expectations and different perceptions of the relevant news over the short and long-run investment horizons. Given their risk profile, we conjecture that they will react more quickly over the short term horizon by rebalancing their portfolio compositions.

As well, no significant impact of the recovered cases announcement on the correlation between Mid / Large-Cap Islamic and Conventional indexes. Interestingly, the same Cap stock pairs did not react positively to death announcements. Also, from the scale
domain, these indexes correlate with each other mainly across high scales (Long-term horizon). It is interestingly to note that our evidence corroborates our findings acquired from multivariate GJR-GARCH-DCC and standard GARCH models. From all our results we recognize that the COVID-19 epidemic could provoke several types of spillovers and contagion compared to other financial disasters. Precisely, the COVID-19 related announcements are driving the correlation and volatility over different horizons, and meaningful change the investors’ expectations and asset valuation which push some portfolio managers to update their investment operations to COVID-19 information inflows. The Efficiency Market Hypothesis asserts that stock prices quickly and fairly assert all accessible information. Nevertheless, supporters of behavioral finance presume that, because of the departure from the rationality hypothesis, the investors may exaggerate to information due to their psychological biases (Rahman et al., 2021). In other words, different market news (especially bad news) linked to risks and transmissible disease can result on investors passiveness which ultimately influence investors’ sentiments as whole (Saleem et al. 2021). As well, it is worth noting that the process of decision making is related to uncertainty, anxiety, and risk aspects. Accordingly, bad news increases potential risks in investment operations which will be reflected in stock returns mainly in period of global risk. Recently, Baek et al. (2020) proved the substantial impact of COVID-19 related- news on US stock market volatility. The findings revealed that volatility is susceptible to both negative (death, infected cases) and positive (recovered news) COVID-19 information, however the negative news is more impactful. Moreover, the results reported an asymmetric impact of the COVID-19 outbreak bad versus good information on volatility spillover. Precisely, news about recoveries cases affects volatility less than information related to death news. This implies that, during global risks period, the stock market reaction to COVID-19 news exhibits a positive–negative asymmetry.

5. Conclusions, managerial implications and future research

In this paper, we analyze the connectedness between the Chinese Islamic and conventional stocks in time of the ongoing COVID-19. We implement a standard multivariate GJR-GARCH model under dynamic conditional correlations and the multiple and partial wavelets coherences to daily data (Mid. and Large Cap. Islamic stocks and their conventional counterparts) and Chinese COVID-19 data including the infected counts, deaths as well as recovered cases for the period going from 2 December 2019 to 8 May 2020. Our main goal is to check to which extent the uncertainty caused by the COVID-19 as well as its related announcements are affecting the connectedness between the Islamic stocks and their conventional counterparts. The multivariate GARCH under DCCs specification discloses a strong positive correlation between Islamic stocks and their conventional counterparts an important time-varying pattern of their dependence structure during the COVID-19 pandemic. When looking to the impact of the COVID-19 counts, we perceive that the impact of COVID-19 infected cases has increased the correlation, while the COVID-19 deaths have a substantial negative impact on the Large Cap. stocks.

However, the recovered patients count have no significant impact on the size of the average’ DCCs. Financially, this result suggests that “bad news” related to infected cases and deaths are influencing the dependence structure between the Islamic Large Cap. stocks and their conventional counterparts. Quite similar results are obtained for the Mid. Cap. stocks, but in reverse order. Meaning, COVID-19 infected cases reduce DCCs, while deaths increase them and recovered cases still have no significant impact in conditional correlation between two Mid. Caps. This may be explained by behavior of local and international investors who are concerned with sharia compliant stocks. These investors will switch their portfolio allocation moving from Islamic stocks to conventional or vice-versa according to their risk short- and long-term risk perception as well to their risk level tolerance. Such short-term investment strategy may contribute to a substantial risk reduction of their Islamic assets’ portfolios during COVID-19 time. When looking to the impact of the COVID-19 counts on the DCC volatility, we perceive that they do not have any significant impact on the DCCs fluctuations. This result is inconsistent with previous works including Baig et al. (2020) in the US market who claimed that infected cases and deaths caused by the new infectious disease have sizable impact on stock market illiquidity and volatility. The negative sentiments and the lockdown and social restrictions are causing deterioration of market liquidity and stability.

Therefore, to broaden our analysis of the multivariate GJR-GARCH we extend this study in two complementary ways. First, we investigated the effect of the COVID-19 related announcements on the strength and the volatility of the dynamic correlations between the Chinese Islamic and conventional stocks by resorting to a standard GARCH modelling of the DCCs. Second, we implement the multiple and partial wavelets to check how the COVID-19 is affecting the Islamic-conventional interplays within the time-scales and investment horizons (frequency bands). Broadly speaking our COVID-19 related announcement effect analysis reveal some interesting results. Indeed, 7 out of 10 COVID-19 related announcement turn out to be significant and we perceive that only announcements which carry serious health treats or economic implications do affect the variance of correlations. Even when an announcement affects the variance of the correlation, the impact is not uniform among different combinations of Islamic and conventional stocks, with same-cap stock pairs being affected in one direction and mixed-cap stocks being affected in the opposite direction. Which give us important implications that mixing Islamic-conventional stocks of different levels of capitalization bring more benefit in terms of diversification rather than holding same Caps of Islamic and conventional stocks or opposite Caps of each. This finding goes in line with conclusion of the study by Umar & Gubareva (2021). Based on their analysis of the coherence between the COVID-19 related Media Coverage Index (MCI) and the movements of the Islamic equities in some sector, their work reveals that some diversification benefits can be attributed to Islamic stocks.

Second, when resorting to the multiple and partial wavelets, our results are exceptionally relevant and offer robust evidence of instability of the co-movement and correlation between Islamic and conventional stocks across various time-scales and over dissimilar sub-periods. Indeed, the weakening of co-movements is especially notable in the very short and short-run investment horizons where the short-term investors operate. Here also, we found no significant impact of the recovered cases announcement on the correlation between Mid. / Large-Cap Islamic and conventional stocks. Interestingly, the same Cap stock pairs did not react positively to death
announcements. Also, from the scale domain, these indexes correlate with each other mainly across high scales (Long-term horizon). It is interestingly to note that our evidence corroborates our findings from the multivariate GJR-GARCH analysis. In sum, the wavelet analysis unveil that the COVID-19 related announcements are driving the correlation and volatility over short and long-run investment horizons, and substantial change in the investors’ expectations and asset valuation process which thrust some portfolio managers to redesign their investment strategies to account for the COVID-19 information inflows.

However, our findings on the multiple and partial wavelets conflict with findings of Hasan et al. (2021) who found also using wavelet-based method that the pandemic creates identical volatility in both Islamic and conventional stock markets. Yarovaya et al. (2021) while using the VARMA-BEKK-AGARCH approach also found Islamic stocks to have stronger spillover with conventional ones at the global level. There are two possible explanations for such outcomes which conflict with our findings. Firstly, both Hasan et al. (2021) and Yarovaya et al. (2021) used global stock market data, while our sample is taken from China stock market which also corresponds to slightly different time periods compare to above studies. Secondly, we distinguish between Large and Mid-cap stocks in our analysis and look at relation between different caps as well, while those two works do not make such distinction. Therefore, it can be concluded that our study is directly related to Chinese Islamic and conventional stock pairs and could also be to extended to some other emerging markets, whereas findings of Hasan et al. (2021) and Yarovaya et al. (2021) are more relevant if looked at the matter from a global investor’s perspective. Work by Uddin et al. (2021) analyzing 34 developing and developed found that country-level economic characteristics and factor play a vital role in reducing the volatility of individual stock markets during pandemic. Therefore, our findings may be applicable to emerging markets with similar economic characteristics and level of stock market development as China. However, the interplay between Islamic and conventional stock may turn out to be different for markets with different economic characteristics.

Our study offers some prominent financial implications for policymakers and asset managers. From an asset management view, Chinese and international traders and asset portfolios managers should consider jointly the connectedness as well as the time-scales and frequencies varying pattern of Islamic and conventional stock indexes when introducing them into their traditional portfolios. They are incited to account for the varying pattern of the Islamic-conventional stocks interplays through short and long-run investment horizons. Furthermore, our results will help to understand whether the Sharia compliant stocks could be perceived as a safe-haven asset against traditional asset classes during tremendous market conditions. For policymakers and regulators, it is useful for them to understand how the two conventional and sharia compliant stocks are behaving during the ongoing COVID-19 outbreak especially when third or fourth wave of the infectious diseases is expected. While China and other countries are racing to defeat economic impact of the pandemic as much as possible, such understanding may help them to design suitable strategies from a regional and global financial stability perspective.

We would like to acknowledge that the present study paves the way for various research avenues. It would be interesting to get hourly data for stocks and COVID-19 counts. Such dataset will be beneficial to understand the intra-day varying pattern of the comovements. It would be interesting to check the relevance of the sharia compliant weak and strong safe-haven (see, Shahzad et al., 2019) during the COVID-19 pandemic. Finally, even if there were some global studies conducted, extending the study to some specific countries such as the US, UK, European, Middle Eastern or Southeast Asian counties may offer new insights to the research question.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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