Portfolio diversification benefits during the COVID-19 crisis in USA: Islamic/conventional stock markets

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Abstract:

This paper investigates the portfolio diversification benefits for Islamic and conventional investors in the United States with its major trading partners (United Kingdom, Canada, China, Japan, Malaysia, and Turkey) before and during the COVID-19 crisis period. Using daily data from 2007 to 2020, we employ four relevant time-varying and timescale-dependent techniques: the dynamic conditional correlation (DCCGARCH) model, The findings suggest that conventional and Islamic U.S. investors who invest with major trading partners may reap large diversification benefits for short investment horizons.

Keywords: COVID-19, Diversification benefits, Trading partners, M-GARCH

1. Introduction:

The integration of international stock market indices and their diversification has attracted the attention of several researchers and financial analysts. The international financial system has amazingly developed, due to financial liberalization, increased trade links and economic globalization. Globalization and securitization have an important role in stock markets' growth of the major industrial countries. Investors are hence allowed to invest outside their home countries to take advantage of geographical diversification benefits and earn higher returns in foreign markets. Besides, the liberalization of financial markets, initiated by most developed countries, has helped foreigners to buy shares in domestic stock markets. On one hand, such an integration has led to increased savings, improved efficiency, and economic growth (Henry, 2000). On the other hand, the synchronization of economic cycles and the correlations between stock market inventories have strongly increased over time and across countries (Khan, 2011). The interdependence between stock markets through the detention of diversified securities constitutes, nowadays, a real concern for investors who struggle to reduce their exposure to risks (Khan, 2011).

Theoretically, the problem of portfolio optimization has been a problem of theoretical and empirical importance in financial markets since the 1950s. It involves choosing an optimal portfolio strategy that balances maximizing investment

returns with minimizing investment risk. The financial literature shows that investors with high risk tolerance invest in riskier portfolios (H. Markowitz, 1952).

Several empirical studies have focused on such an issue in either developed or developing economies. Overall, most studies are carried out in the US and Europe and largely focused on conventional stock market indices. Few studies have examined the degree of diversification for both conventional and Islamic stock market indices to verify which ever contributes most to reducing risks (Arshanapalli & Doukas, 1993; Bugan et al., 2021; Cheng & Cayseele, 2009; Saiti et al., 2014). However, most researchers focused on either classical or Islamic stock market indices. They have not provided any comparison between them. Besides, most studies do not provide the same findings. Such an issue deserves hence further investigation.

Other researchers have investigated the interdependencies of conventional stock indices. However, the findings are inconclusive. According to Saiti et al., 2014, Islamic countries are characterized by a higher diversification potential compared to other regions. Perhaps, the specific characteristics of Islamic stock Indices such as, ethical and ratio screenings, exclusion of financial sectors, exclusion of highly leveraged firms, the limit of interest-based leverage, and, finally, exclusion of using complex and intensive structured financial products, derivatives, and other toxic assets, all of them likely would make Islamic stock indices

better positioned. Therefore, Islamic stock index is argued to be more resilient to a financial crisis compared to a conventional stock index (Raditya Sukmana & Hidayat, 2015).

Based on this literature, the main objective of this paper is to analyze the benefits of portfolio diversification for Islamic and conventional investors in the US with its main trading partners (Canada, China, Japan, Turkey, and Malaysia) before and after COVID-19. To do so, we employ the DCC-GARCH method using Dow Jones conventional and Islamic indices returns.

The rest of this paper is organized as follows. The section 2 presents the literature review. The section 3 describes research methodology. The empirical results are set out in Section 4. Section 5 offers some concluding remarks and recommendations.

2. Literature review:

Theoretically, the pioneering work of Markowitz (1959) was the first to shed light on the portfolio diversification issue. Based on Modern Portfolio Theory, Markowitz, 1959 developed a model to determine the optimal portfolio. Such a portfolio would allow a minimum level of risk, while maintaining a satisfactory level of profitability. Likely, it would offer a higher return for a specific level of risk. The arguments are not limited to risk reduction but also to maximize the portfolio return. In addition, portfolio diversification reduces excessive exposure to risk in the stock markets. Specifically, the strong

interdependence between stock markets exposes investors to perilous situations as these markets move with high correlations. In such a situation, investors likely cannot benefit from cross-border diversification. However, the literature related to portfolio diversification has never ceased to evolve. Based on efficient market hypothesis, Fama (1970) constructed a model in which he criticized the arguments put forward by Markowitz, 1959. For instance, he suggests that market participants could intervene and react instantly in perfect financial markets. Indeed, information symmetry would attract more investors and ensure more credibility on stock prices.

In the financial market literature, several empirical studies have also focused on the link between global markets. To examine the connection between international and regional stock returns, several studies employed the ARDL model and the co-integration method (Arshanapalli & Doukas, 1993; Bley & Chen, 2006, 2006; Majdoub et al., 2016; Wu et al., 2020). Although these different econometric techniques have enriched the literature, they remain limited as they have not taken into account time-varying correlations. They have also ignored different investment horizons over time.

To address this problem, empirical studies focused another econometric method to consider time-varying correlations and scale-dependent correlations. Specifically, in order to detect the presence of time-varying correlations, several studies have

applied dynamic conditional correlation models (DCC-MGARCH) (e.g., Bugan et al., 2021; Rahim & Masih, 2016; Raza et al., 2019; Saiti et al., 2014). Second, to jointly assess co-movements and lag effects between two stock markets in the time and frequency domain (i.e. examining the time variation and scale variation of co-movements between two stock markets), some empirical studies have used CWT (e.g., Aloui & Hkiri, 2014; Mariana et al., 2021; Rahim & Masih, 2016; Rizvi et al., 2015; Sun & Xu, 2018).

3. Methodology:

In this paper, we employ DCC-GARCH method to examine the portfolio diversification benefits for Islamic and conventional investors in the United States with its major trading partners. More specifically, this method is employed to analyze time dependent correlation and volatility of returns of conventional and Islamic indices (Rahim & Masih, 2016). Similar to Rahim & Masih (2016), we test volatility mean reversion using linear restrictions and forecasting correlation of returns over a specific time.

Following Engle (2002), the DCC-GARCH is estimated in two steps. The first step is to estimate the GARCH parameters. The second step is to estimate the correlations. The conditional variance equation of this model is then written as follows:

$$H_t = D_t R_t D_t \quad (1)$$

Where, H_t is the conditional covariance matrix, D_t denotes a diagonal matrix with time-varying standard deviations on the diagonal, and R_t represents the conditional correlation matrix.

4. Data and empirical results:

4.1 Data

In this study, the Dow Jones conventional and Islamic indices returns are used as a proxy for the US stock index returns which is the principal Conventional and Islamic benchmark indices of the US stock exchange. In addition, we use the principal trading partners of United States which are from United Kingdom, Canada, China, Japan, Turkey, and Malaysia. The choice of this index depends mainly on the largest single-point drop in history for the Dow Jones, which fell 2,997.10 on March 16, 2020. The list of the indexes and their respective tickers are in Table 1.

Table 1
List of indices

Ticker	Definition
Conventional indices	
DJUS	Dow Jones US conventional index
DJUK	Dow Jones UK conventional index
DJCA	Dow Jones Canada conventional index
DJCH	Dow Jones Chine conventional index
DJJA	Dow Jones Japan conventional index
DJTUR	Dow Jones Turkey conventional index
DJMA	Dow Jones Malaysia conventional index
Islamic indices	
DJIUS	Dow Jones US Islamic index
DJIUK	Dow Jones UK Islamic index
DJICA	Dow Jones Canada Islamic index
DJIJA	Dow Jones Japan Islamic index
DJTUR	Dow Jones Turkey Islamic index
DJIMA	Dow Jones Malaysia Islamic index

All data comes from Thomson-Reuters Datastream database. These indexes are converted to market returns by calculating the natural logarithmic differences of the daily closing prices ($ln(p_t)-ln(p_{t-1})$). The closing prices are collected during the period from 26th November 2007 to 19th Mars 2020, covering 3195 trading days. The plots are presented in figure 1.

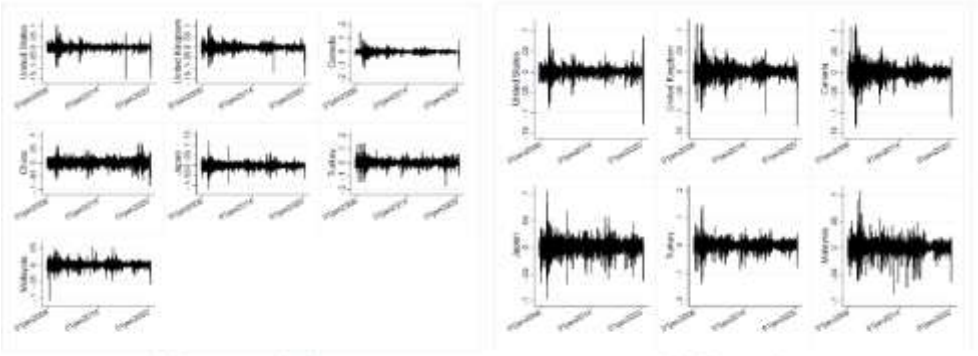

Figure 1: Returns series plot of conventional and Islamic Dow Jones indices (DJUS, DJUK, DJCA, DJCH, DJJA, DJTUR, and DJMA & DJIUS, DJIUK, DJICA, DJICH, DJIJA, DJITUR, and DJIMA)

Table 2 summarizes the descriptive statistics of all the indices used in this study. It shows that the existence of excessive return volatility for the conventional Dow Jones US index since its standard deviation value is high. However, this volatility appears to be lowest for the US Islamic returns. In this case, the time-independent absolute volatility of the return is denoted by the standard deviation. Furthermore, with the exception of the returns of the Dow Jones Conventional Canada Index, the returns are asymmetric. In this case, the skewness[1] result reveals the presence of high risks. Furthermore, the results in Table 2 suggest that the returns of the conventional and Islamic indices

[1] The skewness is the measure of the asymmetric property of any distribution.

are not normally distributed as the kurtosis[2] values are greater than three. This again indicates the existence of high risks. From the results of the Jarque-Bera test, it can be seen that the distribution is not normal as all the returns of the conventional and Islamic indices are significant. This certainly reflects the severity of the variability and risk of the returns of the conventional and Islamic indices, which are significant.

Table 2

Descriptive statistics

Conventional index							
	DJUS	DJUK	DJCA	DJCH	DJJA	DJTUR	DJMA
Mean	-2.80E-05	-0.000247	1.38E-05	4.09E-06	-5.19E-05	-0.000503	-0.000163
Median	0.000660	0.000339	0.000626	0.000000	0.000326	0.000342	0.00000
Maximum	0.107740	0.108351	0.523630	0.078229	0.126605	0.147924	0.054327
Minimum	-0.150628	-0.140642	-0.140697	-0.085298	-0.120659	-0.170506	-0.109175
Std. Dev.	0.014072	0.014142	0.017682	0.013627	0.013748	0.022336	0.009433
Skewness	-1.606557	-0.749510	7.557620	-0.222719	-0.250784	-0.497663	-0.813503
Kurtosis	21.57637	15.32418	250.1342	5.956129	11.42669	9.445471	13.11550
Jarque-Bera	47313.39	20518.90	8161069.	1189.753	9486.572	5662.441	13974.20
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Islamic index							
	DJUSI	DJUKI	DJCAI	DJJAI	DJTURI	DJMAI	
Mean	0.000250	-0.000157	-0.000200	9.28E-05	-4.42E-05	7.88E-05	
Median	0.000655	0.000236	0.000348	0.000273	0.000406	0.000272	
Maximum	0.117498	0.116768	0.118689	0.106586	0.147142	0.108989	
Minimum	-0.128880	-0.131457	-0.137681	-0.095483	-0.138005	-0.086419	
Std. Dev.	0.012069	0.014772	0.017195	0.013078	0.017498	0.012994	

[2] The kurtosis indicates the measure of the fatness of the distribution. In fact, it defines how concentrated the data are around the mean of the distribution.

Skewness	-0.478853	-0.282088	-0.792615	-0.265942	-0.433732	-0.249422
Kurtosis	18.91403	13.81815	14.96492	8.742828	10.62338	9.593077
Jarque-Bera	33836.87	15622.31	19392.63	4428.133	7836.849	5819.894
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000

4.2 Estimation using M-GARCH DCC model

In this section, two types of empirical tests are conducted, namely, comparison of Gaussian DCC and t-DCC models and plotting the estimated Conditional Volatilities and Correlations.

4.2.1 Maximum Likelihood (ML) estimates of the Gaussian DCC and t-DCC models on stock indices daily returns

We first interest in modelling volatility and the correlations between these indices. In this framework, we set $\mu_t - 1 = 0$, and estimate DCC models on the Conventional and Islamic indices daily returns over the period considered. Furthermore, any case of non-convergence was not encountered.

In order to choose the most appropriate model for this study, two main ML estimates are performed on the conventional and Islamic stock indices. The first estimate is based on the Gaussian DCC model. The second estimate focuses on the t-DCC model. Table 3 reports the different results. The maximized log-likelihood values (67973.2 and 66463.07) obtained from t-DCC

models are significantly larger than those are (58148.09 and 58201.78) obtained from DCC Gaussian models, indicating that t-DCC models are the most appropriate for our data. The results of the t-DCC model show that the volatility of returns is statistically significant in all regressions. It is also close to unity. This result suggests the existence of a gradual decrease in volatility.

The results reported in the table 3 show that the volatility parameters are highly significant. Moreover, these results prove that the volatility of the conventional and Islamic Dow Jones indices do not follow the Integrated Generalized Autoregressive Conditional Heteroscedasticity (IGARCH) procedure. In fact, from a theoretical viewpoint, the sum of the parameters $Lambda_1$ and $lambda_2$ must be strictly less than 1 (for example, the sum of the parameters of the US is equal to 0.981 + 0.012 = 0.993). In other words, shocks arising from volatility are not permanent. In this case, investors and portfolio managers might be required to lose good investment opportunities even if they make high profits in the short run.

Table 3

ML estimates of Gaussian t-DCC model on conventional and Islamic stock indices daily returns.

Parameter	Conventional		Islamic	
	Gaussian	t-DCC	Gaussian	t-DCC
Lambda1-DJUS	0.661***	0.981***	0.610***	0.860***
	(0.045)	(0.108)	(0.045)	(0.083)
Lambda1-DJUK	0.804***	0.887***	0.804***	0.860***
	(0.058)	(0.151)	(0.058)	(0.139)
Lambda1-DJCA	0.655***	0.970***	0.655***	0.810***
	(0.054)	(0.099)	(0.054)	(0.114)
Lambda1-DJCH	0.892***	0.877***		
	(0.082)	(0.136)		
Lambda1-DJJA	0.735***	0.899***	0.892***	0.775***
	(0.077)	(0.154)	(0.082)	(0.116)
Lambda1-DJTUR	0.849***	0.946***	0.735***	0.989***
	(0.100)	(0.200)	(0.077)	(0.156)
Lambda1-DJMA	0.753***	0.896***	0.849***	0.905***
	(0.030)	(0.136)	(0.100)	(0.122)
Lambda2-DJUS	0.157***	0.012***	0.353***	0.077***
	(0.025)	(0.001)	(0.030)	(0.009)
Lambda2-DJUK	0.303***	0.022***	0.157***	0.105***
	(0.028)	(0.003)	(0.025)	(0.016)
Lambda2-DJCA	0.022***	0.027***	0.203***	0.189***
	(0.003)	(0.002)	(0.028)	(0.027)
Lambda2-DJCH	0.210***	0.071***		
	(0.036)	(0.013)		
Lambda2-DJJA	0.120***	0.046***	0.122***	0.160***
	0.034	(0.007)	(0.026)	(0.026)
Lambda2-DJTUR	0.117***	0.052***	0.210***	0.010***
	(0.003)	(0.007)	(0.036)	(0.0015)
Lambda2-DJMA	0.227***	0.080***	0.120***	0.075***
	(0.003)	(0.009)	(0.034)	(0.013)
delta1	0.006***	0.992***	0.005***	0.987***

	(0.0001)	(0.003)	(0.001)	(0.001)
delta2	0.993***	0.006***	0.993***	0.011***
	(0.001)	(0.001)	(0.001)	(0.001)
df	4.633***	3.883***		
	(0.169)	(0.158)		
Maximized log-likelihood	66463.07	67973.2	56887.59	58148.09

Notes: This table presents the results of ML estimates of Gaussian and t-DCC models on conventional (column 1) and Islamic (column 2) stock indices daily returns. Standard errors are shown in parentheses. *** represents the significance of the variables at the 1%.

The table 4 then summarizes the different results on unconditional volatility. For more details, we have classified the unconditional volatility between conventional and Islamic indices in table 5, from lowest to highest.

The diagonals of the table 5 show the volatilities of the indices. If the volatility is close to zero, the index has the lowest volatility. However, excessive volatility levels are detected when unconditional volatility is around 1. For our case, we find that the conventional indices (Panel A) have low levels of unconditional volatilities ranging from 0.067 to 0.152. Specifically, we find that the US Dow Jones index is relatively the least volatile compared to the other six conventional indices. More specifically, in contrast to the other six conventional indices, the American Dow Jones index is less volatile. We also remark that the Islamic

indices (Panel B) have low unconditional volatilities ranging from 0.083 to 0.156. It follows from this that the Islamic indices are thus low volatile. By conducting a comparative analysis between the Islamic indices of the different countries in our sample, we remark that the Dow Jones index of the United States is relatively the least volatile.

Table 4

Unconditional correlation and volatilities on Conventional and Islamic stock indices daily returns.

Panel A: Conventional indexes							
	DJUS	DJUK	DJCA	DJCH	DJJA	DJTUR	DJMA
DJUS	0.067	0.174	0.204	-0.018	0.008	0.065	0.021
DJUK	0.174	0.121	0.864	0.061	0.349	0.342	0.459
DJCA	0.204	0.864	0.050	0.055	0.310	0.350	0.400
DJCH	-0.018	0.061	0.055	0.113	0.070	0.105	0.057
DJJA	0.008	0.349	0.310	0.070	0.128	0.121	0.372
DJTUR	0.065	0.342	0.350	0.105	0.121	0.152	0.148
DJMA	0.021	0.459	0.400	0.057	0.372	0.148	0.103
Panel B: Islamic indexes							
	DJIUS	DJIUK	DJICA	DJIJA	DJITUR	DJIMA	
DJIUS	0.083	0.009	0.090	-0.036	0.053	0.613	
DJIUK	0.009	0.139	0.177	0.127	0.089	0.005	
DJICA	0.090	0.177	0.114	0.010	0.067	0.044	
DJIJA	-0.036	0.127	0.010	0.116	-0.008	0.043	
DJITUR	0.053	0.089	0.067	-0.008	0.156	0.007	
DJIMA	0.613	0.005	0.044	0.043	0.007	0.122	

Furthermore, the off-diagonal elements show the unconditional correlations (table 5). We detect that the correlation between the returns of the conventional Dow Jones index of the United States and Canada is the highest likened to the other correlations (i.e., +0.204). This comparison then indicates that the DJUS and DJCA index returns are the most correlated compared to the other returns, but this correlation remains relatively low. This result is not surprising since Canada is the largest trading partner of the United States (Commerce, 2019). However, the considered correlation between the U.S. and Japanese Dow Jones index returns appears to be the lowest as it is equal to +0.008. Based on the above results, it can be seen that U.S. investors could benefit from diversification advantages if they invest in the Japanese stock market. This diversification policy will be realized if conventional US investors include the Japanese stock index in their portfolio compared to other indices. This conclusion was confirmed by Rua & Nunes (2009). We now discuss the results on the unconditional correlations between the returns of the Dow Jones Islamic American Index and other Islamic indices. We find that the correlation between the returns of the US index (DJUS) and the Malaysian index (DJMA) is the highest compared to the other unconditional correlations (i.e., +0.613), thus proving the existence of a strong correlation. However, the lowest unconditional correlation was found between the returns of the DJUS and DJUK index (i.e., +0.009).

Here, it can be concluded that the Malaysian index (purely Islamic DJIMA) does not provide US investors with good opportunities in terms of diversification. However, Turkey's Dow Jones Islamic Index (DJITU) provides better diversification benefits than Canada and Japan.

Table 5

Unconditional correlation and volatilities on Conventional and Islamic stock indices daily returns.

No.	DJCI	Un.Vol	DJII	Un.Vol
1	DJUS	0.067	DJIUS	0.083
2	DJUK	0.050	DJIUK	0.114
3	DJCA	0.103	DJICA	0.116
4	DJCH	0.113	DJIJA	0.122
5	DJJA	0.121	DJTUR	0.139
6	DJTUR	0.128	DJIMA	0.156
7	DJMA	0.152	-	-

Note: DJCI: DJ Conventional indices; DJII: DJ Islamic indices; Un.Vol: Unconditional volatility.

4.2.2 Plotting the estimated conditional volatilities and correlations for conventional and Islamic indices

In this subsection, we present the plots of the dynamic conditional volatilities and correlations, considering the varying properties over time. The figures 2 and 3 illustrate the different results. Figure 2 illustrates the conditional volatilities of conventional and Islamic returns. Specifically, we perform a

comparative analysis according to the different crises (2008 financial and COVID-19 crises).

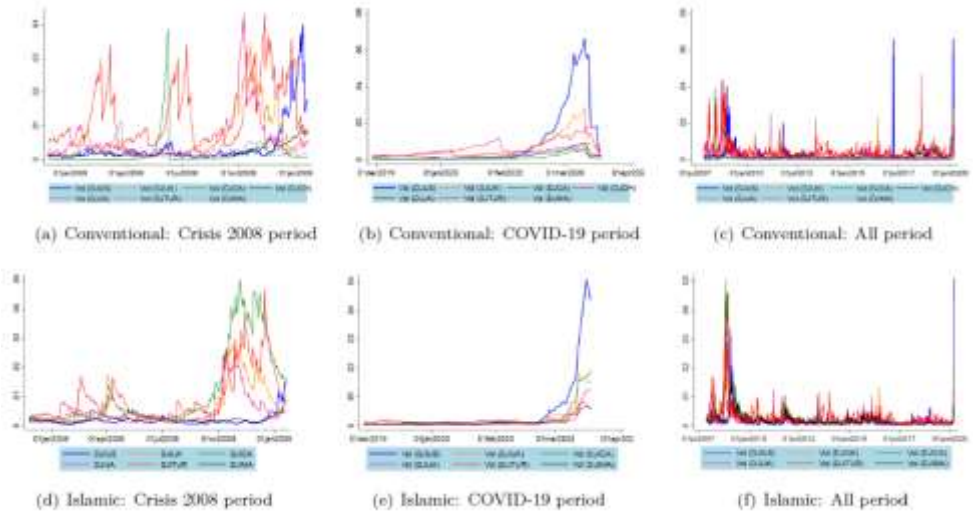

Figure 2: Conditional volatilities of the Conventional and Islamic indices returns.

There appears to be a strong convergence in volatility between the returns of the conventional indices of Turkey, Japan, Canada, and the UK. This strong convergence could be attributed to the global financial crisis that occurred in 2008 (Rahim & Masih, 2016). It reflects greater integration between these markets. However, this contradicts with the case related to the DJ index returns of China and Malaysia. From these results,

excessive integration between stock market returns is detrimental to investors.

This is likely to reduce the opportunities to benefit from portfolio diversification. These results are consistent with those presented in Table 5. Specifically, the conditional volatility of U.S. index returns was also observed to be high in late December 2008. This may have contributed to the onset of the subprime crisis (July 2007) for the first time in the US. On the other hand, it seems that the Japanese conventional and Islamic stock market reached an unusual spike, higher than that of other stock market indices. This spike is mainly due to natural disasters (tsunami, 2011 land movements).

The COVID-19 period is marked by a sharp increase in volatility in both conventional and Islamic stock markets, especially for the United States in late February 2020. According to Baker et al. (2020), the COVID-19 pandemic generated the most volatility in the U.S. stock market compared to other epidemics (SARS in 2003 and the Ebola epidemic in 2015). Indeed, the 2003 SARS outbreak and the 2015 Ebola outbreak generated modest and short-lived spikes in volatility. In addition, other epidemics such as avian and swine flu also generated a small spike. Therefore, Baker et al. (2020) suggested that the COVID-19 pandemic resulted in the third highest peak in volatility since 1900, constituting the highest spikes by historical

standards. Finally, we also find that the spike in volatility from the COVID-19 crisis spiked in the fourth week of February 2020. This result is consistent with that found by Baker et al. (2020).

Furthermore, figure 3 illustrates the conditional correlations. These results consistently confirm the results of the unconditional correlations reported in table 5. Indeed, the conditional correlation between the returns of the conventional DJ indexes of the United States and Japan appears to be the weakest. Moreover, the results confirm the previous results that the returns of the U.S. DJ index are highly correlated with the returns of the conventional index for Canada. Similarly, the results are similar for the Islamic DJ indices, showing a weak correlation between the returns of the US and UK Islamic DJ index, and a strong correlation between the US and Malaysian Islamic DJ index.

Finally, the conditional correlations between the returns of the U.S. DJ indices (conventional and Islamic) and the other indices (trading partners) appear to move quite closely, especially during the 2008 global financial crisis period and especially during the COVID-19 crisis period.

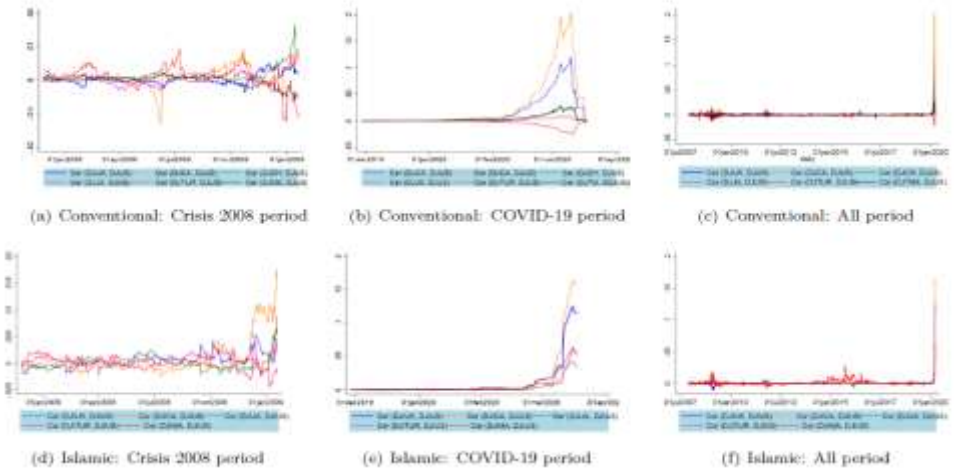

Figure 3: Conditional correlations of the Conventional and Islamic indices returns.

5. Conclusion:

This paper investigates the portfolio diversification benefits for Islamic and conventional investors in the United States with its major trading partners (United Kingdom, Canada, China, Japan, Malaysia, and Turkey) before and during the COVID-19 crisis period. To do so, we collected data on the closing prices of the Dow Jones conventional and Islamic indices from 26 November 2007 to 19 March 2020. These data are daily time series. As in previous studies, we use the DCC-GARCH method.

The results of DCC-GARCH model showed that the unconditional volatilities of conventional U.S. Dow Jones indices

are relatively lowest compared to other conventional indices. In addition, we found that unconditional correlation between the returns of conventional Dow Jones index of the United States and Canada is the highest compared to other correlations. However, the results showed a low correlation between the returns of the Dow Jones Conventional Index of the United States and Japan. Regarding the Islamic index, it seems that the returns of the Dow Jones Islamic indices of the United States and Malaysia are the most correlated. However, the unconditional correlation between the returns of the U.S. and Turkey Islamic indices appears to be the lowest. Based on these results, U.S. investors could benefit from portfolio diversification if they invest in the Japanese stock market. This diversification policy will be realized if conventional US investors include the Japanese stock index in their portfolio. In addition, the Dow Jones Islamic Index of Turkey offers better diversification benefits than Canada and Japan.

In terms of policy implications, the geographic diversification is an appropriate policy for US investors in short investment horizons. Therefore, policymakers need to consider these implications.

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