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Did the Islamic Stock Index Provide Shelter for Investors during the COVID-19 Crisis? Evidence from an Emerging Stock Market

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Abstract: The economic and financial chaos caused by COVID-19 has been a discussion topic since the beginning of 2020. This study intends to provide a parallel comparison of volatility change and external shock persistence of the Islamic and conventional stock indexes of the Pakistan Stock Exchange. The daily stock index was extracted from Eikon Thomson Reuters for the conventional and Islamic stock index from Jan 2018 to April 2021, which was further divided in three periods, i.e., full, pre-, and post-pandemic period. The data have been analyzed using generalized autoregressive conditional heteroscedasticity (GARCH). An optimally parameterized GARCH (1,1) model is used to measure volatility change for both the pre- to post-pandemic periods. The results suggest that the magnitude of risk in a conventional index is significantly higher than that of the Islamic stock index for the period of study. However, the level of COVID shock persistence is longer in the KSE (conventional) index compared to the KMI (Islamic) index.

Keywords: emerging market; Islamic stocks; COVID-19; risk and volatility

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1. Introduction

The spread of an unprecedented pandemic, COVID-19, has damaged the global economy and changed people's lives. Although the virus was deadly for 2% to 3% of infected people, it was highly contagious. The outbreak of the pandemic was triggered in Wuhan city in China in December 2019 where the SARS-CoV-2 virus was identified as responsible for the spread of the deadly disease (ProMED 2019; Sohrabi et al. 2020). The Wuhan Municipal Health Committee (WMHC) and all medical units of the territory struggled hard to handle and find a cure, but the number of infected continued to increase day by day. Considering the urgency of the health crises, a press conference was conducted by the World Health Organization (WHO) on 14 January 2020 and the rapid spread of the novel Coronavirus in the word was announced. It is important to mention that within two months, the pandemic had spread to other countries such as Japan, the UK and Germany. As a result, the WHO declared a global health emergency (WHO 2020). It was declared as pandemic on 11th March 2020 as millions of people were infected worldwide (Dunford et al. 2020).

In response to the pandemic social and economic activities were shaken all over the world. The virus did not only affect the lives and emotions of human beings, but it also negatively impacted economies globally, which grabbed special attention among academic researchers and policy makers (Mousa et al. 2021; Saleem et al. 2021). The issue also needs to be addressed as its severe and far-reaching consequences are being felt across the globe

in the form of increased economic and developmental costs that have also disrupted the overall global value chain. Similarly, the pandemic caused an unparalleled adverse effect on the financial and stock markets all over the world (Goodell 2020). For example, stock markets in the US suffered badly, which caused a rapid decline in the indices and stock prices of different sectors including real estate, the entertainment industry, hospitality, and petroleum (Mazur et al. 2021).

Notably, Baker et al. (2020) reported that the pandemic has had an unusual and extraordinary impact on the stock markets. Similarly, governments barred people from social gatherings and imposed lockdowns that confined economic activities. Moreover, considering the sector-wise performance on the stock market, besides the systematic risk due to the global pandemic, much of the stock in each sector has faced an idiosyncratic risk due to the volatility of stock returns as well (Baek et al. 2020). Supporting the findings from previous studies, Baker et al. (2020), with a comprehensive data analysis, studied the volatility of stock markets. It was concluded that the pandemic caused the suffering of equity markets all over the world in an unexpected way as it caused a worsening decline in the stock and indices of almost every stock market on the globe.

Likewise, signaling theory suggested that public and private information disseminated in the market both have an effect on the stock price and volatility. Phan and Narayan (2020), based on the notion of signaling, found that, when markets responded to the bad news of pandemic, they seemed to negatively react in some countries when the news emerged of there being 100 deaths and one hundred thousand people infected with COVID-19. At the same time, the reaction of the stock markets was also positive, suggesting a simultaneous market correction. Hence, the contradictory results of the same news for different markets suggested a need for more meaningful empirical results from the markets, such as Pakistan, during the pandemic. Moreover, most of the previous research has studied the impact of COVID-19 considering either only conventional market indices, or only considering Islamic indices (see Ashraf 2020; Baig et al. 2021; Saleem et al. 2021; Sharma 2020; Topcu and Gulal 2020; Uddin et al. 2021; Zhang et al. 2020). Moreover, other studies such as Baek et al. (2020) have investigated the effect of the pandemic on conventional stocks only.

Considering the endogenous factors and crisis, earlier research has produced varying results on the performance comparison of both Islamic and convention indices and stocks. For instance, it was found that the Islamic stocks performed better in terms of risk and return (Al-Khazali et al. 2014; Abduh 2020). Contrary to these studies, other studies reported that Islamic stocks or indices underperformed (Hayat and Kraeussl 2011; Rana and Akhter 2015). However, Bayram and Othman (2019), and Trabelsi et al. (2020) concluded that there were no substantial differences between the performance of these two stocks. Therefore, it is crucial to evaluate the reaction of the financial markets in response to the unique exogenous crisis of COVID-19. More specifically, from the investors' perspective, it is pertinent to investigate which indices are relatively safe for investing in terms of risk and volatility during the period of analysis. Therefore, this study intends to investigate the effect of the colossal and exogenous health crisis on risk and volatility for conventional and Islamic indexes not only during the COVID-19 phase but also pre- and post-COVID. Recent researchers analyzed the impact of COVID-19 pandemics on the overall performance of the stock market (see, for instance, Ahmar and del Val 2020; Al-Awadhi et al. 2020; Ashraf 2020; Goodell 2020; Liu et al. 2020). However, limited studies have been conducted for the Islamic stock index in response to the pandemic crisis. Ashraf (2022) studied the impact on Islamic equity investment during COVID-19 for an emerging market. Therefore, the current study is conducted as a value addition to the existing literature from an emerging market like Pakistan. The study is also an attempt to address performance based on volatility and risk for conventional and Islamic stock indices, considering a sub sample from the pre- and post-COVID periods. Furthermore, there are limited studies that have analyzed the pandemic impact on stock volatility and persistence of volatility shocks by comparing the conventional and Islamic indices for emerging markets like Pakistan.

Unlike the financial crisis of 2007, the crisis of COVID-19 is exogenous in nature but is translated into a financial crisis among the world economies. Thus, the pandemic provides an unprecedented opportunity to study the effect of exogenous events on the financial sectors globally (see, Albuquerque et al. 2020). Therefore, it is imperative to conduct a comparative performance analysis of both conventional and Islamic stocks to fully realize the repercussions of a pandemic on the financial market specifically and on the economy in general. Therefore, considering the importance of the pandemic, the following are the objectives of this study: (1) to study and investigate whether both indices behave differently in term of risk volatility during the period of analysis; (2) to analyze the efficiency of indices considering the magnitude of volatility persistence on both of the stock indices. Notably, the research would have certain implications for government regulators, investors and policy makers for safeguarding their interests, considering the investment strategy to minimize the associated risk in response to external shocks and crises.

2. Literature Review

Considering the objectives of this study, the literature review has been divided into three sections. The first section summarizes the literature related to the impact of pandemics on businesses and economic activities. The second examines the impact on the stock market during the period of the pandemic. Lastly, previous studies are presented that are related to stock market volatility in response to the pandemic.

2.1. Economic Impact and Pandemics

Lee and McKibbin (2004) studied the investing and consumption behavior of firms to explain the impact of Severe Acute Respiratory Syndrome (SARS) on the overall economic cost in the effected countries globally. It was concluded that, although the SARS had affected human life at one hand, it had also deteriorated and worsened the economic conditions of the effected countries as well. Another study was conducted by Siu and Wong (2004) in Taiwan which argued that pandemic and health emergencies in the country had adversely impacted economic activities. The outbreak of SARS in Taiwan occurred in 2003. It not only halted tourism relating to economic activities in the country, but also caused biggest the stock market crash in its history (Chen et al. 2007). It was further asserted that the pandemic and health emergencies have an adverse effect on the economy of a country, but the economic conditions do not have a direct relationship with risks to life. Likewise, Chien and Law (2003) studied the relationship between the SARS outbreak and economic activities in Hong Kong. The study concluded that the tourism and hospitality industry were severely influenced by SARS. Moreover, it was argued that both industries are interdependent. These two industries are major contributors to the Hong Kong economy and therefore the SARS pandemic worsened the economic conditions of the country as well.

Chien and Law (2003) examined the effect of SARS on different sectors of the Taiwan economy. The findings of the study have suggested an asymmetric effect. For example, industries of tourism/hospitality were majorly and significantly affected during the SARS pandemic in 2003. However, this pandemic has fueled the biotechnology industry with upward trends and growth, even in a time of economic turmoil. Similarly, it was found that the magnitude of the effect was not same for each industry. For instance, the retail and wholesale sectors were least effected by the pandemic in Taiwan. Furthermore, the researchers concluded that the magnitude effect of the Pandemic may not be same on each country. Hai et al. (2004) estimated that the SARS pandemic effected the Chinese economic growth at a rate of 1% to 2% which is greater than the Taiwan economy, where there was a 0.5% decline in economic growth (Waugh 2003).

Another study was conducted by Blake et al. (2003) to ascertain the impact of foot and mouth disease (FMD) in the UK on tourism and related economic activities. It was found that the outbreak of the disease indirectly affected tourism and several related economic activities. Furthermore, the UNDP (2014) observed and quantified the socio-economic consequences of Ebola virus in effected countries of west Africa. The report revealed that

the after-effects of Ebola virus worsened economic and financial conditions in the countries. Additionally, the news relating to Ebola outbreak gained intensive media coverage which caused a decline in asset prices in the US (Marinč 2016). Several studies have discussed the relationship between the pandemic and stock market performance and will be discussed in the following sections.

2.2. Stock Market and Pandemic

The risk of a pandemic inversely effects investor emotions and sentiments and stock market conditions (Smith 2006). Burns et al. (2012) emphasized that negative emotions such as anxiety and stress are positively related with risk and crises, which may elicit a risk perception in stock investors. As a consequence, the investor seeks both an optimistic and pessimistic approach during the rising and downward trends of the stock market respectively (Burns et al. 2012). A bearish trend was also found in response to exogenous factors such as a pandemic (see, In et al. 2002; Lee and McKibbin 2004; Liu 2020). Studies have shown that news related to a pandemic has a considerable effect on the investors' sentiments. For instance, Donadelli et al. (2017) revealed that the pandemic news reported by WHO had a detrimental effect on investors' sentiments, which also adversely affect the stock market (Wang et al. 2013).

The 'Efficient Market hypothesis' by Fama et al. (1969) explained that both public and private information is reflected in the value of the stock and market indices. Studies have shown that the COVID-19 pandemic had a negative effect on market returns as well. For instance Al-Awadhi et al. (2020) and Liu et al. (2020) reported a negative abnormal return during the period in the 21 stock markets of affected countries in the world. A similar study by Ashraf (2020) concluded an adverse effect on the stock market in response to news regarding a rise in COVID-19 cases in the initial days of pandemic. Phan and Narayan (2020) also revealed that the stock markets adversely reacted to pandemic news in 25 countries. Besides the effect on stock markets, the outbreak of COVID-19 halted the economic activities in the countries in the form of travel bans, restricted business activities etc.

2.3. Stock Market Volatility and Pandemic

The market volatility can be explained as the upwards or downwards fluctuations in the stock indices and return (Bhowmik and Wang 2020). The occurrence of unfavorable events such as pandemics may cause major setbacks to the economic activities of financial sectors and stock markets all over the world (Chowdhury et al. 2021). Recent literature has discussed the stock market volatility in response to global pandemic crises. For instance, considering the Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model, Onali (2020) studied the impact of COVID-19 on volatility change and persistence of Dow Jones stock market and S&P 500 indices. It was concluded that the pandemic had significantly changed the volatility of the stock market and remained in persistence for a longer period. Likewise, similar findings have been concluded by Baker et al. (2020) considering a sample from the US stock market. It was further revealed that the COVID-19 pandemic has posited an unprecedented impact on the volatility of the stock markets around the globe.

Baig et al. (2021) analyzed the relationship between the number of causalities, confirmed cases and lockdowns during COVID-19 on the volatility and liquidity of the US stock markets. Employing the GARCH (1,1) model to estimate the results, it was found that the number of deaths, lockdown events and confirmed cases significantly inversely effected the liquidity and volatility of the US stock markets. Akhtaruzzaman et al. (2021) have also asserted the conditional correlation among death rates, number of confirmed cases and stock market return in G7 countries. It was also revealed that the contagion effect on financial firms is far higher than on nonfinancial firms which affect the hedging prices for covering risk through hedging. Studies have shown that positive and negative news has a significant effect on the volatility of the stock market. Studies have further explained

that negative news regarding the pandemic has evoked higher volatility change in the US stock markets and vice versa (Baek et al. 2020). Moreover, Sharif et al. (2020) have revealed that that the COVID-19 pandemic has given rise to the volatility of the US stock markets, political risk and oil prices during the later period of 2020.

Studies have shown that the Asian market was also affected by the pandemic, due to which markets have witnessed higher volatility risk and longer magnitude of volatility persistence in the post-COVID-19 period (Sharma 2020). The COVID-19 pandemic has significantly affected the volatility of the Indian Stock market (Bora and Basistha 2020). Considering the GARCH (1,1) model it was found that there was higher market volatility during the period of COVID-19. A similar study was conducted by Uddin et al. (2021) from a sample of 34 stock markets around the globe, where it was posited that the degree of volatility increased after the occurrence of the COVID-19 pandemic.

Dharani et al. (2022) examined the impact of COVID-19 on volatility and return considering the Shariah and non-Shariah indices from S&P-1200 from 2010 to 2020. The results from a pooled regression emphasized that, on average, Shariah indices proved to be less volatile than their counterpart non-Shariah indices. Moreover, it was also reported that on average the Shariah sectoral indices witnessed lower risk and high return during the COVID-19 period. Similarly, another study by Ashraf (2022) analyzed the performance of conventional and Islamic stock considering the firm level data during the period of the COVID-19 pandemic. It was concluded that Islamic stock remained less volatile to news relating to the pandemic, compared to conventional stocks. Another recent study by Salisu and Shaik (2022) studied conventional and Islamic stock by considering the acclaimed hedging potential, comparing the overall performance of both Islamic and conventional stock. It was concluded that, although the hedging effectiveness declined for Islamic stock, it still performed better compared to conventional stocks during the COVID-19 pandemic. Furthermore, Moradi et al. (2021) studied the impact of COVID-19 on Tehran stock markets and concluded similar results.

As described, previous studies were largely conducted considering the impact of the COVID-19 pandemic from a sample of conventional indices from the stock markets. Only a few studies have investigated the effect of COVID-19 on the volatility of Islamic stock Indices. For instance, Abdullahi (2021) suggested that the COVID-19 pandemic has had an effect on the volatility of the Islamic stock Indices. The findings from the GARCH and GMM models suggested a direct relationship between an increase in the rate of COVID-19 cases and volatility risk. Another study by Yarovaya et al. (2020) examined the spillover from conventional to Islamic stock indices during the pandemic. However, there is a lack of studies that consider the market behavior of conventional and Islamic indices in terms of magnitude of volatility persistence over the time.

3. Material and Methods

To achieve the research objectives, data for conventional and Islamic stock indices were taken from the Pakistan Stock Exchange (PSX). Initially, the Karachi Stock Exchange (KSE) was incorporated in 1947 right after the independence of the country (Chakraborty 2006). The PSX was established in 2016 after a merger of three stock exchanges, namely the Lahore stock Exchange, Karachi Stock Exchange and Islamabad Stock Exchange (Khan et al. 2021). One of the reasons for choosing Pakistan is that the country has been playing a significant role in the emergence of an Islamic financial system in the region and in the inclusion of the Islamic financial system in financial institutions (Nawaz et al. 2019). Moreover, a conventional system is operating in parallel to the Islamic system in the financial institutions of the country (Akhtar et al. 2021). For the purpose of the analysis, we have selected the KSE index and Karachi Meezan Index (KMI) as representing the conventional and Islamic stock indices respectively in PSX. The data was sourced from the Thomson Reuter DataStream for the period from January 2018 to April 2021.

For the purpose of analysis, we have further divided the total data sample into three categories. Firstly, we have considered the entire time span to estimate the overall volatility

risk during the period for both indices. Moreover, this will also provide an understanding of the market reactions as a whole period. Secondly, we have selected a sub sample for the pre COVID-19 era which covered the period from January 2018 to January 2020, as the WHO declared the COVID-19 pandemic as a global health emergency on 30 January 2020 (Tóth 2021). Thirdly, the sub sample from 31 January 2020 to 30 April 2021 is considered for analysis of the period of shocks due to the pandemic.

Econometric Model

The GARCH (1,1) model has been employed to analyze and estimate the results (Bollerslev 1986). As a first step, the daily returns from stocks were calculated using Equation (1). These returns are further transformed into three separate panels representing the (i) period from January 2018 to April 2021 to evaluate the overall market volatility for the total sample. (ii) The second panel representing the pre-COVID-19 period from January 2018 to January 2020. (iii) The third panel representing the period of Post COVID-19, from the declaration of a global public health emergency by WHO on 30 January 2020 to April 2021.

$$R_{i.t} = \ln\left(P_{i.t} \Big/ P_{i.\ (t-1)} \right) \tag{1}$$

In Equation (1) daily returns of stock i at time t are denoted by $R_{i.t}$, whereas $P_{i.t}$ represented the stock index i, at time t.

Equation (2) represents OLS regression of conditional mean, and the lagged return of the financial time series is used as independent variable. In addition to the conditional mean equation, conditional variance is modelled using GARCH (1,1) as shown in Equation (3). Importantly, assumptions of data normality, fat-tailed and unit root test were performed on both the time series in order to apply GARCH (1,1) effectively. The conditional mean equation helps to measure the white noise, i.e., error term with normal distribution and constant heteroskedasticity. GARCH (1,1) is considered as a more stable and parsimonious model compared to ARCH (p). The model benefits from having only two parameters, whereas ARCH (p) is overparameterized. Furthermore, GARCH (1,1) captures the ARCH and GARCH effects in the time series. The ARCH effect measures the volatility with squared lagged residuals (i.e., white noise of the process), whereas the GARCH coefficient captures volatility clustering with the lagged value of conditional variance i.e., heteroskedasticity. Furthermore, for volatility measures, the changed value of clustering and shocks persistence, the GARCH (1,1) model is considered the most stable model in the GARCH (p,q) family.

$$y_t = \mu_t + \theta_i y_{t-1} + \varepsilon_t \tag{2}$$

$$\varepsilon_t / y_{t-1} \sim N(0,\ h_t)$$

$$h_t = \delta_i + \sum_{i=1}^{p} \alpha_i (\varepsilon_{t-i})^2 + \sum_{i=1}^{q} \beta_i h_{t-i} \tag{3}$$

The stock market return is denoted by y_t, at time t, whereas mean return is represented by μ_t. Equation (2) shows the conditional mean equation where return of stock index is conditional on lagged value of itself, i.e., y_{t-1}. ε_t represents the white noise with normal distribution and is heteroskedastic in nature. However, h_t is the variance of the time series, which is modelled in Equation (3), dependent on lagged squared residuals and conditional on lagged of itself. δ_i, α_i, and β_i are the three coefficients estimated by the GARCH (1,1) model. The model complies with the positivity assumption (see Tsay 2002), i.e., $\delta_i > 0$, $\alpha_i \geq 0$, and $\beta_i \geq 0$. The magnitude of ARCH and GARCH coefficients show the volatility changes due to external shocks, which is the COVID-19 effect in this study. Additionally, the summation effect of α_i and β_i would estimate the persistence of shock in the stock index. The closer the value to 1, the higher the persistence of shocks tend to remain in the stock returns. On the other hand, if the value of persistence measure significantly differs from unity, volatility shock would remain for less time (Chou 1988; Choudhry 1996).

Importantly, if the positivity assumption is not violated, GARCH (1,1) is efficient with a small sample size of 150–200 (David and Ampah 2018; Leong 2018; Lumsdaine 1995). Moreover, several diagnostic tests have been conducted to provide evidence of robust and reliable results. For example, for the remaining ARCH effect, an ARCH-LM test is performed, and Box–Ljung stats with 24 lags are employed to examine autocorrelation.

4. Results and Discussion

This section illustrates the results and analysis from the sample data. The discussion of the descriptive statistics follows the discussion and analysis concerning market volatility and persistence.

4.1. Descriptive Statistics

Table 1 below demonstrates the results from descriptive statistics from the data sample for the selected periods of study. As depicted in the table below, the key descriptive values are shown for the overall period, i.e., from 1 January 2018 to 30 July 2021, the pre COVID-19 period and post pandemic era respectively. The average return value of the KSE index is shown as positive overall for the whole period of analysis and standard deviation is shown as 0.0105, which indicates spread from mean about 1.05%. Contrary to this, the KMI index has depicted an overall negative mean return and standard deviation of almost 1.38%. In addition to this, the average returns from the pre-COVID-19 period are more than the mean returns from the whole period which posits that, in terms of market growth, the pre-COVID-19 era was more favorable. On the other hand, the post COVID-19 period has also shown a positive average return for the KSE index as well. Contrary to the KSE 100 index return, the KMI index return remains negative overall, not only for whole period of analysis. but for pre-COVID-19 and posCOVID-19 period as well. This indicates that the Islamic stock index generated lower and negative returns in the PSX.

Table 1. Descriptive Statistics.

	Mean	Median	SD	Kurtosis	Jarque Bera	ADF
Full Period (2 January 2018–30 July 2021)						
KSE	0.00001	0.00000	0.0105	7.159	721.47 *	0.0000
KMI	−0.00024	−0.00004	0.0138	8.982	1443.34 *	0.0000
Pre-Crisis Period: (2 January 2018–30 January 2020)						
KSE	0.000043	0.00000	0.00954	3.650	9.171 *	0.0000
KMI	−0.000239	−0.00030	0.01291	7.847	517.54 *	0.0000
Post-Crisis Period: (31 January 2020–30 July 2021)						
KSE	0.000089	0.00018	0.01159	8.881	648.43 *	0.0000
KMI	−0.000236	0.00000	0.01486	9.520	772.46 *	0.0000

* Denotes significance at 1%.

The analysis of data using ARCH and GARCH model is suggested when the data is stationary, data are fat tailed and not normal over the sample period (Bollerslev 1986; Chou 1988; Choudhry 1996; Li et al. 2002). In order to apply the GARCH (p,q) model, the presence of the ARCH effect is a pre-condition and hence the time series are first analyzed for the ARCH effect (Bollerslev 1986). Therefore, as shown by Jarque Bera, having significant values at 1% postulates that the data are not normally distributed. Considering the results from Kurtosis, each value is greater than 3.0 which suggests that the data have a fat tail. Furthermore, the Augmented Dickey Fuller (ADF) test was conducted to evaluate the stationarity of data. The results of ADF for all sample sets are significant at 1%, depicting a long run integration at level, i.e., I(0), of the time series. Keeping in view the above pre-conditions, the results from GARCH (1,1) are shown below.

4.2. Volatility Results

This section aimed to provide results and discussion on market volatility changes captured when employing the GARCH (1,1) model. It is pertinent to mention that the

application of the GARCH (1,1) model is dependent on the ARCH effect in the time series. The ARCH model depicts the linear relationship of the squared lagged noise and conditional variance. In Table 2 below, the results of analysis from three sub samples have been given. The F-statistics and probability value for each sample describe the presence of the ARCH effect for each sub sample. It is posited from Table 2 that the ARCH effect is significant at 1% for the whole period sample, whereas for pre and post COVID-19, the presence of an ARCH effect is inferred at 5% level of significance. Similarly, the ARCH effect for KMI index return is significant at 1% for each sub sample of the study. Furthermore, volatility clustering has been depicted in Figure 1 that has shown that the high volatility occurred in response to the occurrence of significant events or news in the market and vice versa. Therefore, we can conclude that the presence of volatility clusters illustrated for all three sub samples provide us also with a strong basis for applying the GARCH (1,1) model for analysis.

Table 2. ARCH Effect of the three periods.

	F Test	Probability	Result
Full Period			
KSE Index return	14.419	0.0001	Present
KMI Index return	13.341	0.0003	Present
Pre-COVID Period			
KSE Index return	5.125	0.0236	Present
KMI Index return	4.972	0.0132	Present
Post-COVID Covid			
KSE Index return	4.566	0.0451	Present
KMI Index return	7.164	0.0074	Present

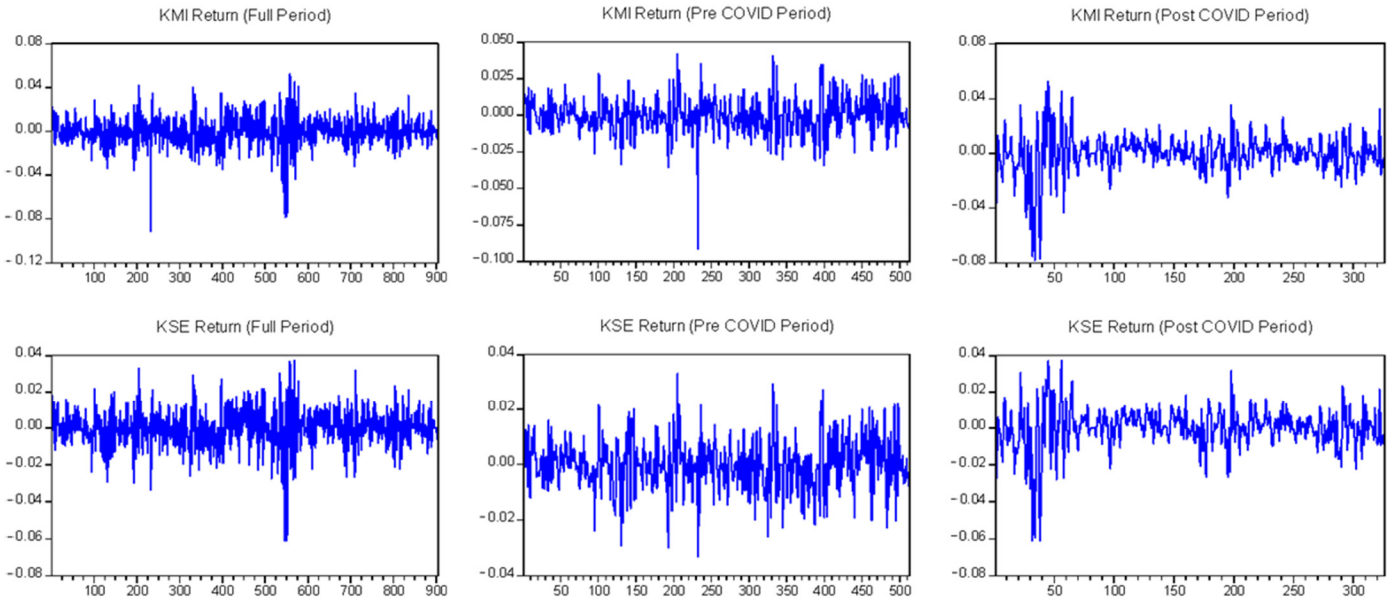

Figure 1. Volatility Clustering.

Table 3 has shown the estimation of two parameters i.e., α_i and β_i along with other parameters from the GARCH (1,1) model. The model estimation also explains the dependence of variance on residual or square lagged noise. It is pertinent to mention that the ARCH coefficient, i.e., α_i, indicates the volatility in the return, whereas the presence of volatility clustering is captured by the GARCH coefficient parameter β_i.

Table 3. GARCH (1,1) results.

	γ	α	β	α+β	ARCH-LM	Q24
Whole Period						
KSE Index	0.00006 (3.056) [a]	0.119 (5.787) [a]	0.824 (25.01) [a]	0.943	0.324 (0.569)	25.127 (0.399)
KMI Index	0.00001 (2.706) [a]	0.146 (3.823) [a]	0.792 (16.691) [a]	0.938	0.122 (0.727)	20.003 (0.697)
Pre-COVID Period						
KSE Index	0.00001 (2.057) [a]	0.099 (2.758) [a]	0.784 (9.724) [a]	0.883	0.0019 (0.966)	17.796 (0.813)
KMI Index	0.00002 (1.834) [b]	0.125 (2.357) [a]	0.769 (8.636) [a]	0.896	0.043 (0.837)	20.893 (0.645)
Post-COVID Period						
KSE Index	0.00005 (2.046) [a]	0.167 (3.851) [a]	0.797 (16.382) [a]	0.964	1.399 (0.237)	20.869 (0.646)
KMI Index	0.00001 (2.132) [a]	0.159 (3.737)	0.798 (16.533) [a]	0.957	0.651 (0.420)	20.133 (0.689)

[a,b] Denotes significance at 1% and 5% respectively. Q(24) denotes Box-Ljung statistics for serial correlation of the order 24 in the residuals.

Concerning the model selection criteria, an optimal GARCH (1,1) is selected based on lowest SIC (Schwarz info criteria), AIC (Akaike Info criteria), minimum of log likelihood, and highest R-square value. Moreover, the model is consistent and best fitted, as it meets the positivity assumptions of the ARCH and GARCH effects, and the unity assumption of measure of persistence.

The volatility comparison for the three sub samples can be made by considering the level of volatility clustering and shocks of the three periods under the sub samples of the data. It can be seen that both indices are at par in terms of their riskiness. It can also be seen that the ARCH coefficient α_i for both indices is similar in terms of level of significance and magnitude. However, the level of riskiness is higher for the Islamic index (KMI), compared to the conventional index (KSE) at PSX. Furthermore, the level of volatility clustering is observed more in the KSE index as well. The GARCH coefficient of 0.82 and 0.79 for KSE and KMI indices, respectively, is significant at 1% which further explains that the KSE 100 index is comparatively more volatile for the overall period of the sample. The sum of α_i and β_i, i.e., $(\alpha_i + \beta_i)$, explains the persistent function of the current volatility shock. Considering the value for the whole period, the response function is estimated as almost same at 0.943 and 0.938 for the KSE and KMI index respectively, which also infers that both indices react in the similar manner. In the pre-pandemic period, the KMI index appeared to be more volatile having a co-efficient value of 0.124, which is significant at 1%. On the contrary, the ARCH coefficient of the KSE index is 0.099 lower than KMI. Moreover, in the pre-COVID period, the GARCH co-efficient is 0.784 and 0.768 for KSE and KMI indices respectively, which implies that both indices have almost the same level of risk of volatility. On the other hand, the persistent function $(\alpha_i + \beta_i)$ prior to the outbreak of COVID-19 is 0.896 and 0.883 for KMI and KSE index respectively, which is lower than the predicted value of persistence level for the whole period of analysis.

Similarly, the magnitude of shocks has increased after the emergence of COVID-19 as a public health emergency by WHO. The ARCH effect has been predicted to be 0.167 and 0.159 for KSE and KMI indices, respectively. From the results, it can be inferred that the investors in the post-COVID period reacted in a passive way as they became more risk averse. In the post-pandemic period, the volatility clustering increased comparing the pre-pandemic period. The results show that both indexes became riskier after the news was announced by the WHO. As per the efficient market hypothesis, the news and events reflect the actual adjustments in the stock returns. The stock markets immediately reacted in a passive way and yielded unexpected returns in the COVID-19 periods. Our findings are consistent with recent literature, such as Ashraf (2020, 2022), Saleem et al. (2021), and Dharani et al. (2022). Importantly, the variation in stock returns was affected more or

less equally in the Islamic and conventional stock indices. The question of the Islamic index providing shelter is compromised when there is a downfall everywhere. As per our findings, we inferred that during a crisis like the pandemic when every economic sector is affected, it is impossible to have a safe investment. Moreover, investors and markets both underperformed due to the overall economic setback caused by COVID-19. The risk factor and uncertainty would be equally the same. In addition, the magnitude of the GARCH coefficient is predicted as almost the same at 0.797 and 0.798 for KSE and KMI indices, respectively.

In contrast, volatility persistence remained more sensitive in the post-pandemic period and volatility shocks were prone to remain for a greater period compared to the pre-pandemic and entire period of analysis. For instance, the intensity of the shocks for 30 days can be predicted as 0.333 ($0.964^{30} = 0.333$) and 0.333 ($0.957^{30} = 0.333$) for KSE and KMI indices. Contrary to this, the shock intensity in the pre-pandemic period for 30 days is estimated as 0.037 ($0.896^{30} = 0.037$) and 0.023 ($0.883^{30} = 0.023$) for KMI and KSE index, respectively, which is lower than the post pandemic period of analysis. With this comparison, the overall response function of both indices turned out to be sensitive. It indicates that even after the first 30 days of external shock, the intensity of shock still remains at 0.333 in both indices compared to 0.037 and 0.023 in pre-COVID period. Furthermore, the comparison of shock intensity posited that the external elements such as a global pandemic affect market volatility, the magnitude of volatility and riskiness of investment as well.

In summary, the findings of the study are consistent with previous research (Baig et al. 2021; Mazur et al. 2021; Sherif 2020; Topcu and Gulal 2020; Uddin et al. 2021), where it was concluded that investors respond passively in panic situations due to the external factors. It is further concluded from the findings of the study that the pandemic has negatively affected the investment behavior for conventional and Islamic stocks. Moreover, the same behavior of conventional and Islamic stock indices infer that the majority investors do not make a conceptual difference between these two types of stock while making investment decisions. In addition, the prime objective of investors is profit seeking rather focusing on Islamic or conventional stocks. Another important element in emerging markets is that investment is sale-driven rather than based on the investor's own choice.

While analyzing the results from the sample data, the economic model is validated by employing Box–Ljung statistics for twenty-four lags to find evidence of a serial correlation. It was inferred that there is no serial correlation in the model. Furthermore, the ARCH-LM test was executed to analyze the remaining ARCH effect in the model. The test concludes satisfactory results as the model employed produced reliable and robust results.

The current study has certain implications for financial regulators, media, and investors in the following ways. The financial regulators such as the central bank and securities and exchange commission (SEC) are required to be proactive in times of potential crisis that create economic and financial distress by educating the investor in a way that they can secure their investment and minimize the risk of loss in panic situations. The media can play an effective role as well in different ways. For example, the financial regulator and media can join together in educating the investors about potential threats. Moreover, the media should report the news with ethical responsibility because misreporting can inflate financial and economic distress, which can deepen the downturn in the stock market and economy as well (Theil 2014). As per investors' concern, the diversified portfolio can be a measure for minimizing loss. They should be well educated and aware of the external factors affecting the stock market so that the investors can make rational decisions while making investments.

5. Conclusions

The effect of the COVID-19 pandemic is not limited to the personal lives of people. Rather, it has affected the economies of the nations at the macro level and financially at the micro level in the corporate world. This study aimed to analyze the effect of the global

pandemic on conventional and Islamic stock indices. The study has analyzed the results considering the two indices namely as KSE and KMI index of the PSX. The results from the analysis posited that the conventional stock index and Islamic stock index behaved in a similar way during the global emergency of the COVID-19 pandemic. For example, the risk associated with both indices return was of the same intensity as the crisis hit both types of stocks and investors have responded to both types of stock, having an adverse effect on volatility and return. Moreover, the breakout of the pandemic made the investors risk averse and worsen the trading activity in the stock market.

The volatility shocks, in response to the COVID-19 pandemic, are held for a longer period than the pre-crises period of the sample data. These findings further revealed that the magnitude of volatility persistence rises in the period of crisis in the Pakistan Stock Exchange. In addition, even the essence of shariah stocks is different from the conventional stocks; the current economic turmoil resisted them to provide a safer zone for the investors. Furthermore, investors' concern is to maximize their profits, so they invest in funds based on their objective rather than giving importance to the conceptual difference of the index. The findings implicate the efficient investment strategy is important for minimizing the risk of loss, which can be possible after increasing investor awareness and education regarding the stock markets, since the Islamic stock index behaved in a similar fashion to conventional index.

However, there is a room for further research in terms of external events. The study can be extended to see the differences in behavior in different economic crises, which may include but is not limited to: the credit crisis of 2008; the Panama leaks; and other exogenous events.

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