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The COVID-19 Pandemic and Instability of Stock Markets: An Empirical Analysis Using Panel Vector Error Correction Model

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Abstract

The objective of this research is to examine the influence of the COVID-19 pandemic on stock markets in a few developing and developed countries. This study uses daily data from January 2020 to May 2021 and obtained from World Health Organization and Thomson Reuters. The secondary data was evaluated through panel econometric methodology that includes different unit root tests, and to analyze the long-run relationship between variables, panel cointegration techniques were applied. The long-run causality among variables was examined through Panel Vector Error Correction Model. The overall findings of this study suggest a long-run association exists between several cases and death with the stock returns of the GCC and other stock markets. Furthermore, the VECM model also identified a long-run causality running from COVID cases and death towards the stock rerun of both sets of stock markets. However, a subsequent Wald test yielded mixed results, indicating no short-run causality between cases and deaths and stock returns in both groups; however, in the case of GCC, several COVID-19 cases are having a causal impact on stock markets, which is notable in light of the fact that the death rate in GCC is significantly lower than in many developed and developing countries.

Keywords: COVID-19, Stock Returns, Pedroni, VECM, Panel Data

JEL Classification Code: EO, G15, C01,C10, C19

1. Introduction

Natural events and disasters such as storms, volcanic bushfires, and earthquakes significantly impact the global economy. For example, between 1989 and 1993, the annual damages incurred by the United States of America as a result of natural catastrophes were estimated to be $3.3 billion, increasing to $13 billion in 1997. In addition, according to Worthington and Valadkhani, Australia lost an estimated $1.14 billion each year from 1967 to 1999 due to the same reason (2004). Many studies have looked at the economic and financial consequences of natural disasters; for example, Fox (1995) tested the impact of natural, industrial, and terrorist disasters on the Australian capital market and applied Box and Tio intervention analysis on daily returns in the different sectors such as consumer discretionary, consumer staples, telecommunication services, and utilities.

Natural catastrophes were determined to have damaged the consumer discretionary, financial services, and material sectors, while the September 11 attacks had a major impact on the market as a single event. Skidmore (2001) investigated the impact of natural catastrophes on the Japanese people's savings behavior, finding that high savings rates were observed in reaction to volcanic eruptions, landslides, and hurricanes. Natural catastrophes have a positive impact on economic growth, productivity, and capital accumulation, according to Skidmore and Toya (2002), who researched the long-term relationship between natural disasters, capital accumulation, economic growth, and productivity.

However, when the world was hit by severe acute respiratory syndrome in the last few years, it didn't end

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there (SARS). It is a viral respiratory disease that first appeared in China in 2003 and has since spread to four other countries. It can transmit by the air or by touching surfaces, and people between the ages of 25 and 70 are more susceptible to harm, with a fatality rate of around 3%. (WHO). Researchers have looked into the global economic impact of the pandemic; Chen et al. (2007) and Chun-Da Chen et al. (2009) examined the impact of SARS on Taiwan's stock market. The empirical findings suggest that SARS has a negative impact on tourism, as well as the wholesale and retail sectors.

According to Keogh-Brown and Smith (2008), SARS had no substantial economic impact, despite what the media said. The impact of the SARS pandemic on the Chinese stock market aggregate price indexes and four other Asian markets was researched by Chen et al. (2018), and the results demonstrated long-term negative consequences. For the instance of Saudi Arabia, Salman and Ali (2021) and Alzyadat and Asfoura (2021) observed similar conclusions. Similarly, Nguyen (2022) examined the impact of COVID-19 on the listed transportation companies and determined that the majority of them have been negatively impacted and are incurring losses.

A doctor at a hospital in Hubei Province recently warned Chinese authorities about a SARS-like disease on December 27, 2020. Chinese authorities announced on December 31, 2020, that they are examining 27 instances of viral pneumonia and have dispatched a team of health experts to the region; authorities stated that seven persons were in severe condition. There had never been a human-to-human transfer before. At the Political Bureau's Permanent Committee meeting on January 7, 2020, key Chinese authorities, including President Xi Jinping, debate the pandemic, stating that they have been aware of the virus since early. COVID-19 was declared a global public health emergency by WHO on March 11, 2020, after the pandemic had spread to over 150 countries. The world is noting that the pandemic would significantly impact health and long-term economic activities that may surface due to mass unemployment and business failure.

The random spread of the pandemic has had a significant impact on stock market speculators and has raised stock market fluctuation worldwide. Global stock markets began to respond to the pandemic's effects as the main index of the Dow Jones fell from December 31, 2019, to March 22, 2020, by 33% and 29%, respectively (Minami Funakoshi, 2020). FTSE100 The central UK's index fell to more than 10% in March 2020, the worst since 1987 (Wearden et al., 2020), and the same case for the Japanese stock market where the index fell to more than 20% compared to the highest position in December 2019 Vishnoi and Mookerjee (2020). The research was conducted to reveal any causal relationship between the COVID-19 pandemic and economic activities. In this regard, the study of Al-Awadhi et al. (2020) revealed that the total number of deaths due to COVID-19 had a significant negative impact on the returns of Chinese companies. COVID-19 subsequently had a significant positive impact on the systematic risk in the global equity market Zhang et al. (2020).

However, to our knowledge, all the studies were mainly concerned with the stock market of developed countries; the analysis proposed in this research paper is to fill the gap in the literature by targeting the impact of the COVID-19 pandemic on the stock markets of developing countries such as the Gulf cooperation council (GCC) which includes Kuwait, Qatar, Saudi Arabia, Oman, Bahrain, and United Arab Emirates and compare the founding with other three major developed stock market indexes such as NASDAQ; Tokyo; London and DW-Jones.

The GCC countries are among the leading crude oil producers in 2018 (OPEC, 2019). Moreover, returns in GCC stock markets are susceptible to the changes in oil prices as it is the primary source of revenue. However, the GCC countries experienced significant fluctuations in oil prices during the spread of the pandemic. According to (Annual Meeting of Ministers of Finance and Central Bank Governors October 25, 2020), the pandemic has had adverse effects on the economies of the GCC countries, where oil exports fell by about $150 billion, up from 37% in 2020 compared to 2019, accompanied by increased government spending on national health and support for families and companies to increase the fiscal deficit in all GCC countries to rise to 9.2% of GDP in 2020 from 2% of GDP in 2019 (World Bank Group, 2021).

According to the International Monetary Fund, the Gulf Cooperation Council countries will lose $270 billion in revenue due to a steep drop in oil prices, compounded by a loss of demand due to the breakout of the new Coronavirus (Babu Das Augustine, 2020; GCC-IMF, 2020). Furthermore, the World Bank's report (2021) depicted the effects of COVID-19 on Gulf Cooperation Council (GCC) economies; the figures show that, with the exception of Qatar, all GCC countries have been negatively affected by the pandemic, owing to Qatar's heavy reliance on natural gas exports and business and tourism reforms. This report shows that Oman's overall growth fell by 6% due to a contraction of non-oil GDP by more than 9% in addition to the closure of the tourism and services sectors; in Saudi Arabia, the number of casualties peaked at 4,400 in June 2020, resulting in a partial closure of travel, as well as a drop in the price of oil, the United Arab Emirates due to 4.4% reduction in oil production reduced the economy by 4% in the first quarter of 2020, as well as the hydrocarbon sector, which is the backbone of the UAE economy, fell to 6% in the second quarter of 2020 and Kuwait falling oil prices and rising casualties to 980 in February 2020 led to a fiscal deficit, prompting the government to withdraw from sovereign assets.

The objectives of this study are as follow:

- Examine the impact of the COVID-19 on the GCC and other three developed stock market indexes.
- To investigate how the number of COVID cases post impacts the stock market performance.
- Undertake a comparative analysis across GCC countries and the other three stock markets.

2. Literature Review

It isn't the first time that major events have affected global stock market performance. The accident in potash mines, for example, had a major negative influence on the firm's market value, according to Kowalewski and Spiewanowski (2020) and Adenomon et al. (2020). Buhagiar et al. (2018) investigated whether football bookies who lose more than the average are just biassed or if their losses are caused by betting on intrinsically unpredictable situations. In a sample of 163,922 soccer players, the study verified the existence of a favored bias longshot. Li (2018) explored how stock markets interact with other news classified by different aspects; results indicate that positive news improves stock market performance and individual stock trading. Alsaifi et al. (2020) applied an event test to study the market's reaction to carbon detection. The study revealed that investors respond significantly negatively to carbon disclosure (Cepoi, 2020).

Bash and Alsaifi (2020) test the uncertain impact of Jamal Khashoggi's evanescence on the Saudi stock market. The study applied a traditional event study to test data. The results revealed that this disappearance supports descending cumulative abnormal returns across all companies implying a negative impact of uncertainty on share returns. Shanaev and Ghimire (2019) studied the impact of political risks on a sample of 289 Russian companies in five years, and the study showed that regional policies pose a greater risk than domestic policies and are crucial in understanding stock return. Ichev and Marinč (2018) showed that COVID-19 had long-term adverse effects on the six ASEAN financial market indices. Liu et al. (2020) computed the abnormal returns in the ten trading days after the pandemic, and the results showed that the Chinese and Asian stock markets had fallen significantly.

Ashraf (2020) investigated the link between COVID-19 fatality cases and stock market returns in 64 countries. The empirical findings revealed that death instances have a considerable negative impact on stock returns. Harjoto et al. (2020) examined the influence on global stock markets of the World Health Organization (WHO, 2019, 2020a, 2020b, 2020c) released on March 11 and the Federal Reserve announcement on April 9 regarding the COVID-19 pandemic. The outcome demonstrated a negative shock for small businesses in emerging nations while stock returns in the United States increased. Pedroni panel cointegration is designed and implemented in several steps to find the long-run relationship between variables. The system calculates the residuals from the cointegration economic regression model's regression in the first phase. The following is the generic model that emerges.

From March 10 to April 30, 2020, Topcu and Gulal (2020) investigated the impact of the pandemic on emerging stock markets. The analysis found that the pandemic's negative effects gradually faded by mid-April, with the pandemic's regional impact being highest among major emerging markets in Europe. To study the effects of the pandemic on the economy, Okorie and Lin (2020) used DE trended Moving Cross-Correlation Analysis (DMCA) and DE trended Cross-Correlation Analysis (DCCA) on the stock returns of 32 of the world's best stock markets. The findings showed that the pandemic has a negative impact on equity returns that will fade with time. The influence of COVID-19 deaths on GCC stock market performance is investigated by Bahrini and Filfilan (2020). The empirical findings revealed that GCC market replays decreased in tandem with an increase in fatality incidents.

3. Methodology

This research thoroughly examines the impact of COVID-19 related deaths, the total reported cases on the stock markets of GCC (Kuwait, KSA, Qatar, UAE, Oman, and Bahrain), and some selected developed countries (USA, UK, and Japan). This study uses daily data from January 2020 to May 2021 and obtained from well-renowned sources. The stock prices were obtained from Thomson Reuters and for the cases and death from World Health Organization (WHO). A list of various econometric methods applied to review the impact of cases and deaths on the stock markets of developed and developing countries.

The Methodology comprises two main sections, section (i) include the informal methods such as descriptive analysis (Mean, Median, Range, and the standard deviation) and correlation analysis to get the fundamental insight of the data, and section (ii) formally analyze panel data through various econometric techniques such panel unit root tests.[1] Such as Levin, Lin & Chu (LLC) (Levin et al., 2002), I'm, Pesaran and Shin W-stat (IPS) (Im et al., 2003), ADF-Fisher Chi-square (ADF), and PP–Phillip and Perran (1988) (PP). The whole idea is to apply various panel unit root tests to ensure the robustness of the data analyzed in this study. To examine the long-run association between the studied variables, a panel cointegration method developed by Pedroni (1999, 2004) was employed, and for robustness purposes, the study further uses Kao (1999) Residual Cointegration Test. In addition to this study further, investigate the long-run causality among the studied variable from Panel Vector Error Correction Model (Panel VECM). Moreover, to evaluate the short-run causality linkage, a well-defined Wald test approach was introduced. The study used below econometric model to analyze panel data for various countries.

$$\text{SR} = \beta_1 + \beta_2 \text{Deaths}_{it} + \beta_3 \text{Cases}_{it} + \mu_{it} \tag{1}$$

Where, i Stand for country i, t Stands for time, SR: Stock returns, Deaths: Total number of deaths recorded due to COVID-19, Cases: Total number of COVID-19 cases recorded, μ: Error term.

The stock returns calculate based on the following formula (Osagie, Maijamaa, and John, 2020):

$$\text{SR}_t = \ln P_t - \ln P_{t-1} \tag{2}$$

Where, SR_t: Represent daily returns, P_t: The closing price of the stock at time t, P_{t-1}: Previous day closing price at time t.

3.1. Pedroni Panel Cointegration

Pedroni panel cointegration is built and implemented in several steps to find the long-run relationship between variables. The system determines the residuals from the regression from the cointegration economic regression model in the first phase. The generic model that results can be seen as follows:

$$\begin{aligned} & y_{i,t} = \alpha_i + \rho_{it} + \theta_{1i} x_{2i,t} + \theta_{2i} x_{2i,t} + \cdots + \theta_{Mi} x_{2i,t} + e_{i,t} \\ & \text{for } t = 1, \ldots, T;\ i = 1, \ldots, N;\ \text{where } m = 1, \ldots, M \end{aligned} \tag{3}$$

Where, T: Refers to the number of observations, N: Refers to the number of individual members, M: Refers to regression variables, N: Different equations with M regressors (Tse, 2000).

The slope coefficients $\theta_{1i}, \ldots, \theta_{Mi}$ are allowed to keep change over the individual countries of the Panel. The population parameter α_i Stand as an intercept term and keeps varying across the countries or individuals' panels. The above equation allows extracting desired results by estimating panel cointegration and retrieving residual to establish possible long-run linkage between variables. The Pedroni panel cointegration has the following statistics to determine long-run association:

1. Panel v–Statistics:

$$T^2 N^{3/2} Z_{v,N,T} \equiv T^2 N^{3/2} \left(\sum_{i=1}^{N} \sum_{i=1}^{T} \widehat{L_{11i}}^{-2} \widehat{e_{i,t-1}} \right)^{-1} \tag{4}$$

2. Panel ρ–Statistics:

$$\begin{aligned} T\sqrt{NZ_{\hat{\rho}N,r-1}} \equiv T\sqrt{N} \left(\sum_{i=1}^{N} \sum_{t=1}^{T} \widehat{L_{11i}}^{-2} \widehat{e_{i,t-1}}^{2} \right) \\ -1 \sum_{i=1}^{N} \sum_{i=1}^{T} \widehat{L_{11i}}^{-2} (\hat{e}_{i,t-1} \Delta \widehat{e_{i,t}} - \widehat{\vartheta}_i) \end{aligned} \tag{5}$$

3. Panel t–Statistics: (non Parametric)

$$\begin{aligned} Z_{tN,r} \equiv \left(\widehat{\delta}_{N,T} \sum_{i=1}^{N} \sum_{i=1}^{T} \widehat{L^{-2}}_{11i} \hat{e}_{i,t-1} \right)^{-1/2} \\ \sum_{i=1}^{N} \sum_{i=1}^{T} \hat{L}_{11i}^{-2} \left(\hat{e}_{i,t-1} \Delta \widehat{e_{i,t}} - \hat{\vartheta}_i \right) \end{aligned} \tag{6}$$

4. Panel t–Statistics: (Parametric)

$$\begin{aligned} Z_{tN,r}{}^{*} \equiv \left(\ddot{s}_{N,T}^{*2} \sum_{t=1}^{N} \sum_{t=1}^{T} \widehat{L^{-2}}_{11i} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \\ \sum_{t=1}^{N} \sum_{t=1}^{T} \hat{L}_{11i}^{-2} \hat{e}_{i,t-1}^{*} \Delta \widehat{e_{i,t}^{*}} \end{aligned} \tag{7}$$

5. Group ρ–Statistics:

$$\begin{aligned} TN^{-1/2} \widehat{Z}_{\hat{\rho}N,T-1} \equiv TN^{-\frac{1}{2}} \sum_{t=1}^{N} \left(\sum_{t=1}^{T} \widehat{e^2}_{i,t-1} \right)^{-1} \\ \sum_{t=1}^{T} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\gamma}_i) \end{aligned} \tag{8}$$

6. Group t–Statistics: (Non-Parametric)

$$\begin{aligned} N^{-1/2} \widehat{N}_{tN,r} \equiv N^{-\frac{1}{2}} \sum_{t=1}^{N} \left(\hat{\delta}_i^2 \sum_{t=1}^{T} \widehat{e^2}_{i,t-1} \right)^{-\frac{1}{2}} \\ \sum_{t=1}^{T} (\hat{e}_{i,t-1} \Delta \hat{e}_{i,t} - \hat{\gamma}_i) \end{aligned} \tag{9}$$

7. Group t–Statistics: (Parametric)

$$\begin{aligned} N^{-1/2} \check{Z}_{tN,r}^{*} \equiv N^{-\frac{1}{2}} \sum_{t=1}^{N} \left(\sum_{t=1}^{T} \hat{s}_i^{*2} \hat{e}_{i,t-1}^{*2} \right)^{-1/2} \\ \sum_{t=1}^{T} \hat{e}_{i,t-1}^{*2} \Delta \hat{e}_{i,t}^{*} \end{aligned} \tag{10}$$

The above seven statistics are part of the Pedroni panel cointegration method, and their results suggest a long-run association between the variables under study.

4. Empirical Finding

The main goal of this research is to examine the COVID 19's large-scale influence on the economy of the GCC and a few industrialized countries. This is one of the few studies to date that looked at the impact of the number of cases and deaths on the stock market's performance as measured by returns. The empirical analysis portion is divided into two sections: one presents the results for the developed world, while the other gives the results for the GCC countries. These sections are followed by a comparison of the two groups.

4.1. Empirical Results for the Developed World

This section is further categorized into two parts, part one represents an explanation of informal outcomes, and part two reports formal results.

4.1.1. Informal Results

The data analysis starts with the descriptive analysis to seek the fundamental insight of the data and identify any possible trend.

Table 1 illustrates the descriptive data, showing that the stock returns have the lowest mean value, while the total number of COVID-19 instances has the highest mean value. In the case of median results, the same pattern was seen. Furthermore, the range data displays the variable SR's minimal value; yet, the highest value corresponds to death and indicates the severity of the pandemic that hit the developed world hard. Furthermore, standard deviation data suggest that SR has the lowest value and has the most constant pattern during the study period; yet, the largest value belongs to the number of cases.

In addition to the descriptive analysis, Table 2 represents correlation outcomes, and it indicates a solid positive linkage between the total number of COVID-19 cases with total deaths during the period. However, the study reveals a weak direction association between SR and the other two variables.

4.1.2. Formal Results

To establish the possibility of a long-run association between variables, it is a prerequisite to check the stationary of the variables, and to this reason, various unit root tests are applied, and the results are presented in Table 3.

Except for stock returns, none of the variables are stationary on level, according to the results of unit root testing. After obtaining the initial difference, variables indicate intended results and are integrated on level one, and panel cointegration testing on the data is one of the most important needs. A well-defined Pedroni panel cointegration approach was used as a result of these findings, and the results are detailed in Table 4.

The Pedroni method's statistics, such as the common AR coefficient within and between dimensions, provide significant results based on the *p*-value against each outcome. Because the significant results allow rejecting the null hypothesis that no cointegration exists between variables, it's worth noting that the number of COVID-19 cases and deaths is linked to stock market performance in the long term. These findings are in line with those of Yousfi et al. (2021), who demonstrated that the COVID-19 pandemic had negative effects on the US and Chinese financial markets and, as a result, their economies. In addition to this study, Hong et al. (2021) also endorsed the negative consequences of COVID-19 on the stock returns of the US stock market. The instability causes inefficiency in the market and helps speculators and traders for profitable opportunities. The identical findings were reported by (Bora & Basistha, 2021; Ashraf, 2020; Takyi & Bentum-Ennin, 2021).

This study further uses the Kao panel cointegration test to check the robustness of the Pedroni method. According to the Kao statistics, the *p*-value is zero, which allows rejecting the null hypothesis that endorses the existence of a long-run association between variables (Table 5).

This study further uses the Panel VECM model to review the long-run causality among variables. Table 6

Table 2: Correlation Analysis

Variables	SR	Deaths	Cases
SR	1		
Deaths	0.022292	1	
Cases	0.016333	0.985171	1

Table 1: Descriptive Statistics

Variables	Summary Descriptive Statistics Panel Data				
	Mean	Median	Maximum	Minimum	Std. Dev.
SR	0.00031	0.00139	0.11015	–0.1374	0.01836
Deaths	112803	41558	589223	1	160149
Cases	5035442	514540	3.3E+07	33	9053848

Table 3: Panel Unit Root[2]

Variables	Level				First Difference			
	LLC	IPS	ADF	PP	LLC	IPS	ADF	PP
SR	23.15* (0.00)	–21.26* (0.00)	269.19* (0.00)	–18.24* (0.00)	–7.64* (0.00)	–23.30* (0.00)	291.84* (0.00)	–9.84* (0.00)
Deaths	–1.23 (0.10)	2.60 (0.99)	2.52 (0.99)	0.18 (0.99)	5.032* (0.00)	–1.61* (0.04)	–1.64* (0.4)	–17.14* (0.00)
Cases	–0.42 (0.33)	3.21 (0.99)	3.10 (0.99)	7.60 (1.00)	3.97* (0.00)	–1.67* (0.04)	–1.70* (0.04)	–17.02* (0.00)

Note: LLC: Levin, Lin & Chu *t**; IPS: Im, Pesaran and Shin W-stat; ADF: ADF-Fisher Chi-square; PP: PP–Phillip and Perran. Level of significance: **p*-value < 0.1,***p*-value < 0.05 and ****p*-value < 0.001.

Table 4: Pedroni Panel Cointegration Test

Alternative Hypothesis: Common AR Coefs. (Within-Dimension)				
Test Statistics	Statistics	*P*-value	Weighted Statistics	*P*-value
Panel v	8.951*	0.000	2.836*	0.0023
Panel rho	–47.768*	0.000	–51.059*	0.000
Panel PP	–21.157*	0.000	–22.503*	0.000
Panel ADF	–14.877*	0.000	–14.422*	0.000
Alternative Hypothesis: Individual AR Coefs. (Between-Dimension)				
Test Statistics	**Statistics**	**P-value**		
Group rho	–51.574*	0.000		
Group PP	–26.678*	0.000		
Group ADF	–17.708*	0.000		

Note: Level of significance: **p*-value < 0.1, ***p*-value < 0.05 and ****p*-value < 0.001.

Table 5: Pedroni Panel Cointegration Test

Kao Residual Cointegration Test		
Test Statistics	*t*-value	*P*-value
ADF	–7.063	0.000

shows the output in this regard, with the error correction term turning negative and statistically significant, indicating the existence of long-run causality extending from many deaths and cases to stock returns. Furthermore,

Table 6: Panel VECM

Panel Vector Error Correction Model		
Variables	Estimates	*P*-values
ΔSR_{t-1}	–0.85	0.4431
ΔSR_{t-2}	–0.03	0.7236
$\Delta Deaths_{t-1}$	0.012	0.5397
$\Delta Deaths_{t-2}$	–5.19E-07	0.5057
$\Delta Cases_{t-1}$	1.05E-07	0.3798
$\Delta Cases_{t-2}$	–8.03E-09	0.4973
Error Correction Term (ECT_{t-1})	–0.85814	0.00
R^2	0.45	
$\bar{R}^2$	0.444	
F-Statistics	81.94 (0.00)	

Note: Level of significance: **p*-value < 0.1, ***p*-value < 0.05 and ****p*-value < 0.001.

a rate of adjustment of 85% towards long-run equilibrium is reported. Furthermore, the coefficient of determination demonstrates that independent variables account for 45% of the variation in stock return. The entire model is significant, according to the *F*-statistics. Furthermore, the Wald test results show that there is no short-run causation between variables.

4.2. Empirical Results for the GCC Countries

The results of the GCC countries are reported into two main sections, informal and formal.

4.2.1. Informal Results

This section shows the informal outcome for the GCC countries, and in this regard, Table 7 illustrates the

Table 7: Descriptive Statistics

Variables	Summary Descriptive Statistics Panel Data				
	Mean	Median	Maximum	Minimum	Std. Dev.
SR	0.00071	0.00094	0.07173	–0.0839	0.00981
Deaths	1180.72	438.5	7085	1	1774.3
Cases	135853	118531	448637	4	113020

Table 8: Correlation Analysis

Variables	SR	Deaths	Cases
SR	1		
Deaths	0.059103	1	
Cases	0.072814	0.838312	1

descriptive statistics. It shows that the SR holds the lowest mean value compared with cases with the highest average. Similarly, the median represents an identical outcome. In the case of range, SR has the minimum value, and the number of cases has the highest. While the measure of dispersion shows that SR portrayed the lowest standard deviation while the number of cases reports the highest.

The correlation analysis outcomes reported in Table 8 and the correlation between SR and the other variables are relatively low; however, there is a strong correlation between cases and deaths.

4.2.2. Formal Results

To apply long-run methods, it is essential to check whether under-study variables are stationary or not, and to this reason, various unit root methods are applied. The outcomes suggest that all the variables are non-stationary at level; however, after taking the first difference, they become stationary except for the case of SR (Table 9).

The results of panel cointegration (Table 10) are very significant, as seen by the p-values for each test statistic, such as the standard AR coefficient within and between dimensions. These strong findings allow the null hypothesis that no cointegration exists between variables to be rejected, and it is thus commendable to remark that the number of COVID-19 cases and deaths is related to stock market success in the long run. These findings are in line with those of other researchers (Salman & Ali, 2021; Madai, 2021; Gupta et al., 2021).

To check the robustness, this research has applied the Kao panel cointegration test, and its outcomes ensure the existence of a long-run association between variables (Table 11).

This study used the Panel VECM model to empirically test the existence of long-run causation among variables, and Table 12 shows the results, with the error correction term prevailing as negative and highly significant. As a result, there is evidence of long-run causality extending from a large number of illnesses and deaths to the stock returns of GCC countries. In addition, a rate of adjustment of 89 percent towards long-run equilibrium is recorded. Furthermore, the coefficient of determination demonstrates that the number of cases and deaths explains 44 percent of the fluctuation in stock return. F-statistics provide a strong foundation for the overall model. Moreover, the results of the Wald test suggest only a short-run causality running from total COVID cases toward the stock returns.

5. Conclusion

The present research aims to statistically examine the COVID-19 pandemic impact on the stock markets of the GCC countries (Kuwait, KSA, Qatar, Oman, Bahrain, and UAE) and look at its effect on the highest performing stock markets of selected developed countries (the USA, UK, and Japan). This study uses daily data from January 2020 to May 2021 and obtained from World Health Organization and Thomson Reuters. This research employed variables such as stock return, number of COVID-19 cases, and number of COVID-19 related deaths. To examine data, a panel of two groups, such as GCC and selected developed countries, is reviewed.

The data analysis is divided into two parts: informal and formal: informal analysis, which provides a basic understanding of the data through descriptive statistics, and correlation analysis. Formal parts, on the other hand, involve unit root testing to examine the stationarity issue, as well as the long-run relationship between variables. To confirm stationarity, a variety of unit root tests were used, including Levin, Lin, and Chu (LLC), I'm, Pesaran, and Shin W-stat (IPS), ADF–Fisher Chi-square (ADF), and PP–Phillip and

Table 9: Panel Unit Root

Variables	Level				First Difference			
	LLC	IPS	ADF	PP	LLC	IPS	ADF	PP
SR	–2.57* (0.0051)	–14.622* (0.00)	–13.60* (0.00)	–24.73* (0.00)	26.09* (0.00)	–28.00* (0.00)	–22.17* (0.00)	–9.10* (0.00)
Deaths	0.38 (0.64)	4.46 (0.99)	3.43 (0.99)	2.40 (0.998)	5.57* (0.00)	–1.25*** (0.09)	–1.19*** (0.098)	–25.39* (0.00)
Cases	1.78 (0.96)	4.58 (0.99)	4.41 (0.97)	2.66 (0.99)	7.74* (0.00)	–0.21 (0.41)	13.11 (0.36)	–26.30* (0.00)

Note: LLC: Levin, Lin & Chu *t**; IPS: Im, Pesaran and Shin W-stat; ADF: ADF - Fisher Chi-square; PP: PP – Phillip and perran. Level of significance: **p*-value < 0.1, ***p*-value < 0.05 and ****p*-value < 0.001.

Table 10: Pedroni Panel Cointegration Test

Alternative Hypothesis: Common AR Coefs. (Within-Dimension)				
Test Statistics	Statistics	*P*-value	Weighted Statistics	*P*-value
Panel v	7.076*	0.00	4.0736*	0.00
Panel rho	–62.951*	0.00	–55.729*	0.00
Panel PP	–28.967*	0.00	–25.819*	0.00
Panel ADF	–20.936*	0.00	–17.595*	0.00
Alternative Hypothesis: Individual AR Coefs. (Between-Dimension)				
Test Statistics	**Statistics**		***P*-Value**	
Group rho	–63.183*		0.00	
Group PP	–34.531*		0.00	
Group ADF	–23.134*		0.00	

Note: Level of significance: **p*-value < 0.1,***p*-value < 0.05 and ****p*-value < 0.001.

Table 11: Kao Panel Residual Cointegration Test

Kao Residual Cointegration Test		
Test Statistics	*t*-value	*P*-value
ADF	–8.539*	0.00

Level of significance: **p*-value < 0.1,***p*-value < 0.05 and ****p*-value < 0.001.

Table 12: Panel VECM

Panel Vector Error Correction Model		
Variables	Estimates	*P*-values
ΔSR_{t-1}	0.015	0.67
ΔSR_{t-2}	–0.011	0.68
$\Delta Deaths_{t-1}$	–3.34E-05	0.06
$\Delta Deaths_{t-2}$	7.38E-06	0.69
$\Delta Cases_{t-1}$	4.19E-07	0.02
$\Delta Cases_{t-2}$	1.86E-07	0.30
Error Correction Term (ECT_{t-1})	–0.8971	0.00
R^2	0.44	
$\bar{R}^2$	0.44	
F-Statistics	150.01 (0.00)	

Level of significance: **p*-value < 0.1, ***p*-value < 0.05 and ****p*-value < 0.001.

Perran (PP). After that, the long-run correlation between variables was analyzed using the famous Pedroni panel cointegration approach, and its robustness was tested using the Kao panel cointegration method. The Panel Vector Error Correction Model was used to investigate the long-term causation of variables.

The overall findings of this study suggest that many cases and death have a long-term relationship with GCC and other stock market returns. In addition, the VECM model found a long-run causality between COVID instances and death and stock reruns in both sets of stock markets. Nonetheless, a Wald test yielded mixed results, indicating no short-run causality between cases and deaths and stock returns in both groups; however, in the case of GCC, several COVID-19 cases are having a causal impact on stock markets, which is noteworthy, and could be due to a lower death rate than many developed and developing countries.

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Endnotes

[1]Levin et al. (2002), Im et al. (2003), ADF-Fisher Chi-square, and PP–Phillip and Perran (1998).

[2]Null Hypothesis H0: Panels Have Unit Root.