4-19-2022

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10.1108/IMEFM-03-2021-0124
This is an author's accepted manuscript of: Rahman, M. A., Khudri, M. M., Kamran, M., & Butt, P. (2022). A note on the relationship between COVID-19 and stock market return: Evidence from South Asia. *International Journal of Islamic and Middle Eastern Finance and Management, 15(2).*
https://doi.org/10.1108/IMEFM-03-2021-0124

A note on the relationship between COVID-19 and stock market return: Evidence from South Asia

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Abstract

The transformation of COVID-19 from a regional health crisis in a Chinese city to a global pandemic has caused severe damage not only to the natural and economic lives of human beings but also to the financial markets. The rapidly pervading and daunting consequences of COVID-19 spread have plummeted the stock markets to their lowest levels in many decades especially in South Asia. This motivated us to investigate the stock markets' response to the COVID-19 pandemic in four South Asian countries, namely Bangladesh, India, Pakistan, and Sri Lanka. To this end, we collected and analyzed the daily data on COVID-19 spread and stock market return over the period May 28, 2020, to October 01, 2020. Using Dumitrescu and Hurlin panel Granger non-causality test, our empirical results demonstrate that the COVID-19 spread measured through its daily confirmed cases in a country significantly induces stock market return. We cross-validated the results using the pairwise Granger causality test and find the results robust. Our study delineates various policy implications and avenues for future research.

Keywords: Causality; COVID-19; Cross-sectional dependence; South Asia; Stock markets.

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1. Introduction

The novel coronavirus disease (COVID-19) has caused economic upheaval by shutting down businesses, throwing the global supply chains into disarray, and placing millions of people under lockdown (Remko, 2020). Owning to the enormous scale of its disruptions, it is being considered a “once-in-a-century” pandemic (Gates, 2020; Horton, 2020). This global health crisis has caused a shock in both developed (McKee & Stuckler, 2020; Yarovaya, Elsayed, & Hammoudeh, 2020) and emerging economies (Hevia & Neumeyer, 2020), bringing economic activities to a standstill (Carlsson-Szlezak, Reeves, & Swartz, 2020; Buheji et al., 2020). As a result, the global economy is experiencing one of the worst economic shocks in many decades (World Bank, 2020; (Nicola et al., 2020). Since February 2020, several firms are involved in divestments due to massive panic and high levels of market volatility resulting from the virus. Dunford et al. (2020) reported that more than 100 countries had fully or partially imposed lockdowns by the end of March 2020 by restricting air and intercity travel. Prioritizing human lives over economic and social activities, all the major cultural, business and educational events around the world have either been canceled or postponed (Chinazzi et al., 2020; Hedgecoe et al., 2020). To curb this highly contagious disease and salvage the economic slowdown, several countries are offering different stimulus measures, including the reduced interest rate and direct monetary support (Ashraf, 2020).

Due to the non-availability of vaccines and targeted therapeutics for COVID-19 treatment to date, this uncertainty and distress in the economic and financial markets are not expected to end very soon (Wang et al., 2020). Keeping in view the long-term implications of this pandemic, the Global Economic Prospects report (World Bank, 2020) projected a reduction by 2.5% and 7% in the per capita income of developing and advanced economies, making it the worst after 1870. Similarly, a 6.2 percent contraction is expected in the global gross domestic product per capita (GDPPC) which is more than twice what the world witnessed during the global financial crisis (GFC). This sense of insecurity and volatility in the economic markets has spilled over to the financial markets as well prompting a synchronized sell-off in equities and commodities (Zhang, Hu, & Ji, 2020). Stock markets which are the backbone of the global financial system recorded huge losses and upheaval during this pandemic pushing investors to look for safe havens (Kinateder, Campbell, & Choudhury, 2021; Hassan et al., 2021). Such uncertainties in stock markets result in flight-to-safety (Adrian, Crump, & Vogt, 2019; Baubeau et al., 2021) (Baubeau et al., 2021), flight-to-liquidity (Ben-Rephael, 2017; (Chulia et al., 2021) and flight-to-quality (Cho, Choi, Kim, & Kim, 2016; (Papadamou et al., 2021) episodes in a bid to safeguard the assets.

The rising number of COVID-19 cases around the world and the extreme susceptibility of stock markets to such externalities (Alber, 2020) motivated many recent researchers to study how the spread of this pandemic is affecting stock markets' performance. However, the findings on the response of the stock market to the number of COVID-19 cases are mixed. Using GARCH (1,1) on a dataset from April 8, 2019, to April 9, 2020, Onali (2020) found that the number of COVID-19 cases and related deaths in the seven countries majorly hit by this pandemic do not have a significant impact on the US stock market returns except for China. However, for some countries, the relationship turns either positive or negative when conditional heteroscedasticity and VAR models are employed. Similarly, based on a period from March 10 to April 30, 2020, Topcu and Gulal (2020) evidenced that COVID-19 spread initially had a negative impact on emerging stock markets in both Asia and Europe. But this negative relationship gradually started to fell and taper off by mid-April.

However, the majority of the studies on the stock markets' response to COVID-19 concluded an adverse effect on stocks' returns. For example, Baker et al. (2020) stated that the stock market during COVID-19 experienced higher volatility than the period of any other recent infectious disease, including the Spanish flu of 1918. Zhang et al. (2020) also confirmed the substantial rise in the volatility of ten stock markets in February 2020 due to COVID-19. Al-Awadhi et al. (2020) investigated the early impact of COVID-19 on share prices using the firm-level data from China and found that overall share prices ratcheted down due to the unfavorable economic outcomes of the disease. Using the daily data of 64 countries, Ashraf (2020) showed that the stock market returns declined as the number of new cases increased. Some other researchers (see e.g., Heyden & Heyden, 2021; Liu, Manzoor, Wang, Zhang, & Manzoor, 2020; (Pandey & Kumari, 2021) also confirmed the catastrophic impact of COVID-19 on stock markets using the event study approach. Alfaro, Chari, Greenland, and Schott (2020) concluded the same results on the relationship between the real-time changes in COVID-19 infection projections and US stock performance. While studying the implications of COVID-19 on the stock markets of China, Japan, Spain, Italy, Germany, South Korea, France, and the United States of America, He, Liu, Wang, and Yu (2020) argued that it had a negative impact on the stock markets although for short-term only.

On the other hand, Brueckner and Vespiganani (2020) showed that COVID-19 infections in Australia and the USA have positively affected their respective stock markets' performance. Ramelli and Wagner (2020) observed that the US stock market recorded three of its worst performance from March 9 to March 16 this year. But it also observed one of its top 10 upsurges during the same period as well. Similarly, He, Sun, Zhang, and Li (2020) while studying the impact of COVID-19 on Chinese stock markets found that it negatively affected stock prices on the Shanghai Stock Exchange, whereas its impact on stock returns listed on Shenzhen Stock Exchange was positive.

Keeping in view the indecisive results of previous studies, studying the stock markets' response to the COVID-19 pandemic in South Asia is justified for various reasons. Though a good number of studies are available which examined the impact of COVID-19 on stock market performance or return, their findings are mostly contradictory and inconclusive.

Moreover, to the best of our knowledge, there is a dearth of empirical evidence on the causal relationship between the number of COVID-19 cases and stock market returns in a panel setting. Only Wang and Enilov (2020) found evidence of unidirectional causality from the number of COVID-19 cases to stock market returns in the largest advanced economies of the world. They used the data of G7 countries covering the period from February 17, 2020, to April 9, 2020, in their study.

Contrary to their study on G7, countries in South Asia are emerging economies that are facing additional challenges to combat COVID-19 due to their dense population, low surveillance system, highly fragile health systems, constrained financial resources, poor infrastructure and limited fiscal scope (Chalise, 2020; Sharma, Talan, Srivastava, Yadav, & Chopra, 2020). Therefore, these countries are expected to have a lingering impact of the virus on stock markets and investors' sentiment. Based on the event study approach, Harjoto, Rossi, and Paglia (2020) also confirmed that the WHO announcement on March 11 2020 that caused a negative shock to the global stock markets was more intense for emerging markets. Even among the emerging economies, the adverse effect was particularly evident in south Asian stock markets (Topcu & Gulal, 2020) where it generated comparatively higher negative abnormal returns (Liu et al., 2020). Hence, by examining the unexplored causal relationship between the number of COVID-19 cases and stock market returns in four south Asian countries i.e., Bangladesh, India, Pakistan, and Sri Lanka, our study fills a significant research gap in the literature. Using Dumitrescu and Hurlin panel Granger non-causality test, our empirical results demonstrate that COVID-19 spread significantly affects the stock market returns.

This study has two significant contributions to the growing literature on stock markets' response to the COVID-19 pandemic. Firstly, it adds to the existing literature on the impact of non-economic variables such as natural disaster, environment, and sports on financial markets by considering the effect of infectious disease (see e.g., Gangopadhyay et al., 2010; Hirshleifer and Shumway, 2003; Lepori, 2016; Kowalewski and Śpiewanowski, 2020; Kaplanski and Levy, 2010; Edmans et al., 2007). Secondly, it adds to the emerging literature on stock markets' response to COVID-19 for South Asian countries' perspective by adopting the novel approach of panel causality test with a larger sample size (see, for example, Ashraf, 2020; Al-Awadhi et al., 2020; Zhang et al., 2020; Baker et al., 2020).

We organize the remaining sections of the paper as follows. Section 2 describes the data briefly and the econometric techniques used in analyzing the data. Section 3 discusses results in the light of objectives. Finally, section 4 provides the concluding remarks with policy implications.

2. Data and Methodology

2.1 Data

We collect the number of daily confirmed COVID-19 cases from Worldometer (2020) and the daily stock market index value from DataStream. We consider four south Asian stock markets for this study, namely, Dhaka Stock Exchange (DSE), Bombay Stock Exchange (BSE), Pakistan Stock Exchange (PSX), and Colombo Stock Exchange (CSE). The sample period covers from May 28, 2020, to October 01, 2020. Next, we compute the daily nominal percentage stock market returns (*r*) as follows.

$$r_t = 100 * \ln\left(\frac{i_t}{i_{t-1}}\right) \quad (1)$$

where r_t represents the return on day *t*, i_t and i_{t-1} indicate the market index on day *t* and *t*-1, respectively.

[Insert Figure 1]

Figure 1 shows the dynamic spread of COVID-19 in Bangladesh, India, Pakistan, and Sri Lanka. India has ranked second in the number of confirmed COVID-19 cases globally as of November 6, 2020 (Worldometer, 2020). With over 1.3 billion people, India is the largest and most populated country in the South Asia region, followed by 221 million people in Pakistan, 165 million in Bangladesh, and 21.67 million in Sri Lanka. This may be one of the reasons behind high COVID-19 cases experienced by India compared to the other three sampled countries, as depicted in Figure 1. Figure 2 shows the dynamics of the stock returns in Bangladesh, India, Pakistan, and Sri Lanka. As can be seen, from the graph, that the volatility of stock returns for India is higher than that of any other sampled country. The return fluctuates between + 9% and -5.8% within our sample period. Besides, we notice that the stock return for Bangladesh remains more volatile at the onset of August 2020 in comparison with other periods. A potential reason could be seen from Figure 1 that the number of COVID-19 cases significantly increased in August 2020, following a more considerable drop before August.

[Insert Figure 2]

2.2 Methodology

We employ panel data analysis to determine the causal impact of COVID-19 cases on the stock market. We consider the stock market returns as a dependent variable and the number of confirmed COVID-19 cases as an independent variable and vice versa in causality analysis.

2.2.1 Cross-sectional dependence

Before running the unit root test, we scrutinize the presence of dependence among the cross-sectional units in our data. The cross-sectional dependence among cross-sectional units indicates that a shock that originated from one cross-section may spill over the other cross-sections. To be more specific, we assume that the number of COVID-19 cases in one country may have a spillover effect on another country. We also make the same assumption for returns. Hence, we perform three cross-sectional dependence tests as a diagnostic check prior to performing panel data analysis. We utilize the Breusch and Pagan LM (BP_{LM} hereafter) test proposed by Breusch & Pagan (1980), Pesaran scaled LM (PS_{LM} hereafter) test and the Pesaran CD ((P_{CD} hereafter)) test introduced by Pesaran (2004) for examining the presence of cross-sectional dependence in the data. One of the major limitations of the BP_{LM} test is that the test performs well only when there are relatively a small number of cross-sectional dimensions and fairly a large number of time dimensions. The PS_{LM} test can take care of this downside. Nevertheless, it cannot successfully deal with the situation when the time dimension is well. The P_{CD} test can overcome the limitations of the former two tests. All three tests consider the null hypothesis of no cross-sectional dependence, i.e., $H_0: Cov(\epsilon_{it}, \epsilon_{kt}) = 0$ for all t & $i \neq k$ against the alternative of cross-sectional dependence, i.e., $H_1: Cov(\epsilon_{it}, \epsilon_{kt}) \neq 0$ for at least one pair of $i \neq k$ where ϵ_{it} is an independent and identically distributed error term. See Tugcu and Tiwari (2016) for more details of these tests.

2.2.2 Panel unit root test

Two generations of tests are available in the literature within the panel unit root-testing framework. The first-generation panel unit root tests assume the cross-sectional independence among the cross-section units, whereas the second-generation tests allow for cross-sectional dependence.

2.2.2.1 First generation panel unit root test

We start with the first-generation panel unit root tests to determine if the corresponding series has a unit root. Three-panel unit root tests, namely Levin–Lin–Chu (LLC hereafter) test introduced by Levin, Lin, & Chu (2002), Im–Pesaran–Shin (IPS hereafter) test introduced by Im, Pesaran, & Shin (2003), and Phillips Perron -Fisher (PP-Fisher hereafter) test proposed by Maddala & Wu (1999) are employed to find out the order of integration for each variable. The LLC test investigates the model where lagged dependent variable is homogeneous across all panel units. In contrast, the IPS test includes heterogeneous adjustment processes and pools the *t*-statistics from univariate independent ADF regression. They relax the restricted assumption of the first-order autoregressive coefficient across the region, which is constant in the LLC test and suggests that it varies across the countries.

2.2.2.2 Second generation panel unit root test

In the presence of cross-sectional dependence in panel data, the first-generation unit root tests results may not be robust. The second-generation panel unit root tests should be used instead (Tugcu, 2018). The second-generation tests consider the heterogeneity assumption and attempt to overcome the limitation of cross-sectional dependence faced by the first-generation tests. In accordance with the second-generation test, the series does not contain a standard autoregressive structure, and the panels are heterogeneous. In this paper, we perform two second-generation tests, such as Pesaran's cross-sectional augmented Dickey-Fuller (CADF) test and Pesaran's cross-sectional augmented IPS (CIPS) test (See Pesaran (2007) for details).

2.2.3 Dumitrescu–Hurlin non-causality test

We assess the causality between the stock market returns (*r*) and the number of COVID-19 confirmed cases using a panel Granger non-causality test (hereafter DH) introduced by Dumitrescu and Hurlin (2012). The DH test provides consistent results in the presence of cross-sectional dependence and heterogeneity, unlike the traditional Granger causality test. The DH linear model is written as follows:

$$r_{i,t} = \varphi_i + \sum_{j=1}^{J} \tau_i^j r_{i,t-j} + \sum_{j=1}^{J} \gamma_i^p x_{i,t-j} + \varepsilon_{i,t} \quad \text{for } i = 1,2,\dots,N;\ t = 1,2,\dots,T \qquad (2)$$

where, $r_{i,t}$ and $x_{i,t}$ denote returns and the number of COVID-19 cases, respectively, for the cross-section dimensions (country in this study) over the time dimensions $t; J$ represents the optimal lag length; φ_i denotes the individual intercepts; $\tau_i^j \ and\ \gamma_i^j$ are the lag and slope coefficients, respectively; $\varepsilon_{i,t}$ is the error term. The DH test's null hypothesis states that there is no causal relationship for any of the cross-section units, whereas the alternative hypothesis posits those causal relationships exist for at least one country.

2.2.4 Robustness checking: Pairwise panel Granger causality test

This study implements another panel data analysis technique known as the pairwise panel Granger causality test to examine the robustness of the results further. This technique is widely used for checking the causality between the variables (see, for example, Jebli, Youssef, & Ozturk, 2014; Saud, Chen, & Haseeb, 2020). The bivariate model of the form:

$$r_{i,t} = \alpha_i + \sum_{k=1}^{K} \beta_{i,k}\, r_{i,t-k} + \sum_{k=1}^{K} \gamma_{i,k}\, x_{i,t-k} + \varepsilon_{i,t} \quad (3)$$

where $r_{i,t}$ and $x_{i,t}$ denote returns and the number of COVID-19 cases for country i in period t. The pairwise panel Granger causality test null hypothesis states that there is no causal relationship for all the cross-section units in the panel.

3. Empirical results

This section begins with the summary statistics of the variables. Table 1 displays the summary statistics of stock market return and COVID-19 cases. The mean value of stock market returns is 0.256, which indicates that, on average, the sample countries experience a 25.67 percent gain in stock market returns during the study period. India's stock has the highest return (34.9%), followed by Bangladesh (24.4%). From the standard deviation of returns, we observe that India is more volatile relative to other South Asian countries considered in this study. The more volatile the market, the higher the risk. Therefore, this is consistent with the philosophy of higher risk, higher return.

[Insert Table 1]

The returns are negatively skewed for Pakistan and Sri Lanka but positively skewed for India and Bangladesh. The stock return series of India appears symmetric and follows approximately normal distribution taking its skewness and kurtosis into account. The average daily cases in COVID-19 confirm that India has a higher number of confirmed cases followed by Bangladesh. In contrast, Sri Lanka has the lowest average daily cases that are about 15 cases.

It is one of the countries in the world that has successfully managed the coronavirus pandemic. The distributions of the number of confirmed cases look symmetric to some extent for all countries other than Sri Lanka. The cases for Sri Lanka are positively skewed and leptokurtic, i.e., more peaked with fatter tails, which strongly suggests that the series deviates from the normal distribution.

Table 2 reports the findings of cross-sectional dependence tests. As can be seen, we do not find evidence of cross-sectional dependence in stock market return (r) at the 5% significance level, implying that the cross-sectional dependence across countries does not exist in the return series. On the other hand, all the results suggest the presence of cross-sectional dependence across countries in the series of COVID-19 cases at the 1% significance level. This finding leads to the evidence of the possible spillover effect of COVID-19 cases in one country on another country in the sample.

[Insert Table 2]

Table 2 reports the stationary property of returns and cases using the first-generation LLC, IPS, and PP-Fishers unit root tests. All three tests consider the null hypothesis of a unit root against the alternative of no unit root.

[Insert Table 3]

Results from all three tests reported in Table 3 show that both returns and COVID-19 cases are integrated of order zero, i.e., stationary, suggesting the rejection of the null hypothesis at a 5% level of significance. This finding is consistent across the models with or without trends.

Table 4 presents results from the second-generation CADF and CIPS Unit Root Test. The null hypothesis that all panels contain unit roots is rejected at the 1% significance level. Being consistent with LLC, IPS, and PP-Fishers unit root tests, both returns and COVID-19 are found integrated of order zero (I (0)) from CADF and CIPS test.

[Insert Table 4]

Next, we run the Dumitrescu and Hurlin (2012) panel causality test that takes care of cross-sectional dependence in the analysis. The Dumitrescu and Hurlin (2012) panel non-causality test results reported in table 5 suggest that COVID-19 causes stock market returns, but not vice-versa. This finding leads to the evidence of a unidirectional causal link running from COVID-19 to stock market returns in the selected countries. This implies that COVID-19 happens to drive the financial markets in our sampled countries.

[Insert Table 5]

We apply the pairwise Granger causality test to check the robustness of our results. Results shown in table 6 demonstrate that COVID-19 does Granger cause r at a 1% significance level, while r does not Granger cause COVID-19 at all conventional significance levels, i.e., 1% and 5%. Results based on the Granger causality test again vouch that COVID-19 causes stock market return, but not vice-versa. These findings suggest that COVID-19 has an impact on the financial markets in the selected countries. Those findings are consistent with Wang and Enilov (2020), who find that COVID-19 cases significantly influence the stock returns for Group of Seven (G7) countries. Overall, our results are consistent irrespective of the techniques used. Therefore, we can conclude that the obtained results are robust.

[Insert Table 6]

4. Conclusions and policy implications

We are in the midst of one of the most dreadful pandemics in history, COVID-19, which has plummeted the global economy and financial markets worldwide (Ramelli & Wagner, 2020). Its spread has posed an unprecedented risk to human lives and financial markets (Goodell, 2020), especially in south Asian countries with limited medical facilities and various financial constraints (Asian Development Bank, 2020; Sharma et al., 2020). To ensure the stability of stock markets and safeguard the investors in South Asia, studying the stock markets' response to this pandemic is the need of the hour.

In response to the inconclusive findings and increasing uncertainty regarding the possible effect of COVID-19 on the stock market return, this study investigates the causal impact of the number of confirmed COVID-19 cases on stock market returns in four South Asian countries, namely Bangladesh, India, Pakistan, and Sri Lanka. To this end, we used daily COVID-19 confirmed cases between May 28, 2020, and October 01, 2020. The empirical results suggest unidirectional causality from COVID-19 to stock market returns, indicating that the spread of COVID-19 has a dominant short-term influence on the stock movements. To the best of our knowledge, this study provides the first empirical insights into the impact of COVID-19 on the stock markets of selected South Asian countries taking the cross-sectional dependence into account. Our results are also in line with the findings of other existing literature on COVID-19. Moreover, the results are robust across the two tests used in this study.

During this unprecedented time of high uncertainty, our findings would be instructive for policymakers to deal with the financial challenges and adopt appropriate financial stability measures. Our findings demand rigorous, well-informed, and effective actions at the national level to avoid negative outcomes and propagations of the COVID-19 shock on stock market returns. Targeted stimulus packages from the governments for the deprived corporate sector (Harjoto et al., 2020) and appropriate adjustments in monetary policies by the central banks (Heyden & Heyden, 2021) can be employed to calm the stock markets. Other initiatives such as testing and quarantining policies, income support packages and public awareness programs can be very effective in sustaining and reviving the stock markets (Ashraf, 2020). Our findings are equally insightful to the fund managers and investors in South Asian countries. Taking into account the possible impact of COVID-19 on stock markets' returns, investors can design their optimal portfolios more effectively (Kelly, 2020).

This study has another important implication in the sense that the impact of COVID-19 on the stock markets of South Asian countries may have spillover effects on other developing or even developed countries as confirmed by others (Gunay, 2020; LE & TRAN, 2021; Okorie & Lin, 2021). Hence, our findings can also be generalized to other countries with caution, but this could also be a potential research question for future researchers to answer. Another area to explore could be the search for safe havens in South Asian countries that can help investors in safeguarding their investments from any future pandemic or financial turmoil.

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Table 1. Summary statistics

Countries	Mean	Median	Standard Deviation	Skewness	Kurtosis	Jarque-Bera
Stock market returns						
Bangladesh	0.244	0.105	0.830	1.512	8.641	153.641
India	0.349	0.071	2.586	0.608	3.999	9.293
Pakistan	0.209	0.194	0.800	-0.670	3.774	8.990
Sri Lanka	0.225	0.137	0.718	-0.198	5.649	26.921
COVID-19 cases						
Bangladesh	2673.867	2756.500	720.341	-0.131	2.203	2.635
India	49031.110	50130.500	29356.130	0.060	1.607	7.323
Pakistan	1951.067	919.500	1760.707	0.847	2.321	12.496
Sri Lanka	15.011	8.500	33.092	7.291	62.627	14130.380

Note: The Jarque–Bera statistic tests for the null hypothesis of normality in the distribution of sample returns and COVIV-19 cases.

Table 2. Cross-sectional dependence tests

Test	**Return (*r*)**	**COVID-19 cases**
BP_{LM}	10.239	165.641***
PS_{LM}	1.223	46.084***
P_{CD}	0.841	-04.129***

*Note: The null hypothesis states that there is no cross-sectional dependence in the panel data. *** indicates significance at the 1% level. BP_{LM}: Breusch and Pagan LM test, PS_{LM}: Pesaran scaled LM test, P_{CD}: Pesaran CD test.*

Table 3. Unit root test results

Test		Return (*r*)	COVID-19 cases
LLC	Constant	I(0)	I(0)
	Constant & Trend	I(0)	I(0)
IPS	Constant	I(0)	I(0)
	Constant & Trend	I(0)	I(0)
PP-Fisher	Constant	I(0)	I(0)
	Constant & Trend	I(0)	I(0)

Note: The results are reported at a 5% level of significance[5]. LLC: Levin–Lin–Chu panel root test, IPS: Im-Pesaran–Shin test, PP-Fisher: Phillips Perron -Fisher test

[5] We use Newey–West bandwidth selection with Bartlett Kernel for performing the LLC and PP-Fisher tests. Also, we adopt the Bayesian Information Criterion (BIC) for determining the optimal lag length.

Table 4. CADF and CIPS Unit Root Test Results

	Return (*r*)		COVID-19 cases	
CADF Unit Root Test				
	Constant	Constant & Trend	Constant	Constant & Trend
Bangladesh	-6.595***	-8.718***	-3.941***	-3.924**
India	-6.552***	-6.620***	-3.144*	-3.376
Pakistan	-8.636***	-8.695***	-1.875	-2.137
Sri Lanka	-4.978***	-5.049***	-7.381***	-7.358***
CIPS Unit Root Test				
CIPS statistics	-6.690***	-7.270***	-4.085***	-4.199***

*Notes: *, **, and *** indicate significance at 10, 5, and 1 percent level of significance. The critical values for the model with constant are -3.89 at 1%, -3.25 at 5%, and -2.92 at 10%. Also, the critical values for the model with constant and trend are -4.38 at 1%, -3.74 at 5% and -3.42 at 10%.*

Table 5. Panel Granger non-causality tests: DH panel non-causality test

Null Hypothesis	W statistic	Z-bar statistic*	p-value
COVID-19 does not Granger cause *r*	7.415	5.108	0.000
r does not Granger cause COVID-19	2.765	0.681	0.495

*Note: *See Dumitrescu and Hurlin (2012) for the definition of Z-bar statistic.*

Table 6. Pairwise Granger Causality Tests

Null Hypothesis	F
COVID-19 does not Granger cause *r*	2.986***
r does not Granger cause COVID-19	1.252

*Note: *** indicates significance at the 1% level*

Figure 1: Dynamic spread of confirmed COVID-19 total cases in selected South Asian countries.

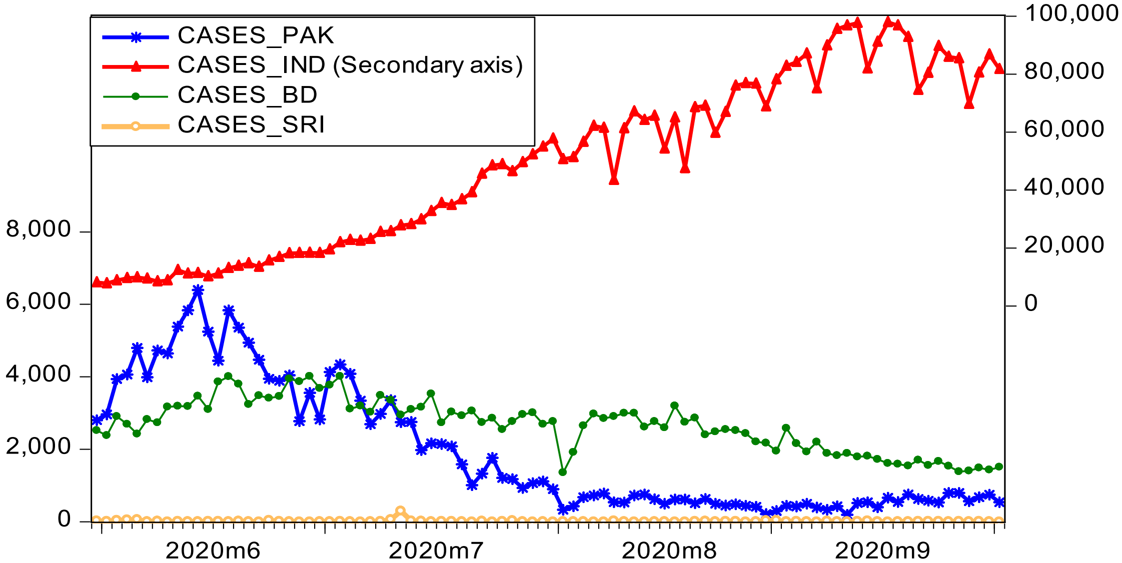

Figure 2: Dynamic of the stock market returns.