SARS-CoV-2 Pandemic's Impact on the Stock Market of Bangladesh: An Exploratory Analysis

Abstract

This research paper empirically analyzes the SARS-CoV-2 (Severe Acute Respiratory Syndrome Coronavirus-2) Pandemic's Impact on the Stock Market of Bangladesh over the period from March 08, 2020 to June 30, 2020. The study employed the Vector Error Correction Model (VECM), the Wald test, and the Pairwise Granger Causality Test by using thirty-six daily data of Sample tests of Covid-19, Covid-19 confirmed cases, death, recovered covid-19 patients, infection rate, fatality rate, recovery rate of covid-19, and return on stock market index in Bangladesh. The results of the model point on the existence of the association between variables on both long and short runs. Again, this causality runs from the studied independent variables to the return on the stock market index in Bangladesh. Overall, the findings of this paper suggest that returns on the stock market index in Bangladesh react to COVID-19 widespread and this reaction changes over time depending on the arrangement of the flare-up.

Keywords: Bangladesh, COVID-19, Pandemic, SARS-CoV-2, Stock market.

1. Introduction

"On December 2019 in Wuhan, China the Coronavirus disease 2019 (COVID-19) was first marked out. This Coronavirus disease is also known as Severe Acute Respiratory Syndrome Coronavirus-2 (SARS-CoV-2). It becomes an outbreak and spreads from China to all over the world. World Health Organization declared the outbreak of Coronavirus disease 2019 as a pandemic On 11 March, 2020. More than 10.47 million cases of COVID-19 confirmed cases with more than 511,253 deaths had been reported in more than 188 countries and territories as of June 30, 2020" (WHO, 2020).

The SARS-CoV-2 pandemic in Bangladesh is part of the global pandemic of Coronavirus disease 2019 (COVID-19). Epidemiology institute, IEDCR (Institute of Epidemiology, Disease Control and Research) of Bangladesh had identified first three known cases on March 08, 2020. Then it had been gradually spreading over the whole country.

Global pandemic as well as lockdown situation in Bangladesh affected each and every sector of the economy. Stock markets of Bangladesh reacted abruptly during this pandemic.

"The stock market in Bangladesh, which had been on a downward trend for the last few months, has recently witnessed massive falls fuelled by the outbreak as frightened investors went for huge selloffs" (DATABD.CO, 2020).

Eichenbaum et al. (2020) applied "the canonical epidemiology model to examine the relationship between economic decisions and epidemics. They found that the severity of the epidemic, as estimated by total deaths, reduced when people were decided to cut back on consumption and vocation".

"Banks are relatively high on liquidity compared to pre-Covid-19 situation. The Statutory Liquid Ratio (SLR) / Net Stable Funding Ratio (NSFR) ratio and overall cash position have improved since the year end. Coupled with the downward revision in the interest rates; Banks are expected to renegotiate their liabilities for a long term at a lower rate and pursue a possible interest rate arbitrage. Simultaneously, banks and customers are expected to terminate their existing IRS (Internal Revenue Service) and enter new hedging relationship" (KPMG, 2020).

"International Data Corporation (IDC) Tech Buyer Presentation used data on consumer perceptions, behaviours, and expectations through IDC Insights' Cross-Industry Consumer Response to COVID-19 to analyze the impact of the COVID-19 pandemic on the U.S. banking industry. The challenges faced by banks are ranging from moving to remote working environments for its contact centre professionals to a move in payments from physical to online to a flare-up of new loan applications and to a difficult loan receivables environment that may make bigger capital reserves depending on the duration of this incident" (D'Alfonso et al., 2020).

The International Monetary Fund (IMF) anticipated that Asia's economic growth to stall for the first time in 60 years this year, further hurting the services sector. Airlines, factories, shops and restaurants suffer an economic crisis due to nationwide lockdowns across regions (World Economic Forum, 2020).

2. Literature Reviews

Ozili and Arun (2020) "examined how social distancing policies affect the economic activities and stock market indices. The results of their study was that the level of economic activities and share price of major stock markets severely affected as the number of international travel restrictions, monetary policy decisions and number of lockdown days increased".

"During COVID-19 pandemic many financial institutions got an opportunity to educate and adopt digital person-to-person payment structures, provide services like mobile check deposit. So, that consumer can pass over an outing to a branch" (Ellis & Apiture, 2020).

Economist Shiller (2020) discussed there are two pandemic of COVID-19. The first one is health pandemic and second one is anxiety over the economic consequences of the first. These two pandemic are correlated and we are always thinking about stories of fear in the second pandemic. In response to the stories of COVID-19 the stock market has been falling like a rock exhausting our lifetime saving.

Sharif et al. (2020) studied "the link between the spread of COVID-19, oil price volatility shock, the stock market, geopolitical risk and economic policy uncertainty in the US within a time-frequency framework. Their results showed that The COVID-19 risk is recognized in a different way over the short and the long run and may be firstly viewed as an economic crisis".

Ashraf (2020) used "daily COVID-19 confirmed cases, deaths and stock market returns data for 64 countries over the period January 22, 2020 to April 17, 2020 to investigate the stock markets' reaction to the COVID-19 pandemic. He found that stock markets responded negatively to the growth in COVID-19 confirmed cases far more than the growth in the number of deaths".

Sansa (2020) studied "the relationship between the COVID-19 pandemic and financial markets from the period dated 1st March 2020 to 25th March 2020 in China and USA. By employing Simple regression model he found that there is a positive significant relationship between the COVID-19 confirmed cases and all the financial markets (Shanghai stock exchange and New York Dow Jones)".

Naidenova et al. (2020) studied "using data on 22 countries to explore the impact of idiosyncratic and systematic shocks of the COVID-19 pandemic on financial markets. Their observation found that systematic shocks are consistently harmful and idiosyncratic shocks are more important for the beginning of the deteriorating of the epidemiological situation in a particular country".

The Pakistan Stock Exchange (PSX) was negatively affected by the panic scale, as COVID-19 confirmed cases increased in various parts of Pakistan. During this COVID-19 pandemic KSE-100 had suffered several trade halts these days to safeguard investors and market participants (Business Recorder, 2020).

Baker et al. (2020) analyzed "the influence of COVID-19 outbreaks on the stock market behaviour and made a contrast to previous infectious disease outbreaks. The study concluded that news related to COVID-19 developments is greatly the dominant driver of large daily U.S. stock market than previous contagious disease outbreak, including the Spanish Flu".

Wilkins (2020) described capital buffers have been relaxed by the regulatory authorities of Canada to make balance sheet space to meet the increased demand for credit. To mitigate the economic fallout and lay the groundwork for recovery the central bank of Canada reduced policy rate and implemented the programs.

Adrian and Natalucci (2020) stated that "many equity markets in large and small economies have suffered declines of 30 percent or more at the drain. Stresses have also surfaced in major short-term funding markets, including the global market for U.S. dollars".

"Banks and capital markets institutions have to remain hyper vigilant and rewrite their business permanence playbooks as pandemic situation of Covid-19 changes. The potential long term impact on banks and capital markets will be a continued decrease in the interest rate, reduced trade activity, and large scale non-performing loans, if Covid-19 outbreak becomes a prolonged recession" (Deloitte, 2020).

"The spread of COVID-19 puts fears over an economic slowdown in Sri Lanka, led to a sell-off in the financial market and capital outflows. The country faced a 70% outflow of foreign-owned T-bills and T-bonds (US$ 372 million or 0.42% of GDP) within two months. On 12th May Sri Lanka's leading stock market index (The CSEALL Price Index) fell to its lowest level in eight years" (The Prospector, 2020).

According to Wagner (2020) "COVID-19 embodies a terrible and novel risk which stimulated feverish behaviour by investors. Reasonable economic expectations underlay movements in the stock prices of individual companies despite the volatility and the panic".

Zhang et al. (2020) scrutinized "the patterns of country-specific risks and systemic risks in the global financial markets. The analysis revealed that the risks of global financial market have increased significantly due to the pandemic. The severity of the outbreak in each country noticeably affected Individual stock market".

Guerrieri et al. (2020) analyzed the economic shocks like shutdowns, layoffs, and firm exits relationship with the Covid-19 epidemic. A fifty percent shock in all sectors is not equal to a 100% shock in half of the economy. They asserted that monetary policy can have magnified effects, by averting firm exits, provided that it is unrestrained by the zero lower bound.

3. Objectives

The objective of this research is to look over SARS-CoV-2 Pandemic's impact on the stock market of Bangladesh. This paper is to investigate the degree by which the news of the sample test of, confirmed case of, deaths due to, recovered patients of, infection rate, fatality rate and recovery rate of COVID-19 have an effect on the stock market of Bangladesh.

4. Rational of the Studies

This paper will generate analytical and policy recommendations on the stock market response to the SARS-CoV-2 pandemic. The policy maker, shareholders, sponsor, financiers, and the government may get valuable lessons from this paper. And also this study will be functional for the learning in financial economics, and applied economics.

5. Methodology

5.1 Sources of Data

Data on the daily return stock market index (DSEX) have been collected from the www.dsebd.org website over the period March 8, 2020 to June 30, 2020, i. e. thirty-six observations. After that, data relating to sample tests of, confirmed cases of, deaths due to, and recovered patients of COVID-19 are gathered from the https://web.archive.org/web/20200325195933/http://www.corona.gov.bd/press-release website for the same period.

5.2 Definition of variables

Table 1: Elucidation of variables

Symbol	Definition	Assessment Method
RSM	Return on Stock Market	The daily percentage change in DSEX, a major stock market index of Bangladesh.
STC	Sample Test of COVID-19	The daily growth in number of sample test of COVID-19.
CCC	Confirmed Cases of COVID-19	The daily growth in COVID-19 confirmed cases or patients.
DDC	Deaths Due to COVID-19	The daily growth in the number of deaths associated with COVID-19.
RPC	Recovered Patients of COVID-19	The daily growth in the number of patients recovered from COVID-19.

IRC	Infection Rate of COVID-19	Ratio of daily confirms cases to the daily Sample Test of COVID-19.
FRC	Fatality Rate of COVID-19	Ratio of cumulative number of death to the cumulative number of confirmed COVID-19 case on each day in Bangladesh.
RRC	Recovery Rate of COVID-19	Ratio of cumulative number of recovered patients of COVID-19 to the cumulative number of confirmed COVID-19 case on each day in Bangladesh.

5.3 Stationarity Test

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests have been adopted to analyze the order of integration of the variables.

The rationale for choosing PP test is that it is *non-parametric*, that is, it does not require selecting the level of serial correlation as in ADF. A non-parametric correction to the t-test statistic has been done by the Phillips- Perron test. In the disturbance process of the test equation Philips-Perron test is robust with respect to the unspecified autocorrelation and heteroscedasticity. PP works well with large scale data. Further, the ADF test works well when there is no sensitivity to structural breaks in the data series. The sample data used in this study have no structural breaks.

5.4 Cointegration Test Using Johansen's Methodology

Johansen (1988) cointegration technique has been used to examine both the number of cointegration equations and the existence of potential long run equilibrium relationship between two variables.

5.5 Vector Error Correction Model (VECM)

Vector error correction model is an appropriate estimation technique when a set of variables have one or more cointegrating equations. It also adjusts deviations from equilibrium. The form of VECM used is:

$$\Delta RSM_t = \alpha_0 + \alpha_1 \Delta ECT_{t-1} + \alpha_2 \Delta RSM_{t-1} + \alpha_3 \Delta STC_{t-1} + \alpha_4 \Delta CCC_{t-1} + \alpha_5 \Delta DDC_{t-1} + \alpha_6 \Delta RPC_{t-1} + \alpha_7 \Delta IRC_{t-1} + \alpha_8 \Delta FRC_{t-1} + \alpha_9 \Delta RRC_{t-1} + \varepsilon_t$$

The parameter ΔECT_{t-1} in the above equation of the VECM is the error correction term measuring the speed of correction of return on stock market (RSM) to its equilibrium level.

5.6 Wald Test

To assess the short-run relationship between variables, Wald Test has been adopted. The Wald statistic test is a joint test for short-run coefficients. Where the null hypothesis is that, all the short-run coefficients are jointly zero.

5.7 Pairwise Granger Causality Tests

In this study a multivariate model of causality has been used to examine the causal relationship between RSM, STC, CCC, DDC, RPC, IRC, FRC, and RRC in Bangladesh. Granger Causality tests based on the error correction model is expressed as follows:

$$\Delta RSM_t = \gamma_0 + \sum_{i=1}^{n}\gamma_{1i}\Delta RSM_{t-i} + \sum_{i=1}^{n}\gamma_{2i}\Delta STC_{t-i} + \sum_{i=1}^{n}\gamma_{3i}\Delta CCC_{t-i} + \sum_{i=1}^{n}\gamma_{4i}\Delta DDC_{t-i} + \sum_{i=1}^{n}\gamma_{5i}\Delta RPC_{t-i} + \sum_{i=1}^{n}\gamma_{6i}\Delta IRC_{t-i} + \sum_{i=1}^{n}\gamma_{7i}\Delta FRC_{t-i} + \sum_{i=1}^{n}\gamma_{8i}\Delta RRC_{t-i} + \gamma_9 \Delta ECT_{t-1} + \varepsilon_t$$

$$\Delta STC_t = \gamma_0 + \sum_{i=1}^{n}\gamma_{1i}\Delta RSM_{t-i} + \sum_{i=1}^{n}\gamma_{2i}\Delta STC_{t-i} + \sum_{i=1}^{n}\gamma_{3i}\Delta CCC_{t-i} + \sum_{i=1}^{n}\gamma_{4i}\Delta DDC_{t-i} + \sum_{i=1}^{n}\gamma_{5i}\Delta RPC_{t-i} + \sum_{i=1}^{n}\gamma_{6i}\Delta IRC_{t-i} + \sum_{i=1}^{n}\gamma_{7i}\Delta FRC_{t-i} + \sum_{i=1}^{n}\gamma_{8i}\Delta RRC_{t-i} + \gamma_9 \Delta ECT_{t-1} + \varepsilon_t$$

$$\Delta CCC_t = \gamma_0 + \sum_{i=1}^{n}\gamma_{1i}\Delta RSM_{t-i} + \sum_{i=1}^{n}\gamma_{2i}\Delta STC_{t-i} + \sum_{i=1}^{n}\gamma_{3i}\Delta CCC_{t-i} + \sum_{i=1}^{n}\gamma_{4i}\Delta DDC_{t-i} + \sum_{i=1}^{n}\gamma_{5i}\Delta RPC_{t-i} + \sum_{i=1}^{n}\gamma_{6i}\Delta IRC_{t-i} + \sum_{i=1}^{n}\gamma_{7i}\Delta FRC_{t-i} + \sum_{i=1}^{n}\gamma_{8i}\Delta RRC_{t-i} + \gamma_9 \Delta ECT_{t-1} + \varepsilon_t$$

$$\Delta DDC_t = \gamma_0 + \sum_{i=1}^{n}\gamma_{1i}\Delta RSM_{t-i} + \sum_{i=1}^{n}\gamma_{2i}\Delta STC_{t-i} + \sum_{i=1}^{n}\gamma_{3i}\Delta CCC_{t-i} + \sum_{i=1}^{n}\gamma_{4i}\Delta DDC_{t-i} + \sum_{i=1}^{n}\gamma_{5i}\Delta RPC_{t-i} + \sum_{i=1}^{n}\gamma_{6i}\Delta IRC_{t-i} + \sum_{i=1}^{n}\gamma_{7i}\Delta FRC_{t-i} + \sum_{i=1}^{n}\gamma_{8i}\Delta RRC_{t-i} + \gamma_9 \Delta ECT_{t-1} + \varepsilon_t$$

$$\Delta RPC_t = \gamma_0 + \sum_{i=1}^{n}\gamma_{1i}\Delta RSM_{t-i} + \sum_{i=1}^{n}\gamma_{2i}\Delta STC_{t-i} + \sum_{i=1}^{n}\gamma_{3i}\Delta CCC_{t-i} + \sum_{i=1}^{n}\gamma_{4i}\Delta DDC_{t-i} + \sum_{i=1}^{n}\gamma_{5i}\Delta RPC_{t-i} + \sum_{i=1}^{n}\gamma_{6i}\Delta IRC_{t-i} + \sum_{i=1}^{n}\gamma_{7i}\Delta FRC_{t-i} + \sum_{i=1}^{n}\gamma_{8i}\Delta RRC_{t-i} + \gamma_9 \Delta ECT_{t-1} + \varepsilon_t$$

$$\Delta IRC_t = \gamma_0 + \sum_{i=1}^{n}\gamma_{1i}\Delta RSM_{t-i} + \sum_{i=1}^{n}\gamma_{2i}\Delta STC_{t-i} + \sum_{i=1}^{n}\gamma_{3i}\Delta CCC_{t-i} + \sum_{i=1}^{n}\gamma_{4i}\Delta DDC_{t-i} + \sum_{i=1}^{n}\gamma_{5i}\Delta RPC_{t-i} + \sum_{i=1}^{n}\gamma_{6i}\Delta IRC_{t-i} + \sum_{i=1}^{n}\gamma_{7i}\Delta FRC_{t-i} + \sum_{i=1}^{n}\gamma_{8i}\Delta RRC_{t-i} + \gamma_9\Delta ECT_{t-1} + \varepsilon_t$$

$$\Delta FRC_t = \gamma_0 + \sum_{i=1}^{n}\gamma_{1i}\Delta RSM_{t-i} + \sum_{i=1}^{n}\gamma_{2i}\Delta STC_{t-i} + \sum_{i=1}^{n}\gamma_{3i}\Delta CCC_{t-i} + \sum_{i=1}^{n}\gamma_{4i}\Delta DDC_{t-i} + \sum_{i=1}^{n}\gamma_{5i}\Delta RPC_{t-i} + \sum_{i=1}^{n}\gamma_{6i}\Delta IRC_{t-i} + \sum_{i=1}^{n}\gamma_{7i}\Delta FRC_{t-i} + \sum_{i=1}^{n}\gamma_{8i}\Delta RRC_{t-i} + \gamma_9\Delta ECT_{t-1} + \varepsilon_t$$

$$\Delta RRC_t = \gamma_0 + \sum_{i=1}^{n}\gamma_{1i}\Delta RSM_{t-i} + \sum_{i=1}^{n}\gamma_{2i}\Delta STC_{t-i} + \sum_{i=1}^{n}\gamma_{3i}\Delta CCC_{t-i} + \sum_{i=1}^{n}\gamma_{4i}\Delta DDC_{t-i} + \sum_{i=1}^{n}\gamma_{5i}\Delta RPC_{t-i} + \sum_{i=1}^{n}\gamma_{6i}\Delta IRC_{t-i} + \sum_{i=1}^{n}\gamma_{7i}\Delta FRC_{t-i} + \sum_{i=1}^{n}\gamma_{8i}\Delta RRC_{t-i} + \gamma_9\Delta ECT_{t-1} + \varepsilon_t$$

Where ECT_{t-1} is the error correction term and ε_t is the uncorrelated random error terms with mean zero. Through the error correction-based causality test, the short-run causal impact is assessed by the *F*-statistics and the significance of the independent variables. Again, the long run association is determined by the error correction term (Odhiambo, 2009b).

6. Data Analysis and Discussion

6.1 Summary Statistics

Table 2 reports summary statistics of the variables of our model. Bangladesh stock market experienced on an average negative 0.23 percent return and swing between negative 6.52 percent and positive 10.29 percent with a lowest standard deviation of 2.62 percent.

Table 2: Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Std. Deviation
RSM	36	-.06520	.10290	-.00230	.02618
STC	36	.00000	.30254	.06475	.06601
CCC	36	.00000	.66667	.09108	.15480
DDC	36	.00000	.50000	.05395	.10055
RPC	36	.00000	.93604	.08096	.19183
IRC	36	.00000	.30000	.15738	.09150
FRC	36	.00000	.12821	.02307	.03123
RRC	36	.00000	.40983	.22481	.14039

Source: Author's own estimation using Stata 14.2.

On an average daily 6.48 percent sample test of COVID-19 has been done. The mean values of Confirmed Cases of COVID-19 and Deaths Due to COVID-19 are 9.1 and 5.39 percent respectively with a standard deviation of 15.48 and 10.05 percent respectively. Daily average value of recovered patients of COVID-19 is 8.1 percent with wide standard deviation of 19.18 percent. IRC has an average value of 15.74 percent and standard deviation of 9.15 percent. Then, fatality rate of COVID-19 recorded with lower mean value of only 2.31 percent with a minimal standard deviation of 3.12 percent. The highest mean value recorded for RRC is 22.48 percent with a standard deviation of 14.04 percent.

6.2 Correlation Matrix

Table 3 reported the pairwise Pearson correlation matrix of endogenous variables of the model. Return on stock market (RSM) of Bangladesh has a negative correlation with STC (r = -0.052), confirmed cases of COVID-19 (r = - 0.308), and IRC (r = - 0.030) but insignificant at 5 percent significance level. Again, RSM has a positive relation with DDC (r = 0.097), RPC (r = 0.046), FRC (r = 0.203), and RRC (r = 0.129) and it is also insignificant at 5 percent.

Table 3: Correlations

Variables		RSM	STC	CCC	DDC	RPC	IRC	FRC	RRC
RSM	Pearson Correlation	1							
	Sig. (2-tailed)								
STC	Pearson Correlation	-.052	1						
	Sig. (2-tailed)	.763							
CCC	Pearson Correlation	-.308	.321	1					
	Sig. (2-tailed)	.068	.056						
DDC	Pearson Correlation	.097	.130	.057	1				
	Sig. (2-tailed)	.575	.448	.742					
RPC	Pearson Correlation	.046	.038	-.064	.357*	1			
	Sig. (2-tailed)	.788	.825	.711	.033				
IRC	Pearson Correlation	-.030	-.669**	-.001	-.144	-.017	1		
	Sig. (2-tailed)	.864	.000	.993	.402	.924			
FRC	Pearson Correlation	.203	.611**	.133	.713**	.367*	-.402*	1	

	Sig. (2-tailed)	.236	.000	.440	.000	.028	.015		
RRC	Pearson Correlation	.129	-.435**	-.197	-.123	.130	.762**	-.111	1
	Sig. (2-tailed)	.455	.008	.249	.473	.449	.000	.518	

** Correlation is significant at the 0.01 level (2-tailed). * Correlation is significant at the 0.05 level (2-tailed).
Source: Author's own estimation using Stata 14.2.

6.3 Stationarity Test

Augmented Dickey-Fuller and Phillips-Perron tests have been adopted to check the order of integration of the variables of the model. The results of the stationarity tests of variables at first difference are reported in Table 4.

Table 4: Unit Root Test Results

Variables		**ADF Test**		**PP Test**		**Staionarity Status**
		t-Statistic	**Prob.***	**t-Statistics**	**Prob. ***	
	Intercept	-9.120401	0.0000	-17.29978	0.0001	
D(RSM)	Intercept and Trend	-9.639610	0.0000	-19.85698	0.0000	**I (1)**
	None	-9.606890	0.0000	-16.44912	0.0000	
	Intercept	-3.819171	0.0078	-13.05515	0.0000	
D(STC)	Intercept and Trend	-9.172026	0.0000	-12.92427	0.0000	**I (1)**
	None	-2.450598	0.0164	-13.58349	0.0000	
	Intercept	-11.20737	0.0000	-7.597185	0.0000	
D(CCC)	Intercept and Trend	-8.767040	0.0000	-7.676672	0.0000	**I (1)**
	None	-11.73880	0.0000	-7.850835	0.0000	
	Intercept	-12.68286	0.0000	-10.76634	0.0000	
D(DDC)	Intercept and Trend	-22.51489	0.0000	-12.04568	0.0000	**I (1)**
	None	-2.753916	0.0077	-11.10541	0.0000	
	Intercept	-8.867538	0.0000	-26.15363	0.0001	
D(RPC)	Intercept and Trend	-8.738666	0.0000	-28.98972	0.0000	**I (1)**
	None	-9.004807	0.0000	-26.52545	0.0000	
	Intercept	-5.737238	0.0001	-15.35401	0.0000	
D(IRC)	Intercept and Trend	-5.352005	0.0008	-23.94134	0.0000	**I (1)**
	None	-5.746677	0.0000	-9.957523	0.0000	
	Intercept	-6.685588	0.0000	-6.687186	0.0000	
D(FRC)	Intercept and Trend	-6.625912	0.0000	-6.640853	0.0000	**I (1)**
	None	-6.787290	0.0000	-6.789024	0.0000	
	Intercept	-6.031807	0.0000	-10.67888	0.0000	
D(RRC)	Intercept and Trend	-5.951218	0.0001	-10.53454	0.0000	**I (1)**
	None	-5.829644	0.0000	-5.938682	0.0000	

*MacKinnon (1996) one-sided p-values. Source: Author's own estimation using EViews 7.

The variables of this study are non-stationary at the level. Stationarity test results at the level of variables are not reported here. After taking the first difference, all the variables of the model become stationary whose results are presented in Table 4. It is, therefore, worth concluding that the variables are integrated of order one.

6.4 Cointegration Test Using Johansen's Methodology

Johansen cointegration test has been applied to determine the possibility of cointegrating association among variables. The results are reported in Table 5 (Trace test) and Table 6 (Maximum Eigenvalue).

Table 5: Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. Of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Probability**
None *	0.994017	751.9953	187.4701	0.0000
At most 1 *	0.991728	577.9563	150.5585	0.0000
At most 2 *	0.986029	414.9313	117.7082	0.0000
At most 3 *	0.972187	269.7256	88.80380	0.0000
At most 4 *	0.938598	147.9289	63.87610	0.0000
At most 5 *	0.557103	53.05850	42.91525	0.0036
At most 6	0.418634	25.36830	25.87211	0.0577
At most 7	0.184335	6.927539	12.51798	0.3521

Trace test indicates six(6) cointegrating equation(s) at the 0.05 level.
** MacKinnon-Haug-Michelis (1999) p-values. * denotes rejection of the hypothesis at the 0.05 level.

Table 6: Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized No. Of CE(s)	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Probability **
None *	0.994017	174.0391	56.70519	0.0000
At most 1 *	0.991728	163.0250	50.59985	0.0000
At most 2 *	0.986029	145.2057	44.49720	0.0000
At most 3 *	0.972187	121.7967	38.33101	0.0000
At most 4 *	0.938598	94.87044	32.11832	0.0000
At most 5 *	0.557103	27.69020	25.82321	0.0281
At most 6	0.418634	18.44076	19.38704	0.0682
At most 7	0.184335	6.927539	12.51798	0.3521

Max-eigenvalue test indicates six (6) cointegrating equation(s) at the 0.05 level.

** MacKinnon-Haug-Michelis (1999) p-values. * denotes rejection of the hypothesis at the 0.05 level.

The outcomes of the trace tests statistics and maximum eigenvalue tests statistics reported in Table 5 and Table 6 respectively confirm that there are six cointegrating associations among variables in the studied model. Both trace and max-Eigen tests reject the null hypothesis regarding the number of cointegrating equation of none, At Most 1, At Most 2, At Most 3, At Most 4, and At Most 5 at the 5% significance level. However, the null hypothesis of the number of the cointegrating equations of At Most 6 could not be rejected at 5 percent significance level by both of the tests. Hence, it is concluded that there are six cointegrating associations between the dependent variable stock market return and independent variables of Sample test of Covid-19, Covid-19 confirm case, death, recovered covid-19 patient, infection rate, fatality rate, recovery rate of covid-19 in the studied model.

6.5 Vector Error Correction Model

Vector error correction model is an appropriate estimation technique when a set of variables have one or more cointegrating vectors. The vector error correction model lets the endogenous variables converge to their equilibrium nexus while allowing a wide array of short-run dynamics. Lag length criteria suggest choosing one lag for estimating VECM.

Table 7: Vector Error Correction Estimates Probabilities in ( )

Error Correction:	D(RSM)	D(STC)	D(CCC)	D(DDC)	D(RPC)	D(IRC)	D(FRC)	D(RRC)
CointEq1	-0.364163	-0.674652	1.029115	0.903906	-2.144747	0.899722	-0.207428	0.101636
	(0.0000)	(0.0000)	(0.0867)	(0.0008)	(0.0167)	(0.0000)	(0.0076)	(0.5418)
D(RSM(-1))	-0.172172	0.421070	-0.974209	0.190402	-0.754822	-0.446096	0.161089	-0.234372
	(0.1667)	(0.0291)	(0.2749)	(0.6301)	(0.5688)	(0.0959)	(0.1605)	(0.3449)
D(STC(-1))	0.383206	-0.291790	0.102186	1.436100	0.235646	-0.578174	0.344417	-0.300932
	(0.0003)	(0.0680)	(0.8901)	(0.0000)	(0.8303)	(0.0097)	(0.0004)	(0.1448)
D(CCC(-1))	-0.131830	-0.528615	0.538065	0.277398	-1.497137	0.827908	-0.158173	0.402707
	(0.0254)	(0.0000)	(0.2015)	(0.1381)	(0.0174)	(0.0000)	(0.0038)	(0.0007)
D(DDC(-1))	0.185918	-0.051012	0.264922	0.002444	0.775605	-0.198755	0.055654	-0.176723
	(0.0013)	(0.5623)	(0.5172)	(0.9893)	(0.2028)	(0.1059)	(0.2903)	(0.1214)
D(RPC(-1))	-0.018765	0.031689	-0.065210	0.034029	-0.115007	-0.088424	0.042445	-0.005326
	(0.2128)	(0.1731)	(0.5455)	(0.4772)	(0.4733)	(0.0067)	(0.0025)	(0.8591)
D(IRC(-1))	-0.381468	0.644318	-0.417331	1.778044	2.348396	-1.116547	0.570925	-0.198243
	(0.0090)	(0.0043)	(0.6879)	(0.0002)	(0.1293)	(0.0004)	(0.0000)	(0.4929)
D(FRC(-1))	-0.828294	0.502937	-1.421854	2.170692	1.382712	-0.006033	0.307120	0.553016
	(0.0144)	(0.3328)	(0.5554)	(0.0435)	(0.6995)	(0.9933)	(0.3220)	(0.4099)
D(RRC(-1))	-0.043614	-0.612818	0.957771	-0.166367	-5.267300	1.028767	-0.414361	0.099776
	(0.7704)	(0.0085)	(0.3720)	(0.7265)	(0.0011)	(0.0016)	(0.0029)	(0.7379)
C	0.004863	0.002112	-0.007736	-0.009547	0.051057	0.000319	0.001588	0.011984
	(0.1719)	(0.7001)	(0.7614)	(0.3988)	(0.1785)	(0.9666)	(0.6278)	(0.0920)
R-squared	0.825984	0.875548	0.296021	0.740739	0.595474	0.787149	0.645072	0.677670
Adj. R-squared	0.760728	0.828879	0.032029	0.643515	0.443776	0.707330	0.511974	0.556797
Sum sq. resids	0.008209	0.019562	0.422383	0.083169	0.933085	0.037926	0.006977	0.032692
S.E. equation	0.018494	0.028549	0.132662	0.058867	0.197176	0.039752	0.017050	0.036908
F-statistic	12.65757	18.76064	1.121325	7.618959	3.925406	9.861665	4.846596	5.606434
Log likelihood	93.34698	78.58530	26.35556	53.98125	12.88162	67.33021	96.11141	69.85477

Akaike AIC	-4.902763	-4.034430	-0.962091	-2.587133	-0.169507	-3.372365	-5.065377	-3.520869
Schwarz SC	-4.453834	-3.585500	-0.513162	-2.138203	0.279422	-2.923436	-4.616448	-3.071939
Mean dependent	0.001974	-0.001663	0.000764	0.001056	0.000939	0.005877	0.000373	0.012054
S.D. dependent	0.037809	0.069015	0.134839	0.098595	0.264381	0.073481	0.024407	0.055439

Table 7 reported the outcomes of the Vector Error Correction Model (VECM). The data show that fitting degree of VEC model $R^2 > .50$, and AIC and SC criteria values are relatively small, indicating the reasonability of the model estimation.

The coefficient of the ECT has been found negative in sign and significant at 1 percent, with a speed of convergence to equilibrium of 36.42 percent. Thus there is a long run causality running from independent variables of STC, CCC, DDC, RPC, IRC, FRC and RRC to dependent variable stock market return. The speed of correction of stock market return towards long-run equilibrium is 36.42 percent. If there is any interruption in the system, then the divergence from the symmetry of the stock market return will be converged by the speed of 36.42 percent.

6.6 Wald Test

The residual of the cointegration equation can be obtained when D (RSM) is the dependent variable. This allowed determining the residual of the cointegration equation as given in the following equation. This is performed by using system equations through Eviews.

D(RSM) = C(1)*(RSM(-1) + 1.15663814483*STC(-1) - 0.525250528781*CCC(-1) - 0.26467698033*DDC(-1) - 0.0936234761442*RPC(-1) + 0.489648710137*IRC(-1) + 1.38727235359*FRC(-1) - 0.0435058037473*RRC(-1) - 0.105466553633) + C(2)*D(RSM(-1)) + C(3)*D(STC(-1)) + C(4)*D(CCC(-1)) + C(5)*D(DDC(-1)) + C(6)*D(RPC(-1)) + C(7)*D(IRC(-1)) + C(8)*D(FRC(-1)) + C(9)*D(RRC(-1)) + C(10)

The Wald test has been employed to assess the short-run relationship. The Wald statistic test is a joint test for short-run coefficients. The null hypothesis is that all short-run coefficients are jointly zero i.e. C (3) = . . . C (9) = 0. Results of the Wald test statistics are reported in Table 8. The probability of the Chi-square value is less than 5 percent. So, null hypothesis can be rejected at 5 percent significance level, meaning that there is a short-run relationship as all coefficients C (3) to C (9) are not zero.

Table 8: Wald Test Results:

Test Statistic	Value	df	Probability
Chi-square	86.02890	7	0.0000
Null Hypothesis: C(3)=C(4)=C(5)=C(6)=C(7)=C(8)=C(9)=0			
Null Hypothesis Summary:			
Normalized Restriction (=0)		Value	Std. Err.
	C(3)	0.383206	0.103000
	C(4)	-0.131830	0.058527
	C(5)	0.185918	0.056925
	C(6)	-0.018765	0.015011
	C(7)	-0.381468	0.144603
	C(8)	-0.828294	0.335537
	C(9)	-0.043614	0.149213

Restrictions are linear in coefficients.

6.7 Pairwise Granger Causality Tests Results

Pairwise Granger Causality Test has been used to assess the direction of the causality of the variables used in the studied model.

Table 9: Pairwise Granger Causality Test Outcomes (Lags: 2)

Null Hypothesis:	Observation	F-Statistic	Probability
STC does not Granger Cause RSM	34	14.2538	0.00005
RSM does not Granger cause STC		3.09445	0.0605
CCC does not Granger cause RSM	34	8.51322	0.0012
RSM does not Granger cause CCC		2.01342	0.1518
DDC does not Granger cause RSM	34	0.10893	0.8972
RSM does not Granger cause DDC		15.6942	0.00002
RPC does not Granger cause RSM	34	0.10071	0.9045
RSM does not Granger cause RPC		0.05313	0.9483
IRC does not Granger cause RSM	34	25.3291	0.0000004
RSM does not Granger Cause IRC		1.39937	0.2629

FRC does not Granger Cause RSM	34	5.92789	0.0069
RSM does not Granger Cause FRC		0.03636	0.9643
RRC does not Granger Cause RSM	34	5.18862	0.0118
RSM does not Granger Cause RRC		0.96121	0.3943

The results presented in table 9 found a unidirectional causality running from STC to RSM, running from CCC to RSM, running from IRC to RSM, running from FRC to RSM, running from RRC to RSM. And this unidirectional causality is significant at 5 percent significance level. Notably, there is no Granger causality between RSM and DDC, RPC.

7. Conclusion

This study analyzes the influence of SARS-CoV-2 Pandemic on the Stock Market of Bangladesh over the period from March 08, 2020 to June 30, 2020. This study uses thirty-six daily Sample test of Covid-19, Covid-19 confirm case, death, recovered covid-19 patient, infection rate, fatality rate, recovery rate of covid-19, and return on stock market index in Bangladesh. This paper found that returns on the stock market index in Bangladesh are cointegrated with the Sample tests of Covid-19, Covid-19 confirmed cases, deaths, recovered covid-19 patients, infection rate, fatality rate, recovery rate of covid-19. Then, The Vector Error Correction Model (VECM) and The Wald test confirm that there is long-run as well as short-run causality running from Sample tests of Covid-19, Covid-19 confirmed cases, deaths, recovered covid-19 patients, infection rate, fatality rate, recovery rate of covid-19 to the stock market return. Next, Pairwise Granger Causality Test validated the existence of unidirectional causality running from STC, CCC, IRC, FRC, and RRC to RSM. Overall, the findings of this paper suggest that returns on the stock market index in Bangladesh react to COVID-19 widespread and this reaction changes over time depending on the arrangement of the flare-up.

8. Limitation and Future Research

The period of time from March 08, 2020 to June 30, 2020 on which this study has conducted is of limited duration, i.e. limited number of observations has been used. The numbers of variables considered in the model are also very limited. Further study can be carried out over a long period of time and including many more variables like stock market determinants, the adaptation of stock market portfolio strategies, possible public policy measures, and other macro variables.

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