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COVID-19, Remittance Inflows, and the Stock Market: Empirical Evidence from Bangladesh

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Abstract

This study's motivation is to investigate the association between the stock market, remittance, and the pandemic of COVID-19 for the period from March 3, 2020, to December 14, 2020. For evaluating the impact of COVID-19 and remittances on stock market behaviour during the pandemic, the study applies Autoregressive Distributed lagged (ARDL) for magnitudes estimation and directional association through the Toda-Yamamoto causality test. Study findings from ARDL estimation revealed that COVID-19 measured by detecting new cases negatively influences the stock market both in the long-term and short-term. Remittance positively influences the stock market behaviour, particularly in the long-term. Furthermore, the directional causality test disclosed unidirectional causal effects between COVID-19 and the stock market behaviour, which establishes all proxy measures for the equation's stock market. The hypothesis results explain the causal relationship between remittance inflows and the stock market in Bangladesh. The study's application will help policymakers rethink the policies for channelizing remittances for productive investment areas. Furthermore, the study's findings will reinstate the widely perceived notions, which is the critical role of remittance in the economy even though the economy passes through a great pandemic.

Keywords: COVID-19, Stock Market, Stock Market Remittances, ARDL, Toda-Yamamoto

JEL Classification Code: F10; F50; F60

1. Introduction

Despite significant medical progress over the last centuries, pandemics still present a considerable threat to the economy's progress and can also have important repercussions for national or regional economies. The novel coronavirus (COVID-19) outbreak that originated in December 2019 at Wuhan city in China has transmuted into an unparalleled economic blackout in the world. The global dissemination of coronavirus (COVID-19) has dramatically affected financial markets around the world. It has generated an unparalleled degree of risk, leading investors to incur substantial losses within a relatively short period. In a study, Goodell (2020) emphasized how epidemics, let alone pandemics, impact financial markets, and imperfect parallels can be drawn from other forms of natural disasters. Markets react to natural disasters such as earthquakes and volcanos, air disasters, and more recent acts of terrorism. Certainly, COVID-19 will impact some industries more than others. Nevertheless, COVID-19 also will enormously affect domestic demands generally across almost every country. An obvious way that pandemics can impact financial systems is through their enormous economic cost. The coronavirus pandemic has reached almost every country in the world. Its spread has left national economies and businesses counting the costs as governments struggle with new lockdown measures to tackle the virus's spread (Ahmar & Del Val, 2020; Al-Awadhi et al., 2020; Puriwat & Tripopsakul, 2021; Ryandono et al., 2021). The economic impact has been even more severe as multiple shocks buffeted emerging market economies. With global trade and oil prices projected to drop by more than 10 percent and 40 percent, respectively, emerging market economies are likely to face an uphill battle.

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In recent times, Bangladesh's economy has been experiencing economic stagnancy due to the serious spread of COVID-19, forcing the government to shut down every movement, including business enterprises, transportation services, educational institutions, etc. Such an economic deadlock severely undermines the economic progress through the financial sector underperformance, the downward trend in international trade, disruption in foreign remittance receipts, etc. Among all macro fundamentals, remittances are an important factor in the global economy and help drive growth both at home and abroad. It is because remittances are treated as an alternative source of money supply in the economy. During this worldwide pandemic, foreign remittance's continual inflows have been adversely affected due to migrant workers' incapacity to generate income. It is anticipated that such cessation of remittance inflows might negatively affect the economy, especially in Bangladesh's financial sector. A vast number of studies divulge the importance of continual remittance inflows in the economy of Bangladesh, especially for the financial sector (Acosta et al., 2009; Bettin et al., 2012; Brown et al., 2013; Chowdhury, 2011; Coulibaly, 2015; Demirguc-Kunt & Peria, 2010; Giuliano & Ruiz-Arranz, 2009; Karikari et al., 2016; Noman, 2020; Uddin & Sjö, 2013). World Bank, in its report, stated that the overall migrant workers' remittance from Bangladesh would decline to $14 billion by 2021—around a 25 percent fall from the previous year. The Bangladesh Bank figures reveal that monthly remittances drop by 25 percent year-on-year, suggesting that the World Bank's prediction is sadly likely to continue. The decline in these historically averaged payments between $300 and $600 a month is a big loss to millions of household revenues in Bangladesh (World Bank, 2019).

The COVID-19 Pass-through on the financial system runs at a supersonic speed and undermines financial stability with a contraction of claims on the private sector, withdrawal of deposits, and tightening of financial conditions. To control this arithmetic, macroeconomic and financial regulators should run at a swift pace by boosting liquidity. Simultaneously, the financial system landscape would be ultra-digital after the great lockdown, with the expansion of fintech on the one hand and the expansion of cyberattacks on the other. To make the most of the financial system's digitalisation and enhance the effectiveness of cybersecurity, financial institutions should implement smart policies and invest in research (Pinshi, 2020). The vulnerability of the pandemic with lower economic immunity is greater in developing countries. The mitigating strategies and protocols to combat the COVID-19 have come at a high economic and human cost and has gravely sullied firms worldwide, especially SMEs, including the shortage of materials, the decline in both global and local demand for their products and services, difficulties in repaying loan and interest, cancellation of orders, dire cash deficit (inflows) and lack of savings (even problems with payroll and utility bills), limitations in recalling the employees back to work, high cost in preventing workplace COVID-19 strategies, absence of new orders, among others (Pinshi, 2020; Robinson & Kengatharan, 2020).

The study's motivation is to assess the stock market's behaviour in Bangladesh during the COVID-19 pandemic. To be more specific, a study intended to investigate the potential impact of COVID-19 on stock market behaviour, measured by stock return, total traded value, and market capitalization, through remittance inflows changes during the studied period. The study applied autoregressive Distributed Lagged (ARDL) to assess both short-run and long-term magnitudes. Their directional relationship is shown applying the causality test proposed by Toda-Yamamoto.

2. Literature Review

Although the economic impacts are yet to be investigated, financial markets responded by early March in the meantime. Following the stock market behaviour, several researchers have put their time to assess the potential effects due to the current pandemic. Researchers have analyzed these effects from several perspectives, including Aldasoro et al. (2020), to analyze the effects of COVID-19 on the European and American banking sectors. They discover that the scale of the COVID-19 crisis means that no bank will remain intact. Central banks drew heavily on US dollar swap lines with the Federal Reserve in the first half of 2020, contributing to a surge in cross-border banking flows during this period. The large increase in cross-border claims on banks operating in the United States – in the form of cross-border interbank and intragroup positions – reflected an increase in dollar liquidity demand from non-US banks partly met through the use of the swap lines. In a global financial system heavily reliant on the use of the dollar, the network of central bank swap lines centred on the Fed serves as a critical elastic backstop for the private provision of dollar liquidity.

Topcu and Gulal (2020) investigated the impact of COVID-19 on emerging stock markets over March 10 – April 30, 2020. Findings revealed that the pandemic's negative impact on emerging stock markets has gradually fallen and begun to taper off by mid-April. In terms of regional classification, the outbreak's impact has been the highest in Asian emerging markets, whereas emerging markets in Europe have experienced the lowest. They also found that official response time and the size of the governments' stimulus package matter in offsetting the effects of the pandemic. Ben Ayed et al. (2020) investigated the impact of COVID-19 on the stock returns performance of all companies listed on the Tunis Stock Exchange. More specifically, they analyzed the impact of (1) the daily growth of confirmed cases, (2) the daily growth of Death tolls, and (3) the daily growth of recovered cases on Stock market outcomes. They used the Swamy–Arora method for panel data analysis from January 20 to April 20, 2020. The findings showed that DCG has a positive impact on stock returns, while DDG decreases stock returns' performance. However, DReC has a positive relationship but not significant. Second, the results highlighted that firm capitalization and the daily return of Brent Crude oil has a positive impact on stock returns, while the FX has a negative impact. Third, these results supported national authorities' efforts in setting up early preventive measures to protect citizens and the economy from the pandemic. By conducting a sectorial analysis, we also find that the cyclical consumer sector has suffered the hardships of COVID-19. However, the stock return of the service sector shows the best performance. These results will be useful for policy authorities seeking to clarify the linkages between economic and medical effects of the novel coronavirus.

Haitham (2020) studied the impact of the COVID-19 on the Arab financial markets. The study applied a simple regression model to investigate the impact of the COVID-19 on the Arab financial markets during the period from dated April 1 2020, to May 21 2020, in Egypt and KSA. The study findings revealed a significant negative relationship between the confirmed cases and death cases from COVID-19, the trading volume on (Egyptian stock exchange and KSA stock exchange) from April 1, 2020, to May 21, 2020, in Egypt and KSA. That means the COVID-19 had a significant impact on the financial markets from April 1 2020, to May 21 2020, in Egypt and KSA.

Liu et al. (2020) used an event study method to calculate the abnormal returns (AR) in the ten trading days following the outbreak, from which it was found that both the Chinese and Asian stock markets had significantly declined, with the cumulative abnormal returns (CAR) remaining negative in all the examined event window periods. This article also analyzed the different industry index responses to the epidemic, from which it was found that the pharmaceutical manufacturing, software, and IT services both had positive CAR, while transportation, lodging, and catering had negative CAR during the event window. These results reflected the investors' expectations for the different industries and the economy under the contagious coronavirus outbreak.

He et al. (2020) analyzed daily return data from stock markets in the People's Republic of China, Italy, South Korea, France, Spain, Germany, Japan, and the United States of America. Our empirical results show that (i) COVID-19 has a negative but short-term impact on affected countries' stock markets and that (ii) the impact of COVID-19 on stock markets has bidirectional spill-over effects between Asian countries and European and American countries.

To understand the impact of the coronavirus on the stability of the financial system and the impact on economic activity, Zhang et al. (2020) showed that the spread of the virus leads to a reduction in economic activity worldwide latter poses new risks to financial stability. Further evidence showed that global financial market risks had increased substantially in response to the pandemic. Individual stock market reactions are linked to the severity of the outbreak in each country.

3. Methodology

3.1. Data and Variable Definition

This study focuses on addressing stock market behaviour during the Corona pandemic from *March 8, 2020, to December 14, 2020*. More precisely, the study considers 160 daily observations. As a dependent variable, stock market behaviour is measured by three proxies: the stock market index, total traded value, and market capitalization. Following existing literature, including Jeris and Nath (2020), the effects of COVID-19 were measured using Covid-19 daily new cases and daily new deaths as independent variables. Additionally, daily remittance inflows are also incorporated in the equation. The money supply in the economy plays a critical role in stock market behaviour, and remittance inflows play a pioneering role in this regard. Furthermore, during the pandemic, it is expected a declining trend of remittance inflows in the economy. Considering the research variables, the generalized empirical equation reported in equations (1A) to (1C) are:

$$\mathrm{S}_i = \alpha_0 + \beta_1 \mathrm{covid}_i + \beta_2 \mathrm{REM}_i + \varepsilon_i \tag{1A}$$

$$\mathrm{TT}_i = \alpha_0 + \beta_1 \mathrm{covid}_i + \beta_2 \mathrm{REM}_i + \varepsilon_i \tag{1B}$$

$$\mathrm{MC}_i = \alpha_0 + \beta_1 \mathrm{covid}_i + \beta_2 \mathrm{REM}_i + \varepsilon_i \tag{1C}$$

The brief descriptive statistics and pairwise correlation matrix are reported in Table 1.

3.2. Econometric Methodology

To explore long-run cointegration and directional causality, the study passes through several steps. Stationary tests are conducted to confirm the existence of unit root by applying the ADF test proposed by augmented Dickey and Fuller (1979), the P-P test initiated by Phillips and Perron (1988), and the KPSS test proposed by Kwiatkowski et al. (1992), and to specify the order of integration, i.e., $I(0)$, $I(1)$ or $I(2)$. If variables are integrated in the second order, the regression model might not be suitable for analysis.

3.3. Autoregressive Distributed Lag (ARDL) Bound Testing

With present limitations on traditional models, the autoregressive distribution lag (ARDL) centred on OLS has recently become a popular approach among researchers. The additional benefit over other cointegration strategies is the flexibility to use several distinct interconnected variables

Table 1: Descriptive Statistics and Correlation Matrix

	S	TT	MC	REM	CN	CD
Mean	4085.098	62728.71	3175812	142.831	2723.39	36.813
Median	3999.494	29069	3122354	131.983	2928	39
StdDev	210.727	63688.72	128262	48.890	1054.677	14.092
Kurtosis	4.134	0.934	3.983059	–0.322	2.257112	2.351
Skewness	1.806	1.384	1.765267	0.852	–1.62845	–1.483
Range	1255.531	224594	761378.4	171.207	4019	64
Minimum	3603.953	6372	2873826	89.834	0	0
Maximum	4859.488	230966	3635204	261.042	4019	64
Sum	241020.809	3700994	1.87E+08	8427.077	160680	2172
Count	160	160	160	160	160	160
Correlation						
DSEXI	1					
TT	0.727	1				
MC	0.998	0.713	1			
REM	0.802	0.912	0.797	1		
CN	0.236	–0.142	0.241	0.102	1	
CD	0.253	–0.090	0.259	0.161	0.976	1

(Pesaran et al., 2001). A linear transformation may also be used to generate a dynamic error correction model (ECM) from ARDL (Banerjee et al., 1993).

This study uses the ARDL model for the study due to the following benefits over other cointegration models. First, regardless of the sample size, the autoregressive distributed lag model is preferable to either limited or finite, consisting of 30 to 80 measurements (Ghatak & Siddiki, 2001; Qamruzzaman & Jianguo, 2018a, 2018b; Qamruzzaman & Wei, 2018). Second, ARDL can efficiently handle the issue of variables mixed order integration. Third, serial correlation and indigeneity problems can be resolved by taking appropriate lag (Pesaran et al., 2001). Fourth, both short-run and long-run elasticities can be detected simultaneously (Pesaran et al., 2001). A simplified ARDL model (Paul, 2014; Qamruzzaman & Wei, 2018) for these variables X, Y, and Z is reported in equation (2)

$$\Delta y_t = \phi_1 + \gamma_1 y_{t-1} + \gamma_2 x_{t-1} + \gamma_3 z_{t-1} + \theta_1 \sum_{i=1}^{n} \Delta y_{t-1} + \theta_2 \sum_{i=1}^{n} \Delta x_{t-1} + \theta_3 \sum_{i=1}^{n} \Delta z_{t-1} + \varepsilon_{1t} \quad (2)$$

Where, γ_1, γ_2, γ_3 are long-run coefficients whose sum is equivalent to the error correction term at the VECM model and θ_1, θ_2 and θ_3 are short-run coefficients. The generalized ADRL model for assessing COVID-19 influences on stock market behaviour through the inflows of remittance in Bangladesh is reported in equation (3A) to 3I:

$$\Delta \text{S}_t = \alpha_0 + \beta_1 \text{S}_{t-1} + \beta_2 \text{COVID\_D}_{t-1} + \beta_3 \text{COVID\_N}_{t-1} + \beta_4 \text{REM}_{t-1} + \sum_{j=1}^{m1} \lambda_0 \Delta \text{S}_{t-j} + \sum_{j=1}^{m2} \lambda_1 \Delta \text{COVID}_{t-j} + \sum_{j=1}^{m3} \lambda_2 \Delta \text{COVID}_{t-j} + \sum_{j=0}^{m4} \lambda_3 \Delta \text{REM}_{t-j} + \varepsilon_t \quad (3A)$$

$$\Delta \text{TT}_t = \alpha_0 + \beta_1 \text{TT}_{t-1} + \beta_2 \text{COVID\_D}_{t-1} + \beta_3 \text{COVID\_N}_{t-1} + \beta_4 \text{REM}_{t-1} + \sum_{j=1}^{m1} \lambda_0 \Delta \text{TT}_{t-j} + \sum_{j=1}^{m2} \lambda_1 \Delta \text{COVID}_{t-j} + \sum_{j=1}^{m3} \lambda_2 \Delta \text{COVID}_{t-j} + \sum_{j=0}^{m4} \lambda_3 \Delta \text{REM}_{t-j} + \varepsilon_t \quad (3B)$$

$$\Delta \text{MC}_t = \alpha_0 + \beta_1 \text{S}_{t-1} + \beta_2 \text{COVID\_D}_{t-1} + \beta_3 \text{COVID\_N}_{t-1} + \beta_4 \text{REM}_{t-1} + \sum_{j=1}^{m1} \lambda_0 \Delta \text{MC}_{t-j} + \sum_{j=1}^{m2} \lambda_1 \Delta \text{COVID}_{t-j} + \sum_{j=1}^{m3} \lambda_2 \Delta \text{COVID}_{t-j} + \sum_{j=0}^{m4} \lambda_3 \Delta \text{REM}_{t-j} + \varepsilon_t \quad (3C)$$

Where, α is an intercept, the long-run coefficients of the empirical model represented by β_1... ... ...β_3 the short-run coefficients exhibited by λ_0... ... ...λ_2, ε_t. The error correction term and m_1, m_2, m_3, m_4, m_5, and m_6 are the optimal lag for the first difference variables selected by the Akaike Information Criterion (AIC).

To implement the ARDL model, this study implements the ordinary least square (OLS) method estimate equation (3), and then cointegration between the variables can be established in three different ways: first, using the F-test of Pesaran et al. (2001) with the null hypothesis of no-cointegration ($H_0 = \beta_1 = \beta_2 = \beta_3 = 0$) against the alternative of cointegration ($H_0 = \beta_1 \neq \beta_2 \neq \beta_3 \neq 0$). Second, a Wald-test (WPSS), which also tests the above joint null. Third, the tBDM-test statistic of Banerjee et al. (1998) with the null hypothesis of no-cointegration (H_0: $\beta_1 = 0$) against the alternative of cointegration (H_0: $\beta_1 < 0$). The testing procedure uses two critical bounds: upper and lower. The null hypothesis is dismissed if the values of the FPSS, WPSS or tBDM statistics surpass the upper limit. If they fall below the lower critical limit, the null will not be dismissed, and the evaluation is inconclusive if they lie between the critical boundaries.

3.4. Toda and Yamamoto (1995) Non-Causality Test

The method introduced by Toda and Yamamoto (1995), commonly recognized as the Non-Causality Test, is used to determine the direct causality between the actions of the stock market, COVID-19, and remittances. The inference from the granger causality test, i.e., that certain parameters are zero together, is not true with the integrated variables. Thus, overcoming current shortcomings in the standard causality test, Toda and Yamamoto (1995) suggested a causality test using the updated WALD test to restrict VAR parameters (k). The causality test is based on the concept of Vector autoregressive at the stage ($P = K + D_{max}$) with the right VAR order K and d extra lag, where d reflects the full order of time series integration

We summarized the empirical model into the VAR system in the following equations, where each variable is treated as the dependent variable in respective equations.

$$\begin{aligned} S_t = \alpha_0 + \sum_{i=1}^{k} \beta_{1i} S_{t-i} + \sum_{j=k+1}^{d_{max}} \beta_{2j} S_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \mathrm{COVID}_{t-i} \\ + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \mathrm{COVID}_{t-j} + \sum_{i=1}^{k} \delta_{1i} \mathrm{REM}_{vol_{t-i}} \\ + \sum_{j=k+1}^{d_{max}} \delta_{2j} \mathrm{REM}_{vol_{t-j}} + \varepsilon_{1t} \end{aligned} \tag{4A}$$

$$\begin{aligned} \mathrm{TT}_t = \alpha_0 + \sum_{i=1}^{k} \beta_{1i} \mathrm{TT}_{t-i} + \sum_{j=k+1}^{d_{max}} \beta_{2j} \mathrm{TT}_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \mathrm{COVID}_{t-i} \\ + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \mathrm{COVID}_{t-j} + \sum_{i=1}^{k} \delta_{1i} \mathrm{REM}_{vol_{t-i}} \\ + \sum_{j=k+1}^{d_{max}} \delta_{2j} \mathrm{REM}_{vol_{t-j}} + \varepsilon_{1t} \end{aligned} \tag{4B}$$

$$\begin{aligned} \mathrm{MC}_t = \alpha_0 + \sum_{i=1}^{k} \beta_{1i} \mathrm{MC}_{t-i} + \sum_{j=k+1}^{d_{max}} \beta_{2j} \mathrm{MC}_{t-j} + \sum_{i=1}^{k} \gamma_{1i} \mathrm{COVID}_{t-i} \\ + \sum_{j=k+1}^{d_{max}} \gamma_{2j} \mathrm{COVID}_{t-j} + \sum_{i=1}^{k} \delta_{1i} \mathrm{REM}_{vol_{t-i}} \\ + \sum_{j=k+1}^{d_{max}} \delta_{2j} \mathrm{REM}_{vol_{t-j}} + \varepsilon_{1t} \end{aligned} \tag{4C}$$

4. Results and Discussion

Empirical model estimation begins with the specification of the variable order of integration. To do so, a three-unit root test is performed, and their results are exhibited in Table 2. Stationary test results revealed mixed order of integration, referring that few variables are stationary at a level, i.e., $I(0)$, and some variables have become stationary after the first difference, i.e., $I(1)$. The mixed order of variables integration permits the application of ARDL for investigating cointegration between variables.

4.1. Autoregressive Distributed Lagged (ARDL)

In the following section, the study intended to investigate the long-run association between COVID-19, remittance inflows, and the stock market by applying ARDL. Empirical model estimation results are reported in Table 3. Short-run model estimation is reported in Panel–A, Panel–B deals with long-run cointegration results, long-run coefficients are exhibited in Panel –C, and finally, empirical model residual diagnostic test results are reported in Panel-D.

The study performs three tests for unveiling conclusive evidence, i.e., first, the modified F-test (FPSS) advanced by Pesaran et al. (2001), Second, a Wald-test (WPSS), which also tests the above joint null. Third, a t-test (tBDM) was proposed by Banerjee et al. (1998). Study findings revealed that the test statistics of all empirical models under three tests are higher than the critical value extracted from Narayan and Smyth (2005) for F-test, and Banerjee et al. (1998) for the t-test. Furthermore, the test statistics of the Wald test are statistically significant. As such, we can conclude that in the presence of long-run cointegration between COVID-19, remittance, and the stock market in Bangladesh.

Table 2: Results of Unit Root Test

Philips-Perron Unit Root Test							
		S	**TT**	**MC**	**REM**	**CD**	**CN**
With Constant	*t*-Statistic	0.114	–1.465	–0.028	0.364	–9.242	–2.757
With *C* & *T*	*t*-Statistic	–0.990	–5.294***	–1.122	–3.833**	–7.148***	–2.243
Without *C* & *T*	*t*-Statistic	2.453	0.087	2.450	1.581	–0.141	0.118
		ΔS	**ΔTT**	**ΔMC**	**ΔREM**	**ΔCD**	**ΔCN**
With Constant	*t*-Statistic	–10.204	–16.005	–10.534	–2.378	–9.242	–9.013
		***	***	***	n0	***	***
With *C* & *T*	*t*-Statistic	–13.498	–16.214	–14.189	–1.6469	–9.833	–15.167
		***	***	***	n0	***	***
Without *C* & *T*	*t*-Statistic	–9.3457	–17.108	–9.587	–2.3596	–9.150	–9.0722
		***	***	***	**	***	***
Augmented Dickey-Fuller Test							
		S	**TT**	**MC**	**REM**	**CD**	**CN**
With Constant	*t*-Statistic	5.9852	–1.7053	5.6583	0.9198	–4.924	–1.3846
		n0	n0	n0	n0	***	n0
With *C* & *T*	*t*-Statistic	3.455	–5.324	3.207	–3.956	–4.551	–1.1598
		n0	***	n0	**	***	n0
Without *C* & *T*	*t*-Statistic	0.9174	–0.0239	1.0427	2.3139	0.1072	0.054
		ΔS	**ΔTT**	**ΔMC**	**ΔREM**	**ΔCD**	**ΔCN**
With Constant	*t*-Statistic	–0.7301	–17.479	–1.0734	–2.6079	–9.33	–7.0111
		n0	***	n0	*	***	***
With *C* & *T*	*t*-Statistic	–2.5379	–17.219	–14.597	–1.9902	–9.827	–7.0435
		n0	***	***	n0	***	***
Without *C* & *T*	*t*-Statistic	–0.3261	–17.108	–0.640	–2.572	–9.241	–7.0862
		n0	***	n0	**	***	***
Unit Root Test Results (Kpss)							
		S	**TT**	**MC**	**REM**	**CD**	**CN**
With Constant	*t*-Statistic	0.8369	0.7355	0.8273	0.8465	0.4712	0.3813
	Significance level	***	**	***	***	**	*
With *C* & *T*	*t*-Statistic	0.2112	0.1957	0.2152	0.2001	0.1857	0.1652
	Significance level	**	**	**	**	**	**
		ΔS	**ΔTT**	**ΔMC**	**ΔREM**	**ΔCD**	**ΔCN**
With Constant	*t*-Statistic	0.2645	0.4381	0.2744	0.3873	0.3417	0.3184
	Significance level	n0	*	n0	*	n0	n0
With *C* & Trend	*t*-Statistic	0.2195	0.1466	0.2213	0.1928	0.1164	0.1956
	Significance level	***	**	***	**	n0	**

Note: Δ Indicates First Difference Operation, *, **, ** Denoted Level of Significance at a 10%, 5%, and 1% Level, Respectively.

Considering the results of the short-term estimation report in Table 3 (panel–A). it is apparent that the coefficients of error correction term (ECT), i.e., a coefficient of –0.261 for model [3], a coefficient of –0.417 for model [6], and a coefficient of –0.139 for model [9], are negative in sign and statistically significant at a 5% level of significance. These coefficients represent the speed of adjustment due to shocks in the prior year toward long-run equilibrium. It is observed that proxy measures of COVID-19 in the empirical models established a negative association with the stock market, more precisely a coefficient of –0.051, and a coefficient of –0.012 for model [3], a coefficient of –0.612, and a coefficient of –0.657 for model

Table 3: Results of Autoregressive Distributed Lagged

	Stock Index			**Total Trade**			**Market Capitalization**		
Panel-A: Short-Run Estimation									
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**	**[7]**	**[8]**	**[9]**
C	1.457_a	-0.510_a	-0.707_a	0.415_c	2.207_b	-2.541_b	-2.376_b	-2.114_c	-2.072_b
@TREND	-0.065_a	0.038_a	0.039_a	0.019_a	0.018_a	0.042_c	-0.016_b	0.032_a	-0.065_c
$\beta 1$	-0.101_c	-0.060_a	-0.053_c	-1.018_a	-0.017_c	0.555_a	-0.562_c	-0.354_a	0.084_b
$\beta 2$	-0.016_a		-0.051_a	0.508_a		-0.612_a	-0.023_a		-0.031_b
$\beta 3$		-0.022_a	-0.012_a		-0.138_a	-0.657_a		0.023_b	-0.090_b
CointEq(–1)*	-0.212_a	-0.065_a	-0.261_a	-0.766_b	-0.283_a	-0.417_a	-0.155_a	-0.144_a	-0.139_a
Panel-B: Long-Run Cointegration Test									
F*pss*	9.149	11.654	13.422	13.391	7.109	8.542	6.236	4.874	7.841
W*pss*	12.005	9.233	12.940	19.664	11.906	32.981	12.934	14.872	9.336
t_{BDM}	–1.344	–0.856	–0.495	–0.482	–0.438	–0.996	–0.221	–0.613	–0.773
Panel-C: Long-Run Coefficients									
$\lambda 1$	0.331_b	0.110_b	0.028_a	1.943_a	0.52_a	3.012_a		0.074_a	0.208_a
$\lambda 2$	-0.014_b		-0.195_b	–0.039		-0.224_b			-0.032_a
$\lambda 3$		0.024	0.143		–0.501	0.314		0.012	-0.039_a
Panel-D: Residual Diagenetic Test									
R^2	0.790	0.697	0.783	0.607	0.778	0.856	0.849	0.776	0.844
F-test	160.461	145.098	133.056	36.198	113.066	271.055	1.530	195.943	177.924
$x^2_{sR.corr}$	0.754	0.362	0.242	0.175	0.45	0.514	0.262	0.347	0.754
x^2_{Nor}	0.501	0.278	0.966	0.874	0.147	0.175	0.497	0.052	0.501
$x^2_{.hete}$	0.834	0.187	0.936	0.964	0.872	0.994	0.736	0.609	0.834
RESET	0.272	0.526	0.193	0.074	0.801	0.76	0.894	0.549	0.272
Stability	S	S	S	S	S	S	S	S	S
F-test bounds critical values (*K* = 3) Narayan and Smyth (2005)									
			1%	5%					
		I(1)	6.97	4.623					
		I(0)	4.828	3.084					

Note: The Subscript of a, b, c: Denote the Level of Significance at a 1%, 5%, 10%, Respectively.

[6], and a coefficient of –0.031 and a coefficient of –0.090 for model [9]. These findings suggest that in the short–run, both new cases detected and new death due to COVID have negatively influenced stock market behavior. Study findings are supported by Ashraf (2020) and Haitham (2020).

Furthermore, exploring the remittance effects on stock market behavior, study findings disclosed that remittance inflows are positively linked with the stock market, which is measured by total traded value (a coefficient of 0.555 for model [6] and market capitalization (a coefficient of 0.084 for model 9). These findings imply that the additional inflows of remittance in the economy will boost the market behavior even though the economy is moving with a pandemic. However, the stock index's remittance effects are negatively interlinked (a coefficient of –0.053 for model 3).

For the long run (see, Panel-C), study findings revealed remittance inflows, i.e., a coefficient of 0.028 for model [3], a coefficient of 3.021 for model [6], and a coefficient of 0.208 for model [9], is positively linked to the stock market in Bangladesh. Study finding suggests that the long-run stock market has experienced positive waves from continual remittance inflows in the economy. Study findings are supported by empirical studies, including (Aluko & Kolapo, 2020; Issahaku et al., 2017; Raza & Jawaid, 2014) _ENREF_54Furthermore, addressing the COVID-19 effect on the stock market, it is apparent that the proxy measure, i.e., COVID_N, exhibits a negative influence on stock market behavior, more precisely, for model [3] a coefficient of –0.195, for model [6] a coefficient of –0.224, and model [9] a coefficient of –0.031. This means every new detection is creating panic among investors based on economic turmoil and financial instability. While investigating the effects of another proxy, i.e., COVID_D, findings revealed a positive relationship; however, the coefficient of market capitalization is statistically significant, which is negative.

Finally, we perform several residual-based diagnostics tests to ascertain the robustness and stability of model estimation. The model is free from serial correlation, error terms are normally distributed, and there is no problem with homoscedasticity. Moreover, Ramsey's RESET confirms model construction validity as well. Model estimation stability is investigated by applying the residual recursive test proposed by Pesaran et al. (2001), commonly known as CUSUM and CUSUM of the square recursive residual test - ascertaining the model stability in estimation as the parameters fall with the critical value at a 5% level of significance.

4.2. Toda-Yamamoto Causality Test

In the following section, directional causality between COVID-19, remittance inflows, and stock market behavior is assessed by performing the causal equation, i.e., Equation 3A, 3B, and 3C. The results of the causality test are reported in Table 4.

Table 4: Results of Toda-Yamamoto Granger Causality Test

	X*	**COVID_N**	**COVID_D**	**REM**	**Causality**
Panel-A: Stock Market Behavior Measured by Stock Market Index					
*X**	–	12.358[a]	11.945[a]	10.411[a]	COVID_N→*X**; COVID_D→*X**; REM←→*X**
COVID_N	0.458	–	8.108b	0.243	
COVID_N	4.201	3.353	–	4.866	
REM	14.388[a]	5.372308	1.171	–	
Panel-A: Stock Market Behavior Measured by Total Traded Value					
*X**	–	14.67[a]	13.61[a]	0.754[a]	COVID_N→*X**; COVID_D→*X**; REM→*X** COVID_N→REM
COVID_N	0.145	–	2.848	0.992	
COVID_N	10.310[a]	9.449[b]	–	3.661	
REM	3.269	12.364a	0.895	–	
Panel-A: Stock Market Behavior Measured by Market Capitalization					
*X**	–	16.078[a]	10.879[a]	14.419[a]	COVID_N→*X**; COVID_D→*X**; REM→*X** COVID_D→REM
COVID_N	0.560	–	7.112[b]	0.971	
COVID_N	1.008	0.742	–	7.518[b]	
REM	8.405[b]	1.717	12.425[a]	–	

Note: The Subscript of a, b, c Denote the Level of Significance at a 1%, 5%, 10%, Respectively.

By considering the results of the causality test, study findings revealed several unidirectional causalities running from COVID-19 to the stock market, which is valid from all three measures of stock market behavior, i.e. [COVID_D → S, COVID_D → TT, COVID_D → MC, COVID_N → S, COVID_N → TT, and COVID_N → MC, respectively]. On the other hand, bidirectional causality is established between remittance and stock market behavior.

5. Conclusion

The study's motivation is to assess COVID-19 effects on stock maker behavior with the presence of remittance inflows during this pandemic for the period from March 8, 2020, to December 14, 2020. To accomplish the research objectives, the study applied the ARDL framework proposed by Pesaran et al. (2001) and the directional relationship was investigated by following the non-causality framework proposed by Toda and Yamamoto (1995). Study findings revealed that both in the long-term and short-term, COVID-19 measured by detecting new cases, i.e., COVID-19_D, is negatively associated with Bangladesh's stock market. This negative finding is valid for all three-proxy, i.e., stock index (S), Total trade value (TT), and Market capitalization (MC). Whereas new death due to COVID-19 exhibits a negative influence on the stock market only in the short-run and is statistically significant. Furthermore, Long-run consequences from COVID-19_D to the stock market are insignificant except for market capitalization.

The findings of the directional causality test results revealed unidirectional causality running from COVID-19 to stock market behavior in Bangladesh, which is valid for each tested causal model. Furthermore, bidirectional relationships prevail between remittance inflows and the stock market, indicating that both variables are essential for future progress, i.e., an efficient stock market induces foreign remittance with investment opportunities. On the other hand, remittance inflows inject additional money into the economy and create potential investors for the stock market.

This study's limitation is that the sample period is minimal though it covers the most recent period. However, this study provides the platform for investigating many research questions concerning the short and long-run impacts of COVID-19 pandemic and remittance on financial soundness, monetary policy, and other macroeconomic factors using real-time data or even large data sample.

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