The Economic Research Guardian – Vol.10.(2)2020
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 10(2): 97-121

Capital Market Reactions to the Arrival of COVID-19: A Developing Market Perspective

Abu Taleb Mohammad Adnan
BGMEA University of Fashion and Technology (BUFT), Dhaka, Bangladesh
E-mail: atmadnan@buft.edu.bd

Mohammad Mahadi Hasan
Anwar Khan Modern University, Dhaka, Bangladesh
E-mail: mahadi@akmu.edu.bd

Ezaz Ahmed
Columbia College, Columbia, USA
E-mail: eahmed@columbiasc.edu

Abstract
Research findings on Capital markets' reaction to infectious diseases in emerging market contexts are not comprehensible. Therefore, using the daily individual stock's return of 311 listed firms during an estimation period of 250 trading days; this research applies an Event Study Methodology to define the immediate stock market response to Covid19's arrival in Bangladesh. Mean Return Model, Market Return Model, and Market model are applied to determine the Average Abnormal Returns and Cumulative Average Abnormal Returns for short term event window. Both Parametric and non-parametric tests of the significance of returns around the several event windows suggest that, despite the perceived weak market efficiency, the local stock market shows unprecedented efficient market reaction to the announcement. The significant statistical difference of CAAR between industry segments in both pre and post-event windows signifies that the negative impact of the announcement was identical for all industry segments. Behavioral overreaction induced Panic selling and herding effect has also been observed among investors due to the announcement. Findings from the study will be useful for investors and financial analysts in accessing the unpredictable systematic risk in portfolio diversification while facilitating policymakers to construct contingency strategy.

Keywords: COVID19, Capital market, Event study, emerging Economy, Bangladesh

JEL classification: G10, G12, G14

Received: 21 August 2020; Received in revised form: 08 October 2020; Accepted: 26 October 2020

1. Introduction

The COVID19 an infectious disease caused by a new kind of SARS-CoV2 (Vukkadala et al., 2020) has evidently caused economic implications in almost all countries (Ashraf, 2020). Although the precise global economic effects are not yet comprehensible, global capital markets have already reacted significantly. For instance, The Dow Jones industrial average, The S&P 500 and NASDAQ composite experienced their largest drop in a decade (Funakoshi and Hartman, 2020). The European and Asian financial markets have also collapsed with the crash in the U.S. UK's broadest benchmark index; FTSE100 fell to its lowest since 1987 by more than 10% while Frankfurt's DAX30 also plummeted significantly due to the epidemic. Asia's major capital indices such as SENSEX (India), NIKKEI (Japan), and STI (Singapore) have experienced major turmoil due to the COVID19 epidemic (Mazur et al. 2020). The volatility index has (VIX) also showed substantial rises, suggesting an inclination for an increased risk. The COVID19 virus with a VIX score of 84.57 is seen as a big concern for the markets as compared with previous high-risk cases such as the 9/11 terrorist attack (41.75), the global financial crisis of 2008 (46.72), U.S. debt crisis 2011(48), and most recent US china trade war 2018 (36.06).

In contrast to developed-country stock markets, developing-country stock markets are usually characterized by smaller sizes in terms of the volume and frequency of trading, the presence of powerful large investors, poorer accountability and transparency, prolonged transaction period and lack of sufficient financial details. Such stock market traits preclude information from being mirrored in stock prices and simply make the market inefficient (Hassan and Kayser, 2019). Behavioral factors are also accountable for the irregularities and disturbances of developing nations' stock markets, as these factors often appear in the form of stock market crashes (Kapoor and Prosad, 2017). Thus, behavioral finance is a critical prospect for evaluating the efficiency of developing countries' capital markets. The many financial irregularities arise from psychological sentiments, such as Prospect/Loss-Aversion Tendency, Regret Tendency, Herding Behavior, Mental Accounting, Anchoring and Overconfidence, over/under reacting. Thus, behavioral finance has become so important that in assessing investment strategy, many investors seem to neglect the fundamental principles of investment theory and are driven by sentiment and other factors that disagree with sound investment theory (Shiller, 2003).

This paper focuses on Bangladesh and its capital market because Bangladesh is an emerging economy located in South East Asia, the second-largest economy in the region and ranked 41st among the world economy. The recent strategic alliance between the DSE and the Chinese conglomerate of the Shenzhen Stock Exchange and the Shanghai Stock Exchange has also given the market more global linkage (Oviand Mahmud, 2018). However, the DSE has been historically characterized as having either weak form of market efficiency or no market efficiency at all (Arefin and Rahman, 2011; Azad et al., 2014; Hassan and Chowdhury, 2008; Islam and Khaled, 2005; Sochi and Swidler, 2018). Unidirectional causal relationship makes the market Informational inefficient (Hasan et al., 2012; Joarder et al., 2014). So, it can be assumed that DSE would react inefficiently to any new public information to the market such as the first detection of COVID19 epidemic in Bangladesh which will be reflected on the individual stock and market return. This research also consider one behavioral finance interpretation which is over reaction led to panic selling caused by the announcement of the identification of infectious disease on the daily stock and market return of DSE to assess market efficiency.

Using the daily return of 311 listed firms in DSE and daily market return (DSEX) of 250 days of estimation period from January 02, 2019 to February 20, 2020, this study applies the event study method (ESM) (Brown and Warner, 1980; Fama et al., 1969) to estimate the announcement effect of disease outbreaks (COVID19) in the stock market of Bangladesh by capturing abnormal changes of stock return after the first case of COVID19 has been identified in Bangladesh on March 08, 2020. This study followed the prominent study of Chen et al. (2007), Schiereck et al. (2016), and Wang et al. (2013) and the contemporary study of Heyden and Heyden (2020) while constructing the methodology and analyzing the findings of the study. Furthermore, the study extends the analysis by segregating the total firms into financial Vs. Nonfinancial and Non-manufacturing (service) Vs. Manufacturing industry to observe the changes in effect.

This study makes contributions to the literature in several aspects. Primarily, this study refers to the literature that deals with the effect of national crises or emergencies on the financial systems, such as earthquakes (Shan and Gong, 2012) and the spread of Ebola (Ichev and Marinč, 2018). Moreover, this study documented the latest consequence of the COVID19 epidemic on stock markets of the developing economy like Bangladesh when majority of the current studies that scrutinize the impacts of COVID19 epidemic on capital markets focus on the developed markets such as Baker et al. (2020) and Alfaro et al. (2020) analyzed the effect of COVID19 on the stock markets of the US and other developed nations. On the whole this study will contribute to the literature by accessing the overall market efficiency of DSE through examining abnormal market return caused by epidemic.

The remainder of this paper is structured as follows; following section offers analysis of the literature. Then, the research methodology section is included. In the last section, the findings, analysis of the study and concluding remarks are included.

2. Literature Review

Consistent with the global financial turmoil due to the COVID19 epidemic, DSE has seen its biggest one-day decline since 2013, day after Bangladesh confirms its first three cases of COVID19. The DSE's standard general index, has dropped 6.51 percent, the highest decline since the index was introduced in 2013. Total market capitalization has decreased by 5.5%. This significant decline shows that Bangladesh has not been invulnerable to the virus-related fear swirling the financial system across the world.

The efficient market hypothesis (EMC) suggests that the capital market would react to any new information (Malkiel and Fama, 1970). Therefore, the news of detection and transmission of a global epidemic is believed to create an impact in the worldwide capital markets. Apart from the EMH theory which promotes the rational investment approach, behavioral finance theories also help to understand the different 'market phenomena' that complement the standard financial theory. One of these theories is Over-/Under-Reaction hypothesis helps to understand why shareholders become confident as the market goes up and expect that it will continue to do so while on the other hand, Investors become highly negative during downturns. A result of putting too much emphasis on recent incidents while overlooking past data is an over- or under-reaction to market volatility that results in prices dropping too much on negative news and rising too much on positive news (Bloomfield, 2010). Negative overreaction often led to panic selling. It is possible to describe panic sales as a sudden rise in sales orders for a specific investment, which drives down the stock price (Dreman and Lufkin, 2000). This can trigger a tumbling impact or "vicious loop" in which investors see a rapidly dropping price as a sign of getting out of a specific investment, which further squeezes the price and encourages more investors to sell their investments. Often this form of sale is motivated by a fear of failure rather than an understanding of the real issue at hand.

Table 1- Summary Literature Review

Author and Year	Disease	Objective	Scope	Methodology	Findings
Nippani and Washer (2004)	SARS	Effect of an unpredicted disease (i.e. SARS) on the capital markets of affected nations.	The daily closing price of principal stock markets indices of China, Canada, Hong Kong, Vietnam Singapore, Indonesia, Philippines, Thailand and S&P 1200 Global index for the period from June 1, 2002 to June 17, 2003.	Event study methodology (ESM)	No adverse effects on capital markets of the impacted countries, excluding China and Vietnam.
Chen et al. (2009)	SARS	Check the effects of SARS on share prices of listed biotech companies in Taiwan.	Daily return from 25th September 2002 to 21st May 2003 of Thirty two (32) companies from the travel, airline, wholesale and Retail and biotechnology industries listed on the Taiwan stock exchange (TSE).	Event study approach with GARCH model	Negative impacts on share prices of the tourism, airlines, wholesale and retail sectors, whereas, biotechnology sector's share price reacted positively.
Pendell and Cho (2013)	Five (5) foot-and-	Analyzing Market responses	Actual daily market returns of eighteen (18)	Event study	The responses of the markets were more

	mouth diseases	from Korean agribusiness shareholders subsequent to five foot-and - mouth disease outbreaks	selected Korean agribusiness firms in six (6) industries to estimate impact of disease infection announcement between 2000 and 2010.		incremental than immediate observed by statistically relevant CAR than an irregular single-day return (AR).
Ichev and Marinč (2018)	Ebola	Impact of the geographical proximity of information disseminated by Ebola along with widespread media attention on US stock markets.	Value-weighted total rates of return of the New York Stock Exchange (NYSE) and NASDAQ Composite listed corporations while taking S&P500 index as the market performance yardstick during 2014 to 2016.	Event Study	Ebola epidemic incidents are most important for enterprises that are geographically closer to both the Ebola virus birthplace and the capital markets.
Kim et al. (2020)	Avian influenza; Swine flu and Salmonella infantis.	Examine the effect of contagious disease outbreaks on the restaurant industry's financial performance in US.	Ninety one (91) publicly traded restaurant firms in U.S. stock markets during 2003 to 2016.	Event study	Epidemic outbreaks have a negative impact on the restaurant business, and the factors such as reliability of brands, promotional outcomes, and Non-manufacturing nature function as risk limiting drivers.
Baker et al. (2020)	COVID 19	Assessing the unprecedented reactions of	Daily reported Covid-19 cases, deaths and returns	Textual Analysis	No previous outbreak of contagious

		the US stock market to COVID-19 pandemic.	in the primary stock exchanges in China, US, Italy, France, Iran, Spain, and the UK from 24 February to 20 April 2020		diseases, such as Spanish flu, has affected the capital markets as heavily as the Corona virus.
Al-Awadhi et al. (2020)	COVID 19	Investigates how infectious diseases i.e. COVID19 affect the Chinese stock markets return.	Stock returns of all firms listed in the Hang Seng Index and Shanghai stock exchange composite Index over the period of 10th January to 16th March 2020.	Panel data regression analysis	Substantial negative impact on equity returns for all listed companies, however, the yield of the IT and Healthcare sector was better than others.
Akhtaruzzaman et al. (2020)	COVID 19	Examines how financial infection develops between China and the G7 nations during the COVID–19 time across non - financial and financial firms.	Daily firm's return and new reported new infections of China and G7 nations for both pre-Corona period- 1st January 2013 to 30th December 2013 and Corona–19 phase from 31st December 2019 to 20th March 2020.	GARCH and Directional spillover model	Non - financial and financial companies both undergo significant changes in conditional correlations between their equity returns, suggesting the relevance of their involvement in transmitting financial contagion.
Zaremba et al. (2020)	COVID 19	Analyzing how government policy interventions t o mitigate COVID-19 spread impact capital	Stock indices returns of sixty seven (67) countries from 1st January 2020 to 3rd April 2020	Panel regressions analysis	Non-pharmaceutical measures are greatly increasing the volatility of the capital markets.

		market volatility?			
Ashraf (2020)	COVID 19	Explore the reactions of capital markets to the COVID-19 pandemic worldwide.	Using daily COVID-19 confirmed cases and deaths and stock market returns data from 64 countries over the period January 22, 2020 to April 17, 2020.	Panel data regression	Stock markets reacted more proactively to the growth in number of confirmed cases than growth in number of deaths.
He et al. (2020)	COVID 19	Exploring COVID-19's early impacts and spillover effect on stock markets.	Daily return data of stock markets indices of the USA, China, Italy, South Korea, France, Spain, Germany and Japan for the period of 1st June 2019 to 16th March 2020.	Event study	The impact of COVID-19 on share markets has short term negative bidirectional spill-over effects between Asian, European and American countries.
Aravind and Manoj krishnan (2020)	COVID 19	Investigate how the outbreaks of COVID19 have impacted large pharmaceutical stocks in India.	Daily price data of the selected Ten (10) Indian pharmaceutical companies listed with NSE from 3rd September 2019 to 28th February 2020.	Regression analysis	Momentum impact continues for pharmaceutical shares as the pharmaceutical shares shift according to the general benchmark index.

Source: Authors, compilation from review of literatures.

As the COVID19 epidemic is persisting in many parts of the world and countries are even significantly lessening the economic and financial activities, the full and final impact of the COVID19 pandemic is yet to be fully discovered. However, most researchers have tried to capture the immediate effect of the deadly COVID19 virus on the capital markets. Such as, a recent study of the Baker et al. (2020) estimated the effects of daily confirmed COVID19 cases and fatalities on the volatility of the Dow Jones index returns through content analysis. The study showed that COVID19 has a far more significant impact on stock market fluctuation than other similar viral infections, like Spanish flu and Ebola. Prior infectious diseases only left modest imprints on the Capital market of the USA. The analysis also suggests that governmental limits on economic operations and voluntary social isolation are the causes of U.S. capital markets' unusual extreme reactions to the COVID19 epidemic relative to past epidemics. Yilmazkuday (2020) also support the findings of the Baker et al. (2020) by providing empirical facts that having a 1% rise in the average daily COVID19 cases in the U.S. contributes in approximately 0.01% of the average decline in the S&P 500 index after the first day and approximately 0:03% of the decrease after one month. A comprehensive analysis carried out by Ashraf (2020) to analyze the reaction of the capital markets to the COVID19 outbreak while using daily COVID19 new cases and deaths and returns on the stock exchanges from 64 countries, revealed that stock markets reacted more rapidly and comprehensively to the increase in the number of cases reported relative to the increase in deaths. However, the findings also indicate that this reaction can differ over time, depending on the outbreak level.

Liew and Puah (2020) have extended the findings by exhibiting that, investors' responses to the COVID19 are distinctive across countries and industries. Communication, consumer items, medical Non-manufacturing, IT, and infrastructure have performed better compared to other sectors, whereas, the energy sector suffered the most in all considered countries. Their findings are consistent with the prior results of Chen et al. (2009) and Wang et al. (2013) on different market context (Taiwan) and other disease outbreak (SARS) however, the result is inconsistent with the findings of Aravind and Manojkrishnan, (2020) which observed significant negative returns experienced by Indian listed pharmaceutical companies due to COVID19. Al-Awadhi et al. (2020) have also presented facts of an enormous negative impact on the stock value of all firms listed in the Shanghai Stock Exchange and Hang-Seng stock exchange composite index. The findings further suggest that the information technology (IT) and pharmaceutical sectors performed better during the outbreak than others. Moreover, in contrast with Chinese residents, foreign investors have a considerably higher negative impact on the returns. Finally, more prominent firms face substantially higher adverse effects on returns than smaller firms.

While analyzing the market spillover (Zeren and Hizarci, 2020) in their study on seven highly infected countries stock exchanges found that both total fatality and new infections numbers have long term co-integration association with regional capital markets while no co-integration found in cases of other market. Identical outcomes have also been observed by Liu et al. (2020) while evaluating the consequences of COVID19 epidemic on twenty-one stock exchanges of seven different countries. Likewise, He et al. (2020) researched the immediate and spill-over impact of COVID19 on stock markets in eight distinct Asian, European and American countries. There was evidence to show that COVID19's influence on stock markets has a bidirectional spill-over impact across all selected countries.

Ru et al. (2020) presented an interesting observation while comparing the capital markets reactions of sixty-five countries to both SARS and COVID19. They argued that even though all markets have reacted considerably to both diseases, countries with prior experience of dealing with SARS have less affected than countries with no previous SARS experience. With a different objective, Akhtaruzzaman et al. (2020) tried to explore how financial contagion happens between China and G7 countries during the COVID19 span, across financial and nonfinancial firms. The analytical findings suggest that listed companies in these countries, both financial and non-financial, witnessed a substantial rise in conditional correlations between their returns on securities, which is consistent with the findings of earlier studies conducted by Baker et al. (2012) and Morales and Andreosso-O'Callaghan (2014). However, the degree of rising for financial firms during the COVID19 epidemic is significantly greater, indicating the prominence of their involvement in spreading financial contagion. The study also showed that optimum hedge ratios increased sharply in most instances, implying higher hedging costs during the COVID19 era. Generally, it can be argued that incidents such as outbreaks of infectious disease can cause adverse shifts in investors' moods, which dramatically influences their investment behavior and, thus, stock market values.

So the study develops the following hypothesis.

H0: Local stock market has not reacted significantly to the detection of infectious diseases such as COVID19.

H1. Local stock market has reacted significantly to the detection of infectious diseases such as COVID19.

3. Data and methodology

This study have adopted the Event Study Methodology (ESM), originally introduced by Fama et al. (1969) and further methodologically developed by Binder (1998), Brown and Warner (1985) and MacKinlay (1997) to analyze the stock market (Dhaka stock exchange) reaction to the first official announcement of COVID19 case in Bangladesh. The COVID19 epidemic announcement was not predictable and known until March 08, 2020 in Bangladesh, although Chinese authorities first confirmed the virus in December 2019 in Wuhan City, China (WHO, 2020). As clarified by Fama (1991), Event studies may provide a good picture of the intensity at which prices are changed to information. Investigating the equity prices around the dates of the incident will also put the focus on the properties of the market response to the announcement and, same time, the market efficiency.

ESM has been extensively adopted in prior and contemporary seminal studies to evaluate the impact of an event on accounting, finance and economic researches such as Nippani and Washer (2004), Chen et al. (2007), Hasan et al. (2017), Ibrahim et al. (2019) and He et al. (2020). Under the assumption of efficient market hypothesis (Malkiel, 2003), ESM is capable of detecting unexpected shifts in a firm's stock value generated by an occurrence above the usual market returns (Mio and Fasan, 2012).

3.1. Data

This study uses all sectors' daily closing stock prices, excluding the Bonds (both corporate and treasury), Debentures, and Mutual Funds listed in DSE. Also, the study used the DSEX index as a market performance standard. The study sample comprises a total of 311 listed firms. The study further categorized the total sample into four (4) different subsamples such as manufacturing (193 firms), Non-manufacturing (118 firms), financial (99 firms), and nonfinancial industry (212 firms) to scrutinize the outbreak announcement effect. Table 2 exhibits the descriptive analysis of data, where it can be seen that all three return models have generated similar average negative return in all event windows with almost identical dispersion value.

Table 2- Descriptive Analysis of CAR

Return	Obs.	Windows	Mean	Median	SD	Max.	Min.	Skewness	Kurtosis
Market Model	311	(-5,-1)	0.01	0.00	0.05	0.33	-0.12	1.70	9.85
	311	(0,0)	-0.01	-0.01	0.03	0.12	-0.09	0.58	5.36
	311	(1, 5)	-0.01	-0.01	0.08	0.54	-0.28	1.58	13.69
Constant Market Return	311	(-5,-1)	0.01	0.00	0.05	0.30	-0.12	1.52	8.91
	311	(0,0)	-0.01	-0.01	0.03	0.12	-0.08	0.54	4.88
	311	(1, 5)	-0.02	-0.03	0.07	0.43	-0.20	1.44	9.92
Mean Adjusted Return	311	(-5,-1)	0.01	-0.02	0.05	0.30	-0.14	1.60	9.53
	311	(0,0)	-0.03	-0.03	0.03	0.09	-0.10	0.55	4.85
	311	(1, 5)	-0.09	-0.10	0.07	0.37	-0.27	1.48	10.48

Source: Authors Calculation

3.2. Event date and estimation window

Before recognizing the event window, identifying the exact event date is vital in event studies (Armitage, 1995). The official confirmation date of first case of COVID19 infection in Bangladesh by the Institute of Epidemiology, Disease Control and Research (IEDCR) of Government of Bangladesh (GoB) was on March 08, 2020, is now considered to be the precise event date employed in this study and the event period is considered as ten (10) trading days covering from 1st march 2020 to 15th march 2020. Seminal studies by Nippani and Washer (2004) also used the first case of infection while Chen et al. (2007) and Wang et al. (2013) used the first fatality to infectious diseases and Chen et al. (2009) and Ichev and Marinč (2018) chose the first time the condition became known to the media. This study uses 250 actual trading days before the 5-day event window as the estimation period to prevent the event from impacting the precision of estimating average return (MacKinlay, 1997). The estimation window starts Thursday, February 02, 2019, and ends Thursday, February 27, 2020.

3.3. Measuring abnormal returns

The models designed to generate expected returns must be specified before an unusual return can be measured. In practice, various approaches have been developed, reviewed, and implemented to quantify the standard rate of return and generate an abnormal return (Peterson, 1989). Here to keep in mind that, in event analysis studies, it is quite common to use more than one standard model to obtain average returns because it allows determining the robustness of the outcomes according to model estimation (Banz, 1981; Kliger and Gurevich, 2014). This study is based on three general models for producing ex-ante normal returns, as previously discussed in pioneer literature by Brown and Warner (1980); MacKinlay (1997), and Strong, (1992). These models are generic versions of the frameworks that were taken for granted in event studies. The models are 1) Mean-adjusted returns, 2) Market-adjusted returns, and 3) Market model.

3.3.1. Mean adjusted model

The mean adjusted return model presume that the ex-ante normal return for a specific stock i is equivalent to the simple mean return of stock i's daily yield in the estimation phase, which may vary among stocks. The abnormal return AR_{it} (equation.1) is equal is the residual amount after deducting the normal return R_t from the actual observed return Rit (Masulis, 1980). The model has been consistent with the hypothesis of the Capital asset pricing model (CAPM) that the stock has a consistent risk exposure and required return (Lintner, 1965; Sharpe, 1964).

$$AR_{it} = R_{it} - \bar{R}_i \quad (1)$$

where; AR_{it} is the abnormal return; $\bar{R}_i$ is the simple average of security i's average return in the estimation period and R_{it} is the return of security i in period t.
The measurement of these returns R_{it} is calculated as:

$$R_{it} = ln\left(\frac{P_t}{P_{t-1}}\right) \quad (2)$$

where; Rit is individual stock return, Pt is current price, Pt-1 is prior day price.

Although the method of constant mean return is undoubtedly the simpler approach, (Brown and Warner, 1980, 1985) argued that it frequently yields outcomes very close to those of more complicated methods.

3.3.2. Market adjusted return model

Another simple method by Cable and Holland (1999) assumes that the normal return on all stocks is the return on the market as measured by a large stock market benchmark such as the US S&P 500 and UK FTSEALL. Unlike the mean adjusted return method, this approach takes into consideration market-wide changes that happened at the same time as the sample firm's experienced event (Dyckman et al., 1984). The return volatility which is the abnormal (ARit) return is the gap between the return on a sample stock (Rit) and the subsequent return on the market index (Rmt) (Strong,

The Economic Research Guardian – Vol.10.(2)2020
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 10(2): 97-121

1992). This study used the DSEX index of Bangladesh index as a benchmark index to calculate the market return and then abnormal return. This relation is described by the following equation.

$$AR_{it} = R_{it} - R_{mt} \tag{3}$$

where; Rmt is the market portfolio/index return on day t

3.3.3. Market model

This method takes into consideration all market-wide variables and each security's systemic risk. This single-factor standard is based upon on one-factor return model developed by Sharpe (1963). It utilizes a more sophisticated simulation approach to equity returns relative to previously addressed simplified methods by predicting linear relationships between stocks and contemporary market portfolio return. The relation is defined in the equation below;

$$E_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{4}$$

where; Eit is the expected return of stock i on day t; Rmt is the market return at period t; αi and βi are the model parameters and ε_{it} is the error term.

The αi and βi parameters are typically calculated by an OLS regression with equity return as the dependent parameter and market yield as an independent parameter. This model offers a potential development over the simplistic return model by eliminating the fraction of the return associated with volatility in the market return which can lead to an enhanced ability to recognize the impact of the events (Ahlgren and Antell, 2012). The abnormal return (AR) for stock i on day t is defined as:

$$AR_{it} = R_{it} - E(R_{it}) \tag{5}$$

where: ARit is the abnormal return of stock i on day t; E (Rit) is expected return.

According to the study of Dyckman et al. (1984), the ability of the three approaches to appropriately predict the existence of abnormal performance is similar, though they showed a slight bias for the market model, which was statistically significant. Likewise, Brenner (1979) and Klein and Rosenfeld (1987) argued that the use of multiple model matters. Market model have been quite extensively used by contemporary event studies to analyze the impact of disease outbreak such as Nippani and Washer (2004), Loh (2006), Chen et al. (2009) and He et al. (2020).

This paper also measures the Average of Abnormal Returns (AARs) (Equaltion.6) and cumulative value of AARs (CAARs) (Equation no. 7 and 8), which is predicted to reflect the aggregate market response. CAAR inconsistencies around the date of the event suggest that market investors consider the information material of the analyzed event that symbolizes the price of the shares (Suwanna, 2012). Moreover, efficiency of the market is determined just after event by evaluating the CAARs, that is, from the day of the incident (t0), forward (t1). If no abnormalities are observed in the post event window phase of the event window, findings may conclude that the market has completely absorbed the information. Which is market efficiency characteristic (Bowman, 1983; Yen and Lee, 2008). Conversely, if CAAR anomalies arise after the date of the event, it can be inferred that the information was not completely processed until it was transmitted, implying that the market did not respond efficiently

$$AAR_t = \frac{1}{Nt}\sum_{i=1}^{N} AR_{it} \quad (6)$$

where; ARRt is the estimated AAR in period t, ARit is stock i's estimated AR at period t and n is the number of observations.

$$CAR_{(t1,t2)} = \sum_{t1}^{t2} AR_{it} \quad (7)$$

where; CAR (T1, T2) is the cumulative abnormal return from period T1 to T2.

$$CAAR_{(T_1,T_2)} = \frac{1}{N}\sum_{i=1}^{N} CAR_{it} \quad (8)$$

where; CAAR (T1, T2) is the estimated CAR in period t.

3.4. Statistical significance measures

Instead of focusing on single statistical test statics, we use multiple test statistics that include both parametric and non-parametric test statistics to confirm the tests are robust. Such measures are quite well-specified and more effective in random samples of data from Asian capital markets (Campbell et al., 2010; Corrado and Truong, 2008; Rani et al., 2015). This research incorporates the three frequently used parametric and two non-parametric test statistics widely used for measuring the significance of AARs and CAARs over the event duration. Such nonparametric experiments are usually not used in isolation but in combination with the parametric equivalents (Kang and Stulz, 1996; Kolari and Pynnönen, 2010). The use of non-parametric testing allows a robustness verification of the results based on parametric tests. If the declaration of the first COVID19 case resulted in large irregular returns, the t-statistics would vary significantly from zero.

The three parametric test-statistics, namely, Time-Series t-test cross sectional t-test or crude dependence test (Brown and Warner, 1980, 1985) and standardized cross-sectional test (Boehmer et al., 1991) have been implied to test for the significance of CAAR over the three event windows. The two non-parametric test statistics, namely generalized sign-test (Cowan, 1992), rank-test (Corrado, 1989; Corrado and Zivney, 1992) have been conducted to test the significance of CAARs.

This study also tries to identify whether is any significant difference between the price reaction of firms from manufacturing sector and Non-manufacturing sector as well as the difference between the firms from financial and non-financial sector. This study uses parametric two sample t-test (also known as Welch's t-test) as well as nonparametric Mann-Whitney U test (Bowman, 1983) also called the Wilcoxon rank-sum test as applied by Schiereck et al. (2016) to verify if the identified difference between the groups is significant.

4. Results and discussion

To test whether the announcement of the detection of infectious disease impacts the stock market of Bangladesh, event study analysis is applied to examine the relationship between the date of announcement of the first detection of COVID19 and the market reaction of all listed firms in DSE. Table 3 exhibits average abnormal return (AAR) for all listed firms in three different return models for 5 days pre and post event window. The empirical results show that all three models produced significantly negative abnormal returns on event day 0 although the day -1, -3 and -4 before the announcement produced statistically significant (99%) overall positive abnormal return in all three model. However the return became statistically significantly negative on day -2 in CMM and statistically insignificant in MRM and MM. The post facto reaction from market also exhibited statistically significant (99%) negative AAR in day 1 in CMM and MRM. However the market reversed sharply on day 2 with noteworthy positive AAR, significant at 99% in all three models. Yet, market again significantly generated negative ARR on day 4 and 5 in all return models which could be described as the persisting effect of COVID19 on capital market.

Table 3- Market response to Covid-19 reflecting on overall stock return

	CMM			MRM			MM		
Day	AAR	T-Stat	P Value	AAR	T-Stat	P Value	AAR	T-Stat	P Value
-5	-0.022	-15.42***	0.00	-0.0075	-5.10***	0.00	-0.005	-3.36***	0.00
-4	0.013	8.07***	0.00	0.006	3.93***	0.00	0.005	3.51***	0.00
-3	0.015	8.69***	0.00	0.007	4.19***	0.00	0.006	3.72***	0.00
-2	-0.013	-7.99***	0.00	-0.001	-0.61	0.54	0.001	0.80	0.42
-1	-0.002	-1.28	0.20	0.003	1.51	0.13	0.003	2.17**	0.03
0	-0.031	-17.89***	0.00	-0.009	-5.31***	0.00	-0.005	-3.20***	0.00
1	-0.078	-50.17***	0.00	-0.012	-7.56***	0.00	-0.001	-0.41	0.68
2	0.046	30.15***	0.00	0.009	5.97***	0.00	0.004	2.48**	0.01
3	0.021	14.21***	0.00	0.002	1.19	0.23	-0.001	-0.64	0.53
4	-0.029	-16.13***	0.00	-0.005	-3.00***	0.00	-0.001	-0.68	0.50
5	-0.054	-32.36***	0.00	-0.015	-9.14***	0.00	-0.008	-4.85***	0.00

Note: Number of sample is 311 listed firms in Dhaka stock exchange (DSE), Bangladesh. 10%, 5% and 1% significant level = *, ** and *** consecutively.
Source: Authors Calculation

Multiple event windows has been used in this study to see the market reactions through calculating Cumulative Average Abnormal Returns (CAARs) to the arrival of COVID-19 event on stock price of 311 listed firms in DSE. The event windows are Pre (-1, -1), Post (0, +1), and event day (0, 0).

Table 2 represents the reactions of CAARs to the arrival of the Corona virus. The immediate reaction to the first announcement is significantly negative. This suggests that, despite the perceived weak co-integration with other Asian markets (Subhani et al., 2011) and having weak market efficiency (Mobarek and Keasey, 2000) the domestic stock market is heavily affected by the gravity of the situation. The first COVID case appears to turn market sentiment considerably and cause negative CAARs in the first day after its announcement. The findings exhibits that the COVID-19 has a significant effect on stock return which is in the line with efficient market hypothesis (EMC), which suggests that capital market would react to any new information (Fama, 1970), therefore the news of detection and transmission of the pandemic believed to create impact in the global as well as local capital markets. This result is quite consistent with the earlier findings of Chen et al. (2009) and Al-Awadhi et al. (2020) with different market context.

Table 4 - Market Reaction of Covid-19 on Firm's Stock Return

Model	Windows	CAARs (%)	Test Statistics				
			t-test time-series	t-test cross-sectional	Boehmer Test	Corrado Rank test	Sign test
CMM	(-1...-1)	-0.22	-1.33	-1.25	-2.22**	-0.43	-3.48***
	(0...0)	-3.06	-18.69***	-17.81***	-18.11***	-2.26**	-12.10***
	(0...+1)	-10.88	-46.99***	-44.70***	-43.19***	-4.09***	-16.86***
MM	(-1...-1)	0.35	2.30**	2.04**	1.30	0.09	-0.20
	(0...0)	-0.59	-3.84***	-3.50***	-3.26***	-1.24	-2.93***
	(0...1)	-0.79	-3.68***	-3.05***	-2.78***	-1.14	-1.00
MRM	(-1...-1)	0.26	1.70*	1.50	0.82	0.03	0.19
	(0...0)	-0.91	-5.95***	-5.30***	-4.68***	-1.65*	-3.45***
	(0...+1)	-2.09	-9.62***	-8.59***	-6.78***	-3.04***	-5.27***

Note: Number of sample is 311 listed firms in Dhaka stock exchange (DSE), Bangladesh. 10%, 5% and 1% significant level = *, ** and *** consecutively.
Source: Authors Calculation

To test the robustness of the results, this study has further divided the total sample into four major sub-samples such as Financial (FI) vs. Non-financial industries (NFI) and Manufacturing (MI) vs. Non-Manufacturing Industries (NMI). Table 5 presents the CAAR for financial vs. nonfinancial firms display that in pre event window (-1,-1), Financial industry's stock return were negative and statistically significant in all return models. However, variability in return, as well as statistical significance, has been observed in the post event phase (0, 1), where, CMM and MRM showed statistically significant pessimistic return, the MM however exhibited insignificant negative return. In terms of test statics, parametric test statics are showing more unified results. Overall, it is observed that the announcement event window (-1, -1) has negatively affected the financial stocks in DSE quite significantly, which is well verified in all return and statistics.

The Economic Research Guardian – Vol.10.(2)2020
Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 10(2): 97-121

Table 5 - CAAR for Financial and Non-Financial Industry

Industry	Model	Window	CAAR (%)	Test Statistics				
				t-test time-series	t-test cross-sectional	Boehmer et al.	Corrado rank	Sign test
FI	CMM	(-1…-1)	-1.11	-3.84***	-5.24***	-5.29***	-0.94	-5.24***
		(0...0)	-3.12	-10.8***	-14.02***	-15.5***	-2.40**	-8.89***
		(0...1)	-9.97	-24.4***	-24.18***	-26.3***	-3.91***	-9.71***
	MM	(-1...-1)	-0.57	-2.10**	-2.77***	-2.50**	-0.70	-2.50**
		(0...0)	-0.76	-2.83***	-3.40***	-3.48***	-0.87	-2.09**
		(0...1)	-0.35	-0.93	-0.76	-0.10	-0.24	-0.26
	MRM	(-1…-1)	-0.60	-2.20**	-2.79***	-2.58**	-0.74	-2.44**
		(0...0)	-0.94	-3.46***	-4.22***	-4.14***	-1.11	-2.23**
		(0...1)	-1.10	-2.87***	-2.73***	-1.34	-0.98	-1.62
NFI	CMM	(-1...-1)	0.23	1.14	1.00	0.00	-0.13	-0.53
		(0...0)	-3.01	-15.1***	-13.08***	-13.0***	-1.94*	-8.51***
		(0...1)	-11.26	-39.9***	-37.77***	-34.9***	-3.72***	-13.7***
	MM	(-1...-1)	0.81	4.38***	3.57***	2.69***	0.50	1.58
		(0...0)	-0.47	-2.54**	-2.12**	-1.93*	-0.78	-2.00**
		(0...1)	-0.91	-3.49***	-2.93***	-3.05***	-0.97	-0.90
	MRM	(-1...-1)	0.69	3.70***	3.01***	2.21***	0.44	2.02**
		(0...0)	-0.88	-4.71***	-3.81***	-3.27***	-1.11	-2.53**
		(0...1)	-2.50	-9.48***	-8.37***	-7.06***	-2.59**	-5.15***

Note: Financial industry comprises of 99 listed firms in Banking, Insurance and Non-banking Financial Institutions and Non-Financial firms comprises of 213 listed firms. 10%, 5% and 1% significant level = *, ** and *** consecutively.
Source: Authors Calculation

While analyzing the impact of announcement on non-financial stocks' aggregate return, the pre event period showed completely different scenario. The overall pre-event (0, 0) CAAR was positive and statistically significant in all return model except CMM. The actual event window (0, 0) has generated significant overall negative market return. Moreover, unlike financial firms, non-financial firms have experienced statistically significant negative return in all measurement models. In aggregate it can be said reasonably that non-financial industry has been more exposed to the announcement of first COVID19 detection.

Semi-annual Online Journal, www.ecrg.ro
ISSN: 2247-8531, ISSN-L: 2247-8531
Econ Res Guard 10(2): 97-121

Table 6 - CAAR for Manufacturing Firms and Non-manufacturing Firms

Ind.	Model	Windows	CAAR (%)	Statistics				
				t-test time-series	t-test cross-sectional	Boehmer et al.	Corrado rank	Sign test
MI	CMM	(-1…-1)	0.24	1.15	1.04	0.20	-0.08	0.02
		(0...0)	-2.91***	-14.0***	-12.2***	-12.0***	-1.92*	-8.15***
		(0...1)	-11.2***	-38.1***	-36.2***	-33.1***	-3.7***	-13.2***
	MM	(-1...-1)	0.70	3.60***	3.02***	2.34***	0.52	2.33**
		(0...0)	-0.78	-4.02***	-3.25***	-2.83***	-1.02	-2.27**
		(0...1)	-2.46***	-8.93***	-7.91***	-6.71***	-2.6***	-5.00***
	MRM	(-1…-1)	0.82	4.23***	3.55***	2.80***	0.57	1.89*
		(0...0)	-0.40	-2.05**	-1.69*	-1.59	-0.71	-1.70*
		(0...1)	-0.96	-3.50***	-2.96***	-3.10***	-0.97	-1.12
NMI	CMM	(-1...-1)	-0.93	-3.49***	-3.91***	-4.70***	-0.92	-5.58***
		(0...0)	-3.27	-12.3***	-14.8***	-16.3***	-2.5***	-9.14***
		(0...1)	-10.23	-27.1***	-26.3***	-28.5***	-4.0***	-10.5***
	MM	(-1...-1)	-0.38	-1.51	-1.61	-2.03**	-0.74	-2.63**
		(0...0)	-0.85	-3.41***	-3.98***	-3.86***	-1.11	-2.44**
		(0...1)	-0.36	-1.03	-0.84	-0.20	-0.39	0.00
	MRM	(-1...-1)	-0.43	-1.71*	-1.78*	-2.19**	-0.79	-2.54**
		(0...0)	-1.09	-4.37***	-4.91***	-4.58***	-1.41	-2.54**
		(0...1)	-1.38	-3.89***	-3.59***	-2.13**	-1.38s	-1.98*

Note: Manufacturing industry comprises of 191 listed firms and Non-manufacturing firms comprises of 118 listed firms. 10%, 5% and 1% significant level = *, ** and *** consecutively.
Source: Authors Calculation

Table 6 exhibits the manufacturing firms' and Non-manufacturing firms' aggregate market reaction to the first COVID19 announcement expressed in CAAR in three different event windows. The findings are quite similar to each segment. Both manufacturing and non-manufacturing firms have experienced significant negative market returns due to the COVID19 announcement on the event day (0, 0), which continues to the next event phase (0, 1) also. However, the pre-event (-1, -1) returns are different for each segment, where manufacturing firms showed positive average return before the announcement, and Non-manufacturing firms experienced negative average returns. Overall, both the industry segments have experienced statistically significant abnormal negative returns due to the first COVID19 identification.

Table 7 - Difference of CAARs between Financial and Non-Financial Industry

Model	Windows	CAARs FI	NFI	Difference of CAARs	Welch's T Test	P value	Wilcoxon rank sum test	P value
CMM	(-1…-1)	-0.011	0.002	-0.013	-3.65***	0.00	-3.13***	0.00
	(0...0)	-0.031	-0.030	-0.001	-0.31	0.75	0.18	0.85
	(0...1)	-0.099	-0.112	0.012	2.48**	0.01	2.37**	0.01
MM	(-1...-1)	-0.005	0.008	-0.013	-3.79***	0.00	-3.28***	0.00
	(0...0)	-0.007	-0.004	-0.002	-0.81	0.42	-0.17	0.85
	(0...1)	-0.003	-0.009	0.005	1.03	0.30	1.18	0.23
MRM	(-1…-1)	-0.006	0.006	-0.012	-3.49***	0.00	-2.97***	0.00
	(0...0)	-0.009	-0.008	-0.000	-0.17	0.86	0.35	0.72
	(0...1)	-0.011	-0.025	0.014	2.69**	0.01	2.58***	0.01

Note: 10%, 5% and 1% significant level = *, ** and *** consecutively.
Source: Authors Calculation

Table 7 and 8 present the significance of the difference CAARs between industry segments (i.e. financial vs. Non-Financial firms and Manufacturing vs. Non-manufacturing firms). The difference is insignificant in the actual event window (0, 0), however, significant statistical difference has been exhibited in the pre event as well post event windows between industry segments indicating that the negative impact of the first COVID19 detection announcement was largely confined to both financial and non-financial sector as well manufacturing and Non-manufacturing sector. Moreover, it has been observed that Non- financial firm' and manufacturing firms' returns have been more negatively influenced by the announcement in event and post event phase considering the pre-event positive CAARs.

Table 8: Difference of CAARs between Manufacturing firms and Non-Manufacturing firms

Model	Windows	CAARs		Difference of CAARs	Welch's T test	P value	Wilcoxon rank sum test	P value
		MI	NMI					
CMM	(-1…-1)	0.002	-0.009	0.011	3.52***	0.00	3.18***	0.00
	(0...0)	-0.029	-0.032	0.003	1.07	0.28	0.51	0.60
	(0...1)	-0.112	-0.102	-0.009	-1.99**	0.04	-1.92*	0.05
MM	(-1...-1)	0.008	-0.003	0.012	3.63***	0.00	3.27***	0.00
	(0...0)	-0.004	-0.008	0.004	1.42	0.15	0.74	0.45
	(0...1)	-0.009	-0.003	-0.006	-1.10	0.27	-1.08	0.27
MRM	(-1…-1)	0.007	-0.004	0.011	3.37***	0.00	3.01***	0.00
	(0...0)	-0.007	-0.0109	0.003	0.94	0.34	0.31	0.75
	(0...1)	-0.024	-0.0138	-0.010	4.63***	0.00	4.43***	0.00

Note: 10%, 5% and 1% significant level = *, ** and *** consecutively.
Source: Authors Calculation

5. Conclusions

This paper offers the first and original empirical study of Bangladesh's stock market reaction to the COVID19 epidemic. Markets are still highly unpredictable and unstable because of the considerable uncertainty surrounding the epidemic and financial implications. This study aimed to examine the immediate impact of the announcement of the first COVID19 case on DSE.

An event study approach with three different return models, namely constant mean return model, market return model and market model, is tested for significance by parametric and non-parametric test statistics. Research results suggested that (1) Announcement of the first COVID19 detection in Bangladesh has a significant negative effect on stock market returns across all firms and industries. Both the event period (0, 0) CAAR and post event phase (0, 1) CAAR have generated statistically significant negative returns for all firms. (2) Nonfinancial industry has been more exposed to the announcement of first COVID19 detection as measured by statistically significant negative CAAR on event and post event period. (3) The significant statistical difference has been exhibited in the pre- event and post-event windows between industry segments, indicating that the negative impact of the first COVID19 detection announcement was largely confined to both the financial and nonfinancial sector as well manufacturing and Non-manufacturing sectors. (4) DSE which has been empirically characterized as market inefficient reacted significantly efficiently to the announcement of epidemic detection. (5) Behavioral overreaction induced Panic selling and herding effect has been observed among investors due to epidemic detection. The epidemic is perceived as a damping economic development by shareholders and worries about future income. The typical investors' reaction is to sell the stocks before the extent of the depreciation is clear.

Considering the empirical value of the findings, it can be concluded that these finding will be highly effective in addressing this epidemic issue efficiently for retail and personal investors, investment managers, industrial and financial analysts to develop contingent investment strategies while considering global systematic risk factor. There is considerable space for more research into investors' reactions within and between domestic and regional markets, and attention should be given to investors' confidence and volatility.

References

Ahlgren N, Antell J (2012). Tests for Abnormal Returns Under Weak Cross Sectional Dependence. *Hanken School of Economics Working Paper* No. 561.

Akhtaruzzaman M, Boubaker S, Sensoy A (2020). Financial Contagion During COVID-19 Crisis. *Finance Research Letters*. Forthcoming. Doi: 10.1016/j.frl.2020.101604.

Al-Awadhi A M, Alsaifi K, Al-Awadhi A, Alhammadi S (2020). Death and Contagious Infectious Diseases: Impact of the COVID-19 Virus On Stock Market Returns. *Journal of Behavioral and Experimental Finance*. 27(1): 8-13.

Alfaro L, Chari A, Greenland A N, Schott P K (2020). Aggregate and Firm-Level Stock Returns During Pandemics, in Real Time. *NBER working paper* No w26950.

Aravind M, Manojkrishnan C (2020). COVID19: Effect on Leading Pharmaceutical Stocks Listed with NSE. *International Journal of Research in Pharmaceutical Sciences.*11(1): 31-36.

Arefin J, Rahman R M (2011). Testing different forms of efficiency for Dhaka Stock Exchange. *International Journal of Financial Non-Manufacturings Management.* 5(1): 1-20.

Armitage S (1995). Event Study Methods and Evidence on Their Performance. *Journal of Economic Surveys.* 9(1): 25-52.

Ashraf B N (2020). Stock Markets' Reaction to COVID-19: Cases or Fatalities?. *Research in International Business and Finance.* 54(1): 17-23.

Azad A S, Azmat S, Fang V, Edirisuriya P (2014). Unchecked Manipulations, Price–Volume Relationship and Market Efficiency: Evidence from Emerging Markets. *Research in International Business and Finance.* 30(2014): 51-71.

Baker M, Wurgler J, Yuan Y (2012). Global, local, and Contagious Investor Sentiment. *Journal of Financial Economics.*104(2): 272-287.

Baker S R, Bloom N, Davis S J, Kost K J, Sammon M C, Viratyosin T (2020). The Unprecedented Stock Market Impact of COVID-19. *National Bureau of Economic Research Working Paper* No. w26945.

Banz R W (1981). The Relationship between Return and Market Value of Common Stocks. *Journal of Financial Economics.* 9(1): 3-18.

Binder J (1998). The Event Study Methodology since 1969. *Review of Quantitative Finance and Accounting,* 11(2): 111-137.

Bloomfield R (2010). *Behavioural Financein Behavioural and Experimental Economics*. Palgrave Macmillan:UK.

Boehmer E, Musumeci J, Poulsen A (1991). On the Use of the Multivariate Regression Model in Event Studies. *Journal of Financial Economics.* 30(2): 253-272.

Bowman R G (1983). Understanding and Conducting Event Studies. *Journal of Business Finance and Accounting.* 10(4): 561-584.

Brenner M (1979). The Sensitivity of the Efficient Market Hypothesis to Alternative Specifications of the Market Model. *The Journal of Finance.* 34(4): 915-929.

Brown S J, Warner J B (1980). Measuring Security Price Performance. *Journal of Financial Economics.* 8(3): 205-258.

Brown S J, Warner J B (1985). Using Daily Stock Returns: The Case of Event Studies. *Journal of Financial Economics*. 14(1): 3-31.

Cable J, Holland K (1999). Modelling Normal Returns in Event Studies: A Model-Selection Approach and Pilot Study. *The European Journal of Finance*.5(4): 331-341.

Campbell C J, Cowan A R, Salotti V (2010). Multi-Country Event-Study Methods. *Journal of Banking andFinance*. 34(12): 3078-3090.

Chen C D, Chen C C, Tang W W, Huang B Y (2009). The Positive and Negative Impacts of the SARS Outbreak: A Case of the Taiwan Industries. *The Journal of Developing Areas*. 43(1): 281-293.

Chen M H, Jang S S, Kim W G (2007). The Impact of The SARS Outbreak on Taiwanese Hotel Stock Performance: An Event-Study Approach. *International Journal of Hospitality Management*. 26(1): 200-212.

Corrado C J (1989). A Nonparametric Test For Abnormal Security-Price Performance In Event Studies. *Journal of Financial Economics*. 23(2): 385-395.

Corrado C J, Truong C (2008). Conducting Event Studies with Asia-Pacific Security Market Data. *Pacific-Basin Finance Journal*.16(5): 493-521.

Corrado C J, Zivney T L (1992). The Specification and Power of The Sign Test in Event Study Hypothesis Tests Using Daily Stock Returns. *Journal of Financial and Quantitative Analysis*. 27(3): 465-478.

Cowan A R (1992). Nonparametric Event study Tests. *Review of Quantitative Finance and Accounting*. 2(4): 343-358.

Dreman D N, Lufkin E A (2000). Investor Overreaction: Evidence that its Basis is Psychological. *The Journal of Psychology and Financial Markets*. 1(1): 61-75.

Dyckman T, Philbrick D, Stephan J (1984). A Comparison of Event Study Methodologies Using Daily Stock Returns: A Simulation Approach. *Journal of Accounting Research*. 22(1984): 1-30.

Fama E F (1970). Efficient Market Hypothesis: A Review of Theory and Empirical Work.. *Journal of Finance*. 25(2): 28-30.

Fama E F (1991). Efficient Capital Markets: II. *The Journal of Finance*.46(5): 1575-1617.

Fama E F, Fisher L, Jensen M C, Roll R (1969). The Adjustment of Stock Prices To New Information. *International Economic Review*. 10(1): 1-21.

Funakoshi M, Hartman T (2020). Mad March: How the Stock Markets is being Hit by COVID-19. World Economic Forum. www.weforum.org/agenda/2020/03/stock-market-volatility-coronavirus/. (accessed in April 23, 2020).

Hasan M M, Ibrahim Y, Olajide R J, Minai M S, & Uddin M M (2017). Malaysian Acquiring Firms' Shareholders' Wealth Effect Following Cross-Border Acquisition. *Journal of Accounting and Finance in Emerging Economies*, 3(2): 149-160.

Hasan M Z, Kamil A A, Mustafa A, Baten M A (2012). Relationship between Risk and Expected Returns: Evidence from The Dhaka Stock Exchange. *Procedia Economics and Finance*. 2(2012): 1-8.

Hassan M H, Kayser M S (2019). Ramadan Effect on Stock Market Return and Trade Volume: Evidence from Dhaka Stock Exchange (DSE). *Cogent Economics and Finance*. 7(1):1-11.

Hassan M K, Chowdhury S (2008). Efficiency of Bangladesh Stock Market: Evidence from Monthly Index and Individual Firm Data. *Applied Financial Economics*. *18*(9): 749-758.

He Q, Liu J, Wang S, Yu J (2020). The Impact Of COVID-19 on Stock Markets. *Economic and Political Studies*. 8(3): 1-14.

Heyden K J, Heyden T (2020). Market Reactions to the Arrival and Containment of COVID-19: An Event Study. *Finance Research Letters*. Forthcoming. Doi: 10.2139/ssrn.3587497.

Ibrahim Y, Minai M S, Hasan, M M, and Raji J O (2019). Agency Costs and Post Cross Border Acquisition Performance of Malaysian Acquirers. *International Journal of Business and Society*. 20(3): 870-887.

Ichev R, Marinč M (2018). Stock Prices and Geographic Proximity of Information: Evidence from the Ebola Outbreak. *International Review of Financial Analysis*. 56(c): 153-166.

Islam A, Khaled M (2005). Tests of Weak-Form Efficiency of The Dhaka Stock Exchange. *Journal of Business Finance and Accounting*. 32(7-8): 1613-1624.

Joarder A M, Ahmed M U, Haque T, Hasanuzzaman S (2014). An Empirical Testing of Informational Efficiency in Bangladesh Capital Market. *Economic Change and Restructuring*. 47(1): 63-87.

Kang J K, Stulz R M (1996). How Different is Japanese Corporate Finance? An Investigation of the Information Content of New Security Issues. *The Review of Financial Studies*. 9(1): 109-139.

Kapoor S, Prosad J M (2017). Behavioural Finance: A Review. *Procedia Computer Science*. 122(1): 50–54.

Kim J, Kim J, Lee S K, Tang L R (2020). Effects Of Epidemic Disease Outbreaks on Financial Performance of Restaurants: Event Study Method Approach. *Journal of Hospitality and Tourism Management*. 43: 32-41.

Klein A, Rosenfeld J (1987). The Influence of Market Conditions on Event-Study Residuals. *Journal of Financial and Quantitative Analysis*. 22(3): 345-351.

Kliger D, Gurevich G (2014). *Event Studies for Financial Research: A Comprehensive Guide*. Palgrawe MacMillan.

Kolari J W, Pynnönen S (2010). Event Study Testing with Cross-Sectional Correlation of Abnormal Returns. *The Review of Financial Studies.* 23(11): 3996-4025.

Liew K S, Puah C H (2020). Chinese Stock Market Performance in the Time of Novel Coronavirus Pandemic. *MPRA working Paper* No. 100414.

Lintner J (1965). Security Prices, Risk, and Maximal Gains from Diversification. *The Journal of Finance.* 20(4): 587-615.

Liu H, Manzoor A, Wang C, Zhang L, Manzoor Z (2020). The COVID-19 Outbreak and Affected Countries Stock Markets Response. *International Journal of Environmental Research and Public Health.* 17(8): 2800.

Loh E (2006). The Impact of SARS on the Performance and Risk Profile of Airline Stocks. *International Journal of Transport Economics/Rivista Internazionale Di Economia Dei Trasporti.* 33(3):401-422.

MacKinlay A C (1997). Event Studies in Economics and Finance. *Journal of Economic Literature.* 35(1): 13-39.

Malkiel B, Fama E (1970). Efficient Capital Markets. *A Review of Theory and Empirical Work. Journal of Finance.*25: 383-417.

Malkiel B G (2003). The Efficient Market Hypothesis and Its Critics. *Journal of Economic Perspectives.*17(1): 59-82.

Masulis R W (1980). The Effects of Capital Structure Change on Security Prices: A Study of Exchange Offers. *Journal of Financial Economics.*8(2): 139-178.

Mazur M, Dang M, Vega M (2020). COVID-19 and The March 2020 Stock Market Crash. Evidence From S&P1500. *Finance Research Letters.* 101690. Forthcoming. Doi: 10.1016/j.frl.2020.101690.

Mio C, Fasan M (2012). Does Corporate Social Performance Yield any Tangible Financial Benefit During A Crisis? An Event Study of Lehman Brothers' Bankruptcy. *Corporate Reputation Review.*15(4): 263-284.

Mobarek A, Keasey K (2000). Weak-Form Market Efficiency of An Emerging Market: Evidence From Dhaka Stock Market Of Bangladesh. *ENBS Conference*, Oslo.

Morales L, Andreosso-O'Callaghan B (2014). The Global Financial Crisis: World Market or Regional Contagion Effects? *International Review of Economics andFinance.* 29: 108-131.

Nippani S, Washer K M (2004). SARS: A Non-Event for Affected Countries' Stock Markets? *Applied Financial Economics.* 14(15): 1105-1110.

OviI H, Mahmud N (2018). DSE Signs Strategic Partnership Agreement with Chinese Consortium, *Dhaka Tribune*. Retrieved from https://www.dhakatribune.com/business/stock/2018/05/14/dse-signs-strategic-partnership-agreement-with-chinese-consortium.

Pendell D L, Cho C (2013). Stock Market Reactions to Contagious Animal Disease Outbreaks: An Event Study in Korean Foot-And-Mouth Disease Outbreaks. *Agribusiness*. 29(4): 455-468.

Peterson P (1989). Event Studies: A Review of Issues and Methodology. *Quarterly Journal of Business and Economics*. 28(3): 36-66.

Rani N, Yadav S S, Jain P (2015). Impact of Mergers and Acquisitions on Shareholders' Wealth in the Short Run: An Event Study Approach. *Vikalpa*. 40(3): 293-312.

Ru H, Yang E, Zou K (2020). What Do We Learn from SARS-Cov-1 To SARS-Cov-2: Evidence from Global Stock Markets. *BOFIT Discussion Paper* No. 15/2020.

Schiereck D, Kiesel F, Kolaric S (2016). Brexit:(Not) another Lehman Moment for Banks? *Finance Research Letters*. 19(2016): 291-297.

Shan L, Gong S X (2012). Investor Sentiment and Stock Returns: Wenchuan Earthquake. *Finance Research Letters* .9(1): 36-47.

Sharpe W F (1963). A Simplified Model for Portfolio Analysis. *Management Science*. 9(2), 277-293.

Sharpe W F (1964). Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *The Journal of Finance*. 19(3): 425-442.

Shiller R J (2003). From Efficient Markets Theory to Behavioral Finance. *Journal of Economic Perspectives*. 17(1): 83-104.

Sochi M, Swidler S (2018). A Test of Market Efficiency when Short Selling is Prohibited: A Case of the Dhaka Stock Exchange. *Journal of Risk and Financial Management*. 11(4): 59.

Strong N (1992). Modelling Abnormal Returns: A Review Article. *Journal of Business Finance and Accounting*. 19(4): 533-553.

Subhani M I, Hasan S A, Mehar D, Osman M (2011). Are the Major South Asian Equity Markets Co-Integrated?.*International Journal of Humanities and Social Science*. 1(12): 117-121.

Suwanna T (2012). Impacts of Dividend Announcement on Stock Return. *Procedia-Social and Behavioral Sciences*. 40(2012): 721-725.

Vukkadala N, Qian Z J, Holsinger F C, Patel Z M, Rosenthal E (2020). COVID-19 and the Otolaryngologist: Preliminary Evidence-Based Review. *The Laryngoscope*. Forthcoming. Doi: 10.1002/lary.28672.

Wang Y H, Yang F J, Chen L J (2013). An Investor's Perspective on Infectious Diseases and Their Influence on Market Behavior. *Journal of Business Economics and Management*. 14(1): 112-S127.

World Health Organization (WHO) Situation Report on Coronavirus Disease 2019. https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200423-sitrep-94-covid-19.pdf. (Accessed in September 23, 2020).

Yen G, Lee C f (2008). Efficient Market Hypothesis (EMH): Past, Present and Future. *Review of Pacific Basin Financial Markets and Policies*. 11(2): 305-329.

Yilmazkuday H (2020). Covid-19 Effects on the S&P 500 Index. *SSRN*. Doi: 10.2139/ssrn.3555433.

Zaremba A, Kizys R, Aharon D Y, Demir E (2020). Infected Markets: Novel Coronavirus, Government Interventions, and Stock Return Volatility around the Globe. *Finance Research Letters*. 35(2020): 1-7.

Zeren F, Hizarci A (2020). The Impact of COVID-19 Coronavirus on Stock Markets: Evidence from Selected Countries. *Muhasebe ve Finans İncelemeleri Dergisi*. 3(1): 78-84.