



Evaluating the Effects of the COVID-19 Pandemic on Daily Market Return in Pakistan Stock Exchange

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ABSTRACT

The capital markets are highly interconnected in the modern economic system, and it is one of the most vulnerable sectors to any financial and natural disaster occurring around the globe. The COVID-19 pandemic not only affects the capital market of the host nation but also creates problems in other parts of the world's capital markets as well. The main objective of this event study is to empirically analyze the impacts of the COVID-19 pandemic on the daily stock market returns in Pakistan, which is a fast-growing and emerging market in South Asia. For this, we used secondary data to evaluate the effects of COVID-19 in different dimensions i.e., total cases, new cases, total deaths, new deaths, and the positive rate on the daily stock returns of 531 listed companies in the Pakistan stock exchange over the period of March 2020 to November 2021. For stationarity of the variables, we applied an augmented Dickey-Fuller (ADF) unit root test. The results of the study obtained through ARCH family regression estimation revealed that the total number of cases, new cases, and the positive rate are negatively affecting the stock market returns in Pakistan while the total deaths and new deaths are positively affecting the stock market returns during the pandemic.



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1. Introduction

COVID-19 is part of a large family of viruses (Coronaviruses) first outbreak in the city of Wuhan, Hubei Province of P.R. China in the month of December 2019 in the seafood market (Sohrabi et al., 2020) and afterward spread quickly in other regions of the World as well. On December 31, 2019, World Health Organization (WHO) implement health emergencies in the World for this rapid COVID-19 outbreak and on 11th March 2020 it recognized the virus as a global pandemic. The disease affects millions of people and more than 170 countries (WHO, 2020). This is the 5th pandemic that human beings are faced since the 1918 flu global attack. More than 55 million people died before this pandemic due to different global viruses (Y.-C. Liu, Kuo, & Shih, 2020). In February 2020, the Ministry of Health Pakistan confirmed the first case of the coronavirus in Karachi and the second one in Islamabad (Ali, 2020). The number of infected coronavirus patients reached 20 within 15 days. The sharing of Pakistan's economic,

religious, and environmental boundaries with Iran and China, the worst-hit states of COVID-19, brings Pakistan at substantial risk for the epidemic. During the COVID-19 breakout in Iran, a vast number of travelers return from Iran to Pakistan making it a border emergency (Waris, Atta, Ali, Asmat, & Baset, 2020). As a result of this widespread Pandemic, 308,458,509 confirmed cases and 5492595 deaths have been reported globally. Similarly in Pakistan, the total number of confirmed cases was 1305707 along with 28972 casualties (WHO, 2022).

The development of capital and financial markets is recognized as a major driver for economic growth. The novel Coronavirus (COVID-19) outbreak shocked the world and caused an unexpected wave of economic disorder in global financial markets after the great depression (Ahmed, 2020). The sudden outbreaks of COVID-19 significantly affect the national and global economy through disturbances in the World supply chain, decrease in production, and volatility in financial institutions (Maital & Barzani, 2020; McKercher & Chon, 2004). All countries worldwide use different policy tools to control the outbreak including travel restrictions, social distances, border closure, and lockdowns (Thunström, Newbold, Finnoff, Ashworth, & Shogren, 2020). These measures, however, decrease economic activities, reduce business, and profoundly impact stock exchange markets. The consequences of COVID-19 have been observed in the shape of economic downturns all over the globe, but the situation is more worsen in emerging and developing economies due to declining exports, inflation, and international debt (Hevia & Neumeyer, 2020).

Stock markets are extremely sensitive and quickly predict fluctuations in market return when any event occurs in the economy domestically or globally. Stock market performance during the past responses to major events i.e., disasters, news, political and environmental issues (Al-Awadhi, Alsaifi, Al-Awadhi, & Alhammedi, 2020). However, there is limited research on the extent to which pandemic diseases interact with stock market returns, particularly in Pakistan. The COVID-19 pandemic affects the globe socially and economically but its impacts on stock exchange markets are obvious and attract many researchers to explore this phenomenon at the country level for better future policy formulations. Pakistan is one of the most affected countries by this Pandemic and faces the serious issues of financial vulnerability, higher levels of inflation, and slower economic growth.

The Pakistani government has taken several steps such as the suspension of international travel, the closure of educational institutions, and the closure of schools in the province to reduce the outbreak that has harmed economic development. In such unexpected events or disasters, overall economic performance is anticipated to become worse because of public fears of declining financial activity, and profits, and the terrible emotions of traders. In regular marketplace benchmarks, we exhibit those consequences within side the shape of lower liquidity and return. Major events always affect the stock markets argued many researchers (Haque & Sarwar, 2013; Waheed, Sarwar, Sarwar, & Khan, 2020). The epidemic has also affected the US stock market (Baker, Bloom, Davis, & Terry, 2020). The effect of COVID-19 on the financial boom and inventory expenses and determined that affects aversion to inventory divisions (Gormsen & Koijen, 2020).

Pakistan Stock Exchange is one of the best-performing and leading stock exchanges in Asia consisting of 531 listed companies over 36 business sectors. Pakistan Stock Exchange is the combination of three stock exchange markets namely "The Karachi Stock Exchange" established in 1947, the Lahore Stock Exchange established in 1970 and the Islamabad Stock Exchange market established in 1989. Later, the Government of Pakistan merged these three markets into a single market named "Pakistan Stock Exchange Limited" (PSX) on January 11, 2016, with the main objective to facilitate investors to sell and purchase their bonds and securities in dependable, safe, and consistent trading environment. The main purpose of this research is to examine the effect of COVID-19 on stock market outcomes and performance in Pakistan, particularly the effects of total death, total cases, new cases, and positive rate on daily market

return, by answering the questions of 'how does Covid-19 affect the Pakistan Stock exchange or does the sudden outbreak of corona pandemic affect the stock markets in Pakistan or not?

2. Literature Review

In previous studies, researchers have investigated the impact of different epidemics on health (Gillani, Shafiq, Ahmad, & Zaheer, 2021) and a few researchers on stock market performance (Jiang et al., 2017; H. Liu, Manzoor, Wang, Zhang, & Manzoor, 2020). The COVID-19 pandemic outbreak was an extraordinary event in nature that force one-third of the world's population to lock down. Several studies have been initiated to measure the impact of the COVID-19 lockdown on stock market performance. Al-Awadhi et al. (2020) expressed that the rise in the daily number of confirmed cases and deaths rate negatively influences the stock returns of all firms listed in the stock exchange markets in China.

Similarly, another study initiated by Ashraf, Rizwan, and Ahmad (2020) observed that there exists a negative relationship between confirmed cases and market returns in 64 nations. Their study was based on examining the impact of COVID-19 on Islamic Equity Investments (IEIs) during the COVID-19 pandemic. Ding, Levine, Lin, and Xie (2020) play out their examination of corporate insusceptibility during the Coronavirus pandemic of 6,000 organizations in 56 nations that how coronavirus occurrences impact stock costs and corporate qualities in this situation. Ventures with more grounded pre-2020 funds, less pandemic weakness, fewer dug-in pioneers, and higher social obligation exercises saw a humble pandemic-actuated stock value drop, as per the exploration.

Alfaro, Chari, Greenland, and Schott (2020) also observed a negative relationship between coronavirus and stock return in USA firm-level analysis. They attempt to clarify why startling varieties in the Coronavirus direction contaminations are estimating securities exchange returns in the USA. This finding was based on a sample of 4, 070 firms listed in the United States indicating that if the projected infections are reported to be doubled in media, then the next day aggregate US market returns are decreased and vice-versa. Although all Firms face losses, the losses are much deeper in the companies or industries which are highly conducive to disease transmission. Similarly, Zhang, Hu, and Ji (2020) in their comprehensive study confirm this negative association between COVID-19 and stock market returns in the Japan, Korean, and Singapore stock markets.

Schoenfeld (2020) analyzed the danger component concerning monetary business sectors and pandemics. The Coronavirus pandemic is utilized as a characteristic investigation in the review to perceive how monetary business sectors respond to huge pandemics. The discoveries show that supervisors misjudge pandemic-related danger when contrasted with SEC-ordered danger models, bringing about a drop in business esteem around here. For Pakistan-specific studies, while assessing the impact of COVID-19 on the stock market Waheed et al. (2020) inspected the influence of covid on the Karachi stock exchange (KSE) and found contradicting results as compared to other studies. They concluded that KSE-100 index stock returns and COVID-19 have a positive relationship due to the timely intervention and policies of the government.

Another study by Ahmed (2020) determines the impact of COVID-19 on the performance of the Pakistani Stock Market during the first half of 2020. This study uses the data of COVID-19 related to several positive cases, fatalities, recovers, and the closing prices of the PSX 100 index. The findings of the study suggest that only COVID-19 recoveries are influencing the performance of the index and the daily positive cases and fatalities are insignificantly related to the performance. Ellahi and Ahmad (2021) investigated the impact of COVID-19 on different listed companies' stock market returns in Pakistan over the period of December 2019 to October 2020 by using panel data fixed effect model. The results of the study revealed that only

healthcare industries and a few essential profitable industries show positive daily market returns while all other industries' daily market return decreases during COVID-19.

Shehzad, Xiaoxing, and Kazouz (2020) reported that the restrictive fluctuation of financial exchanges between Europe and the USA is enormous for the span of the time Coronavirus related to the worldwide money-related emergencies (GFC) of 2007–2009. Fallahgoul (2020) set up that the monetary section is the greatest dicey, while wellness is the most extreme confident over the Coronavirus pandemic. He, Sun, Zhang, and Li (2020) asserted that creation, records period, tutoring, and wellness care in Chinese areas stayed stable during Coronavirus. Gu, Ying, Zhang, and Tao (2020) found that the Chinese creation area turned out to be not hit using crown emergency, yet creation, records move, pc administrations and programming, and wellness care and social work had been decidedly impacted via Coronavirus.

From the above-said literature review, it is obvious that the COVID-19 pandemic and related lockdown adversely affects stock market returns in COVID-19-affected nations. However, we have truly little information about the impact of COVID-19 on the Pakistan stock exchange market which is rapidly emerging as well as Pakistan successfully managed this Pandemic and reviving the stock market. This gap in the literature and the potential development of the Pakistan stock market and government policies motivated us to initiate this study. This study contributes to the existing literature related to COVID-19 and its impacts on Pakistan Stock Exchange and for better future policy implications.

2.1 Research Question

Pakistan's financial markets are emerging but not as developed as other developed markets. It is also observed that the financial markets in Pakistan also suffered from volatility issues in the past like terrorist attacks, political instability, and speculations. Pakistan is a developing country and facing many challenges like poverty, inflation, and debt crisis. The literature review confirmed that COVID-19 adversely affects stock exchange markets in all regions of the World due to high transmissions of COVID-19, but their results are different from region to region. Moreover, the existing studies on Pakistan selected an exceedingly small period and produce inconclusive results. We in this research want to empirically analyze the impact of COVID-19 on stock market returns in Pakistan. Based on the literature review and statement of the purpose, we in this study try to answer the following questions.

- How is COVID-19 transmitted and affected Pakistan?
- Does the sudden outbreak of the Novel Coronavirus or COVID-19 affect the daily return of the stock market in Pakistan?

2.2 Hypothesis

Based on the above literature review and research questions, we in this study try to validate the following hypothesis.

H₁: Total number of cases not affecting the stock market returns.

H₂: The New cases are not affecting the stock market returns.

H₃: Total number of deaths is not affecting the stock market returns.

H₄: New deaths are not influencing the stock market returns.

H₅: Positive rates are not affecting the daily stock market returns.

3. Data, Variables, and Model Specifications

3.1 Data

The study used high-frequency secondary data from March 18, 2020, to October 26, 2021, obtained from the Pakistan Stock Exchange data set and our World in Data Website. In this paper, the daily market return is used to measure the performance of the stock exchange market in Pakistan. In this study, five explanatory variables measuring COVID-19 were taken to evaluate their impact on stock market returns. To smooth and normalize the data, we take the natural logarithms of all the variables except the positive rate. The details of the variables and data sources are expressed in Table 1.

Table 1
The Detail of the Variables

Variable	Notion	Role	Description of Variable	Data Source
Daily Returns	DR	Dependent variable	Daily return of the market, we measure it as the log difference between the closing price of the market and the opening price of the market.	Pakistan Stock Exchange (PSX, 2021)
Total Cases	TCS	Independent variables	Total number of cases reported. These are the total cases accumulated daily.	Our World in Data (2021)
New Cases	NC		New cases are reported daily. This figure comes out after the COVID testing of the people daily.	
Total Death	TD		The total number of deaths. accumulated daily.	
New Death	ND		The number of deaths reported daily.	
Positive Rate	PR		Positive rate of the screening test.	

3.2 Model Specifications

Based on the literature review, the main objective of this study is to determine the impact of COVID-19 on the daily return of the Pakistani stock exchange market during the pandemic. Our econometric model can be expressed as follows.

$$DR_{it} = \alpha + \beta_1 TCS_{it} + \beta_2 NC_{it} + \beta_3 TD_{it} + \beta_4 ND_{it} + \beta_5 PR_{it} + \varepsilon_{it} \quad (1)$$

Here, DR represents the daily return of the market, measured as the difference between the opening price of the stock market and the closing price of the market. This measure is extensively used in literature to measure the performance of the stock exchange market. We take daily returns to measure the Pakistan exchange market volatility by following Bora and Basistha (2021). TCS is the total number of COVID-19 cases, NC represents the new cases diagnosed daily, TD is the total number of deaths due to COVID-19, ND is the new deaths reported daily due to COVID-19, PR is the number of positive cases and ε_{it} is the error term in the model.

3.3 Estimation Techniques

To get empirical results, this study applied Autoregressive Conditional Heteroscedasticity (ARCH) family regression to measure the impacts of COVID-19 on daily stock market return by following Brooks, Faff, McKenzie, and Mitchell (2000). The ARCH-family estimation is robust, and it has been extended well as compared to the initial ARCH model presented by Engle (1982) and the GARCH model presented by Bollerslev (1986). These additions in the ARCH family model have attempted to refine the mean and the variance equations for better understanding and capture the stylized features of the high-frequency data as our data is present. For this

estimation, first, we assure the stationarity of the data. We use the Augmented Dicky Fuller unit root test to check the stationarity of the data.

The ARCH/GARCH model is extensively used in the financial market to measure market returns. Engle (1982) proposed the concept of autoregressive conditional heteroscedasticity (ARCH). This model says that the variance of the error term at one time depends upon the squared error terms from previous periods. In financial time series analysis, researchers widely use this model to measure stock market volatility. This model is allowed the variance of residuals (shocks) to depend upon their history. In this model, all our explanatory variables are stationary at lag1.

4. Results and Discussion

The results of the study are explained with the help of descriptive analysis, correlation matrix, graphical analysis, and regression analysis.

4.1 Descriptive Analysis

Descriptive statistics of the study have been reported in Table 2. There is a total 605 number of observations shown in the second column, the third and fourth columns are devoted to showing the mean value and the standard deviation of the variables. The extreme values i.e., maximum and minimum values of the data are expressed in the last two columns. The mean value of the daily return of the market is negative with a higher level of dispersion which shows a higher level of volatility in market return. All indicators of COVID-19 i.e., total cases, new cases, total deaths, new deaths, and positive rate have a stable pattern.

Table 2
Descriptive Statistics

Variable Name	Obs.	Mean Value	Std. Dev.	Minimum	Maximum
DR	605	-22	381	-1502	2200
Total Cases	605	581150	397401	454	1279373
New Cases	605	2114	1625	0	12073
Total Deaths	605	12775	9043	2	28595
New Deaths	605	47	38	0	313
Positive Rate	604	.069	.049	.011	.256

Table-3, express the pairwise correlation matrix. A pairwise Covariance matrix is used to determine the nature of the relationship (positive or negative) between two variables. The positive values represent that both variables are varying in the same direction and the negative values represent that the two values are varying in opposite directions. Total cases, new deaths, and total deaths are positively correlated with stock market return while new cases and positive rates are negatively correlated with stock market return. The value of the off-diagonal represents the covariance of each pair of variables and the values of principal diagonals represent the covariance of individual variables. The results show no evidence of multicollinearity. The values of the principal diagonal are equal to 1 and all off-diagonal values are lower than 0.80.

Table 3
Pairwise Correlations

Variables	R	TCS	NC	ND	TD	Positive rate
R	1.000					
TCS	0.018	1.000				
NC	-0.019	0.436	1.000			
ND	0.014	0.398	0.847	1.000		
TD	0.025	0.799	0.435	0.401	1.000	
PR	-0.071	-0.414	0.278	0.347	-0.421	1.000

For stationarity, the result obtained through the ADF unit root test revealed that all the variables are stationary at 1st difference. Total cases, new cases, new deaths, and the positive rate is significant at the 1 percent level while total deaths and daily return are significant at the 5 percent level.

Table 4
The Results of ADF-Unit Root Test

Variables	At Level		At 1 st Diff.		Nature
	T-statistics	P-value	T-statistics	P-value	
R	-1.841	0.657	-3.766	0.036**	I(I)
Log TCS	1.543	0.970	-3.402	0.000*	I(I)
Log NC	-3.000	0.970	-12.286	0.000*	I(I)
Log ND	-2.760	0.212	-16.101	0.000*	I(I)
Log TD	2.472	0.997	-2.895	0.046**	I(I)
PR	-2.248	0.190	-2.508	0.000*	I(I)

*H0 is rejected at 1 percent level of significance, **H0 is rejected at 5 percent level.

4.2 Graphical Analysis

In the graphical analysis, different diagrams show the trend of variables used in this study. Graph 1 shows that over the period total covid cases increased rapidly during the coronavirus outbreak. Graph 2 shows the relationship between stock market returns and total covid cases. There is a negative relationship between these two variables in this study. As covid cases increase stock market returns fluctuate gradually. The Blue bottom line shows the trend of stock market returns that vary near to zero value and decrease slowly as total covid cases increase over the period.

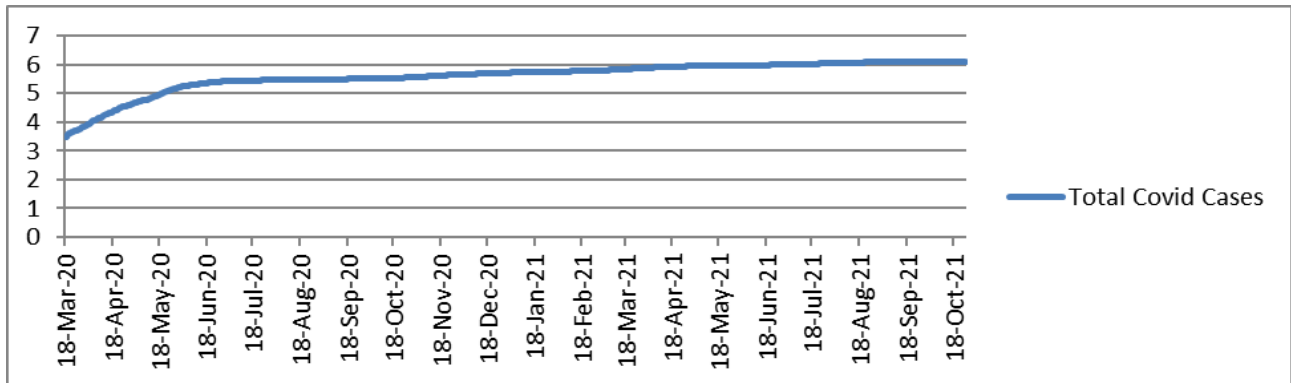


Figure 1: Total Covid-19 Cases

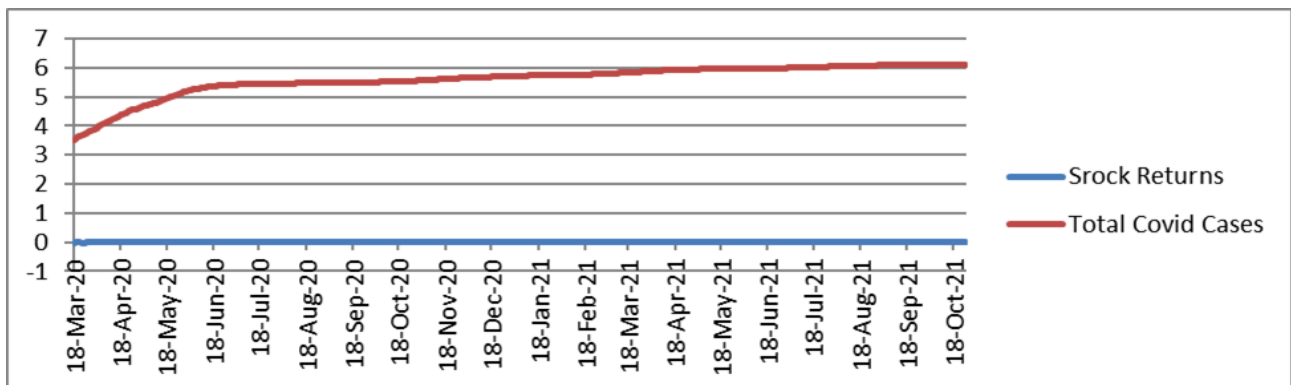


Figure 2: Stock Market Returns and Total Covid-19 Cases

Graph 3 shows that the period covid new cases move ups and down during the coronavirus outbreak. Graph 4 shows the relationship between stock market returns and covid new cases reported. There is a negative relationship between these two variables in this study. As covid new cases increase stock market returns decrease gradually. The Blue bottom line shows the trend of stock market returns that vary near to zero value and fluctuate slowly over the period as covid new cases increase over the period.

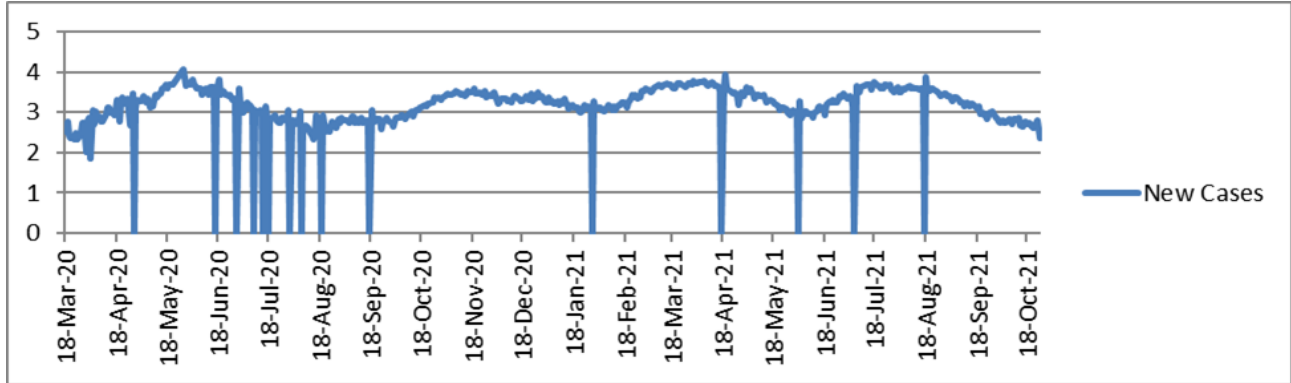


Figure 3: New Cases Reported

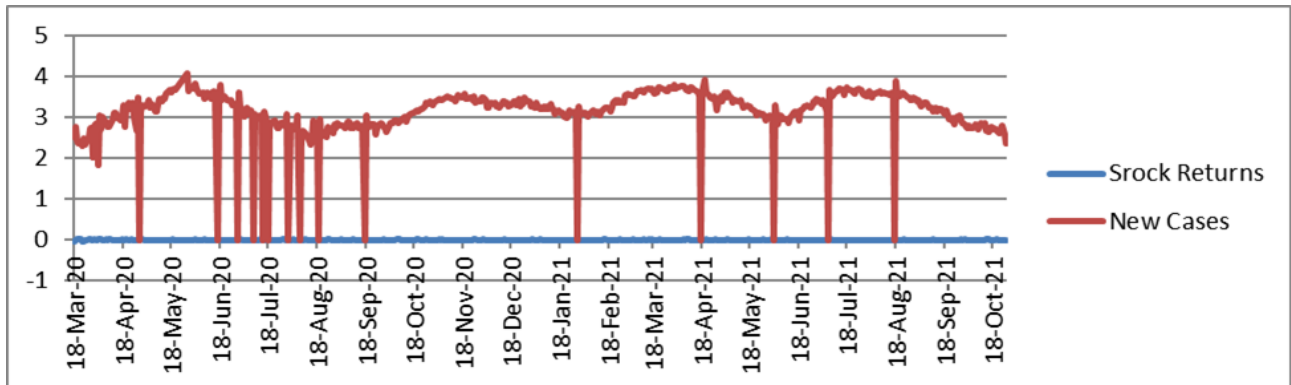


Figure 4: Stock Market Returns and New Cases Reported

Graph 5 shows that over some time total deaths increase during the coronavirus outbreak. Graph 6 shows the relationship between stock market returns and total deaths. There is a positive relationship between these two variables in this study. As total deaths increase, stock market returns gradually increase. The Blue bottom line shows the trend of stock market returns that vary near to zero value and increase slowly over the period as covid total deaths increase over the period.

Graph 7 shows that over a period, new deaths increase during the coronavirus outbreak. Graph 8 shows the relationship between stock market returns and new deaths. There is a positive relationship between these two variables in this study. As new deaths increase, stock market returns gradually increase. The Blue bottom line shows the trend of stock market returns that vary near to zero value and increase slowly over time as new deaths increase over time.

Graph 9 shows that over the period covid positivity rate during the coronavirus outbreak. Graph 10 shows the relationship between stock market returns and covid positivity rate. There is a negative relationship between these two variables in this study. As the covid positivity rate decreases, stock market returns gradually increase. The Blue bottom line shows the trend of stock market returns that vary near to zero value and stock market returns increase slowly as the positivity rate decreases over the period.

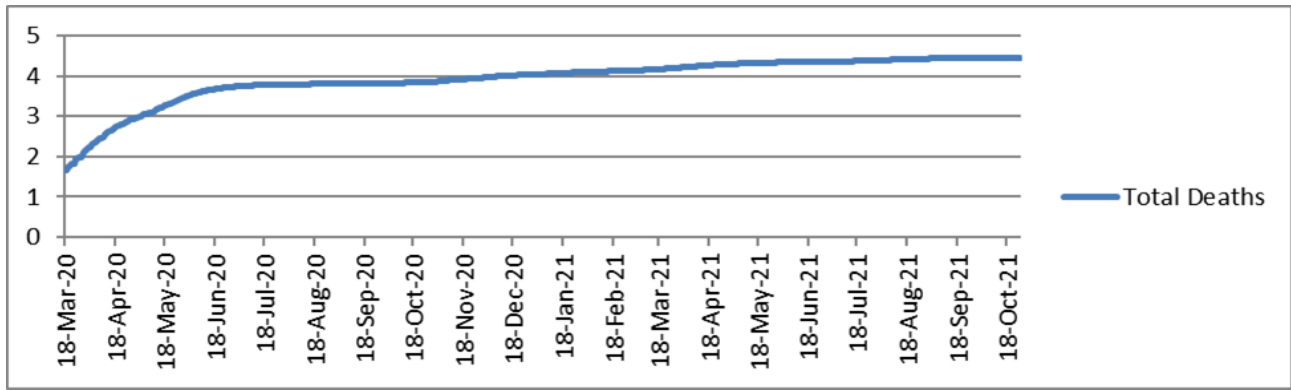


Figure 5: Total Deaths

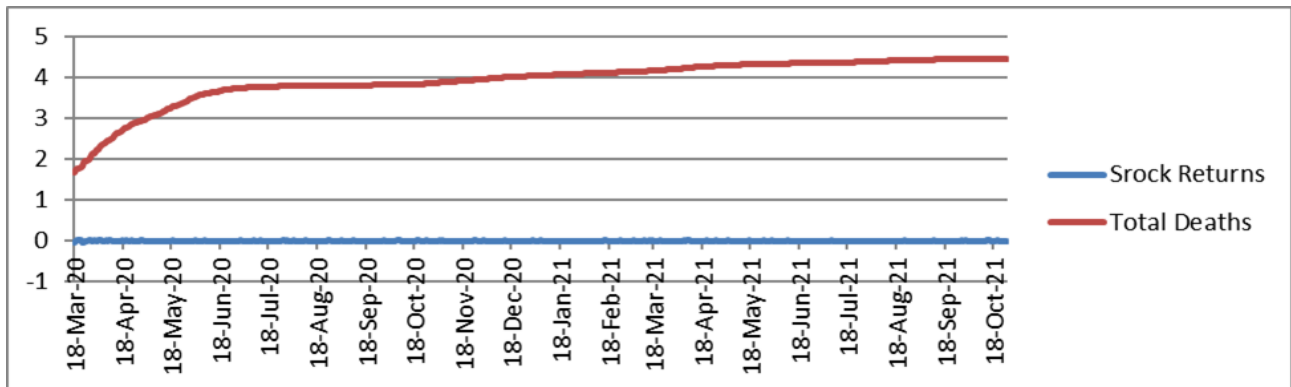


Figure 6: Stock Market Returns and Total Deaths

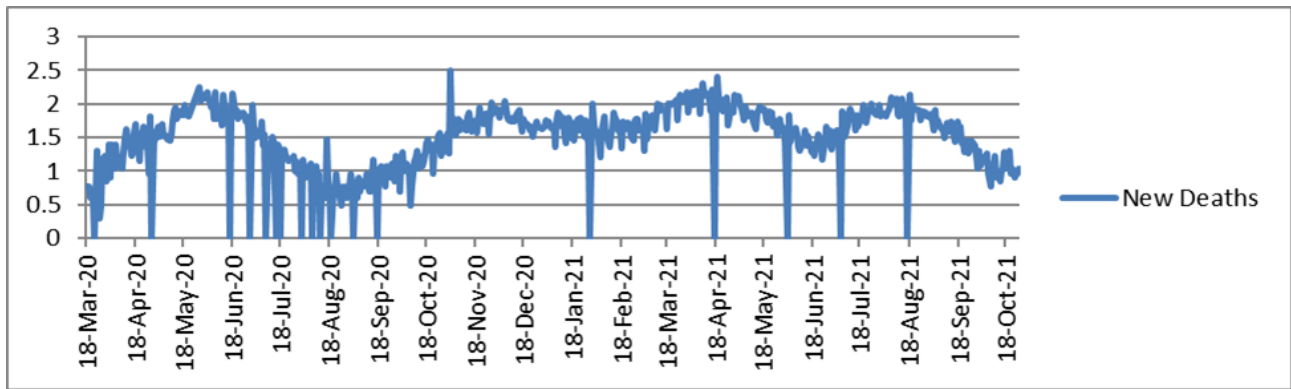


Figure 7: New Deaths

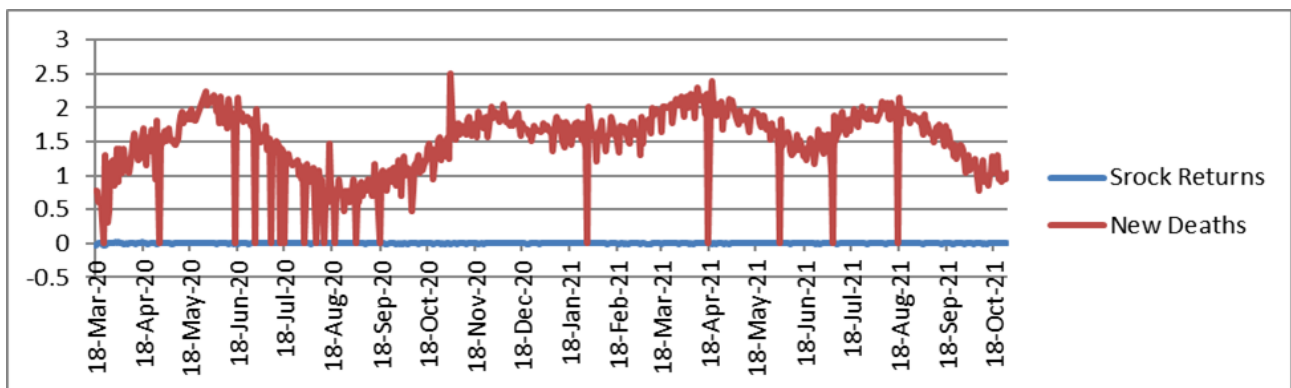


Figure 8: Stock Market Returns and New Deaths

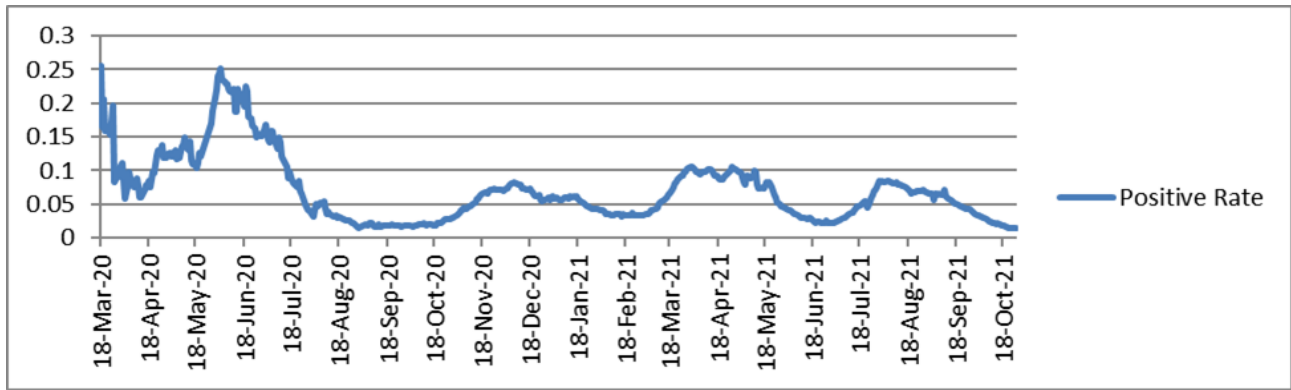


Figure 9: Positivity Rate

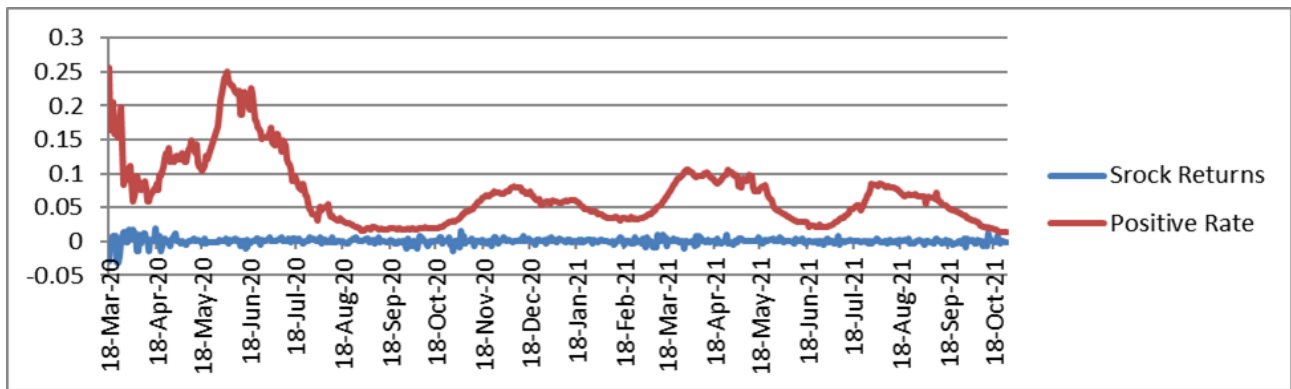


Figure 10: Stock Market Returns and Positivity Rate

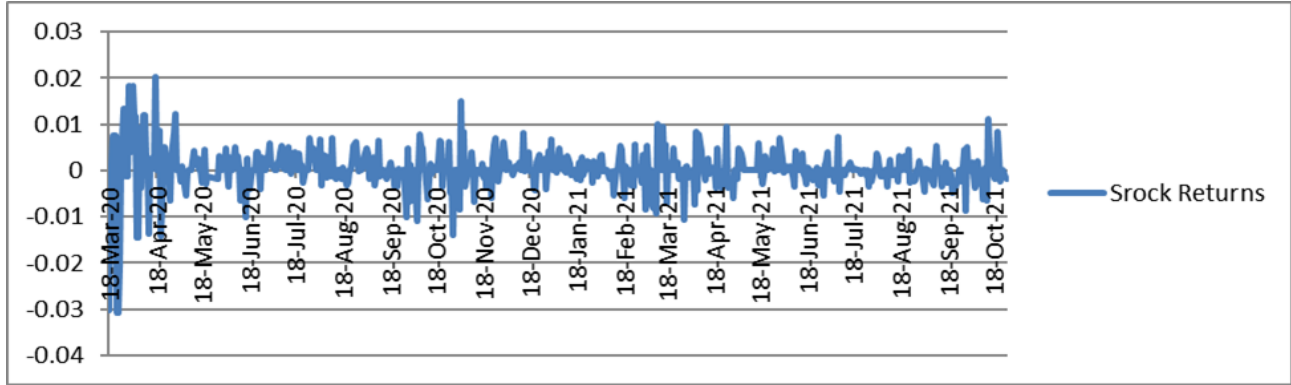


Figure 11: Stock Market Returns

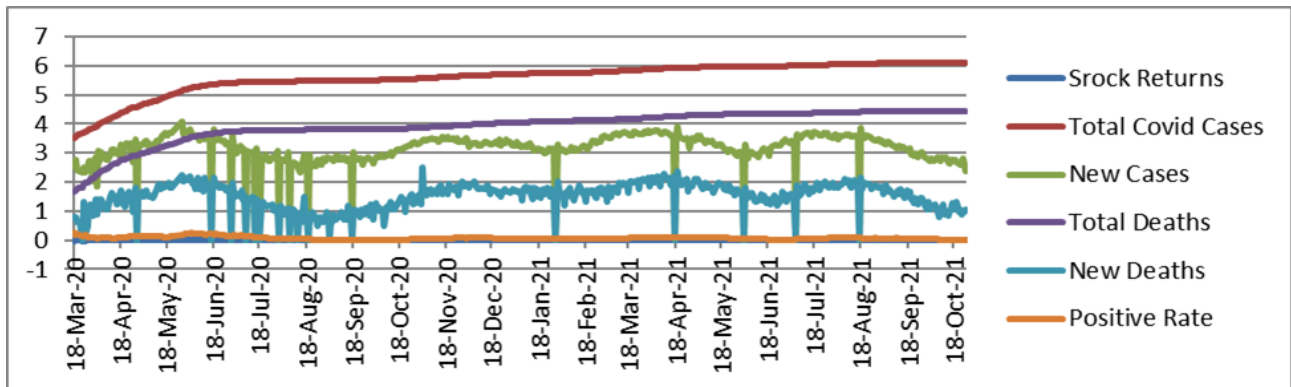


Figure 12: Overall Variables Relationship

Graph 11 shows the huge fluctuation in the stock market returns during covid outbreak over a period. Graph 12 shows the relationship between dependent and independent variables. Three variables show negative, and two variables show a positive relationship with stock market returns. The overall trend of variables is plotted in Figure 12.

4.3 Estimation Results

The result of the ARCH family regression is reported in Table 5. The result of the study revealed that COVID-19 has a significant effect on the daily stock market return of all listed companies in the Pakistan Stock Exchange. The total number of cases, new cases, and positive rate of the test decrease the daily market return. These results are significant at a one percent level of significance and our proposed first, second, and fifth null hypotheses are rejected. The coefficient values of these variables represent negative shocks in stock market return and reduce daily market return. Our results are matched with the results of Alfaro et al. (2020); Bora and Basistha (2021) and Stefan, Birkenfeld, Schulze, and Ludwig (2020), which concluded that COVID-19 negatively affects the performance of the stock exchange. Moreover, Ellahi and Ahmad (2021) also found the negative impact of COVID-19 on market return in Pakistan. But the findings of our study are different than the result of Ahmed (2020) which concludes that in Pakistan daily positive rate and death rate are insignificant and Waheed et al. (2020), which concludes that COVID-19 has no effects on the Karachi stock exchange market. The probable reason may be the small sample size and the different estimation techniques used by these studies.

Table 5
Results of Autoregressive Conditional Heteroscedasticity (ARCH) Family Regression

Sample	18-Mar-20-26-Oct-21 with Gaps		Number of Obs. = 393			
Distribution	Gaussian		Wald chi2(5) = 211.34			
Log-likelihood	1528.446		Prob > chi2 = 0.0000			
Variables	Coefficient	Std. Error	Z	p> z	95% Conf. Interval	
Log TCS	-0.328	0.005	-6.15	0.000	-0.043	-0.023
Log NC	-0.002	0.0008	-2.72	0.007	-0.003	-0.001
Log ND	0.003	0.001	4.20	0.000	0.001	0.005
Log TD	0.029	0.005	5.44	0.000	0.019	0.040
Positive Rate	-0.019	0.005	-3.36	0.001	-0.031	-0.008

Source: Authors' own calculation

This study also found a positive relationship between the total number of deaths and new deaths with the stock market return. The coefficient of the variables shows positive shocks in the stock market return volatility. These results are significant at a one percent level of significance and reject our third and fourth null hypotheses that new deaths and total deaths are not affecting stock market return. Our study also highlighted that the overall negative shock of COVID-19 on Pakistan stock exchange market return is dominant over the positive shock. This overall negative impact of COVID-19 on the stock market return volatility also has been observed in the Indian stock exchange (Bora & Basistha, 2021). The main reason for this overall negative impact of COVID-19 is that foreign investors withdraw their foreign portfolio investments in Pakistan and the lockdown decrease industrial production which also built pressure on the stock market and their company's returns.

5. Conclusion and Policy Implications

In this paper, we try to see the impacts of COVID-19 on the returns of the Pakistan stock exchange market which is an emerging exchange market in South Asia. The empirical results were obtained through ARCH family regression estimation while using the data from March 2020 to November 2021. After making a comprehensive descriptive and graphical analysis, the result revealed that with higher negative mean returns, the stock market faces losses during the pandemic. Our study findings matched with previous literature. COVID-19 has influence globally

markets badly but in the case of Pakistan, it has shown a minimal effect on the stock market returns of PSX. Pakistan is a developing country with low income and people have strong religious beliefs. Meanwhile, the government of Pakistan tried its best to overcome the severe influence of covid outbreak by introducing smart lockdown policies and provisions for vaccinations.

The result of the study shows that COVID-19 has collapsed the backbone of the financial market in Pakistan. To recover and boost up the stock market in Pakistan, proper policy measures and liquidity injections are required from the government otherwise this crisis would have been the worst. Many investors feel the sale and purchase decision is exceedingly difficult after COVID-19 as the prices of the stock are high. To overcome the uncertainty in the stock market in Pakistan, investors must have to shift their investment from a bleak prospect to the bright one like the pharma pharmaceutical sector. A financial market is a key market to represent the economic conditions of a nation. For sustainable and inclusive economic growth government should provide financial assistance to highly affected destroyed sectors of COVID-19.

In further research, one can investigate the impact of COVID-19 on the sentiment of investors and the share value of registered companies in the stock market as well along with other macroeconomic variables. In the policy outlook, there is a need to increase the facilities and modern mechanisms for investors that will improve the market capitalization in the stock market.

Author contribution

Musarat Abbas: study design, data analysis, methodology, preparing original draft
Muhammad Mansha: study design, data collection, graphical visualization, drafting
Saeed ur Rahman: critical revision, incorporation of intellectual content, editing

Conflict of Interests/Disclosures

The authors declared no potential conflicts of interest w.r.t the research, authorship and/or publication of this article.

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