International Journal of Innovation, Creativity and Change. www.ijicc.net
Volume 17, Issue 1, 2023

Pakistan's Leading Stock Exchange and COVID-19 Nexus: Evidence from Quantile Regression Analysis

Tahir Munir[1], Rabia Al Mamlook[2], Abdu R Rahman[3], David Paul Suda[4], Asma Faraz[5], [1]Department of Anaesthesiology, The Aga Khan University, Karachi 74800 Pakistan, [2]Department of Industrial and Manufacturing Engineering, Western Michigan University, Kalamazoo, United States. Department of Aeronautical engineering Al Zawiya University, Al-Zawiya City, Libya, [3]Institute for Global Health and Development, The Aga Khan University, Karachi 74800 Pakistan, [4]Department of Statistics and Operations Research, University of Malta, Imsida 2080, Malta, [5]Department of Anaesthesiology, The Aga Khan University Hospital, Karachi 74800 Pakistan. Email: [1]tahirmunir677@yahoo.com, [2]Rabiaemhamedm.almamlook@wmich.edu, [3]abdur.rahman@stat.qau.edu.pk, [4]david.suda@um.edu.mt, [5]asma.hasnain@aku.edu

The contagious pandemic COVID-19 outbreak has disrupted numerous economic and business activities worldwide. This study focuses on COVID-19's effects on KSE-100 index (Karachi stock exchange), which is a part of a developing country. From 2 March 2020 to 9 November 2021, COVID-19 confirmed, recovered and deaths cases were taken as covariates for the COVID-19. To explore the conditional distributional impact of COVID-19 on KSE-100, we employ robust quantile regression analysis with detailed asymmetric evidence. The results show that the confirmed and recovered cases have a significant positive impact on KSE-100 whereas expired cases having a significant negative influence. These findings contradict previous studies in the world, which claimed that COVID-19 had a negative impact on developed stock markets while aligning with a vast literature of Pakistan stock exchange. It seems that as the result of timely policy implemented by the government of Pakistan. For investors, these findings are robust, which leads to providing practical policy to combat such circumstances in the future.

Keywords: *COVID-19 and stock market, quantile regression, Pakistan stock market and pandemic.*

Introduction

In December 2019, the infectious disease Coronavirus (2019nCOV) or COVID-19 first appeared in Wuhan, Hubei Province, China (cf., WHO, 2020 [1]). It has spread faster than other viruses since its discovery in January 2020, and it has quickly gained worldwide attention. The Chinese government's reaction to the new virus was to completely shut down Wuhan, the disease's epicenter. This was later proven to be an effective method of pandemic control in various countries around the world. To stop the spread of the disease, the entire city was shut down on January 23, 2020, (cf., Guardian, 2020 [2]). With approximately 9.1 million COVID-19 positive cases reported worldwide and 472,539 deaths, South Korea is the second country to be hit by a COVID-19 pandemic, following China. Hopkins, year 2020. Since the disease's emergence, positive and death cases have been increased.

COVID-19 was declared a global epidemic by the World Health Organization on March 11, 2020, affecting over 170 countries (cf., WHO, 2020 [1]). The COVID-19 outbreak has the potential to be remembered as a watershed moment in the history of an underappreciated threat. Therefore, the mainstream market risk outlets and the urgent climate change problem have piqued the interest of corporate decision-makers and policymakers. Curfews and other major personal life disturbances are occurring in Pakistan and other countries. There is widespread fear, in addition to the obvious tragedies of death and illness (to a large-scale buying of everyday goods). Because the epidemic's spread, scope, mortality rate, policy responses, and human behavior are all unknown, the economic impact of COVID-19 is unknown.

According to economists, the COVID-19 is expected to slow global economic growth by 0.15% points in 2020, resulting in $135 billion in delayed or unproduced goods and services. Three factors will determine how the virus affects travel, consumer buying, production, and trade this year: first, how quickly it spreads and how long it lasts; second, how much fear affects travel, consumer buying, production, and trade; and third, what policymakers do to prevent the virus from spreading and improve productivity. In this instance, the stock marketplace can help determine which companies' creditors are most affected by the virus outbreak's direct and indirect effects, as well as which companies are unlikely to be affected. As a result, the stock exchange provides a constantly updated and much-welcomed snapshot of what the markets believe will be the epidemic's long-term economic impact. Since the Great Depression, COVID-19 disease had surprised the worldwide economy and financial markets, posing a serious threat to economic and financial sustainability, and has become a hot topic for researchers. Few studies, however, have looked at the impact of lockdown and compared relative analysis during the COVID-19 spread. On a larger scale, preventive measures like increasing social distance and blocking have worked, but at the expense of lower store sales and the closure of various businesses.

The recession in COVID-19 has had an impact on the global stock market. On almost every continent, the pandemic's infectious effect on the global stock market can be seen, Li *et al.* (2020) [3], Li *et al.* (2020) [4], He *et al.* (2020) [5], Gao et al. (2022) [6], and Zhang *et al.* (2022)

[7], a few cited therein. Taking inspiration from the aforementioned research, we are investigating the impact of the COVID-19 pandemic on the performance of the KSE-100 index. The primary objective of the study is to explore the Karachi stock market performance in COVID-19 pandemic. Secondly, using the advance quantile regression model to determine the asymmetric distributional behavior of the stock market in Pakistan.

The remainder of the study is structured as follows: A overview of the literature is in Section 2. Section 3 describes the study model and the subsequent methodology, while Section 4 discusses the empirical findings and Section 5 contains a conclusion and policy recommendation.

Literature review

This section is based on some relevant research studies that investigated the stock market's behaviour in various countries during the COVID-19 challenging situation.

He *et al.* (2020) [5] made an effort to investigate the direct effects and knock-on effects of COVID-19 on stock markets. They empirically analysed daily return data from stock markets in the People's Republic of China, Italy, South Korea, France, Spain, Germany, Japan, and the United States of America. They performed conventional t-tests and non-parametric Mann-Whitney tests. Their findings demonstrated that i) COVID-19 has a short-term, negative impact on stock markets in affected countries and (ii) that there are bidirectional spillover effects between Asian, European, and American countries from the impact of COVID-19 on stock markets. Ashraf (2020) [8] investigated how the COVID-19 epidemic affected the stock markets. He examined daily COVID-19 confirmed cases, deaths, and stock market returns data from 64 nations between January 22, 2020, and April 17, 2020, and discovered that the increase in COVID-19 cases had a negative impact on stock markets. The short-term effects of the coronavirus outbreak on 21 top stock market indexes in significant affected nations, such as Japan, Korea, Singapore, the USA, Germany, Italy, and the UK, were assessed by Liu *et al.* (2020) [9]. Global stock markets have been directly impacted by the serious effects of infectious disease. Results showed that following the viral outbreak, stock markets in significant affected countries and regions plummeted sharply. Countries in Asia had greater negative anomalous returns as compared to other countries. Wild swings in the pricing of stock market risk, caused by changes in risk aversion or sentiment, are predicted by Cox *et al.* (2020) [10] based on estimates from a dynamic asset pricing model. They discovered additional proof that the Federal Reserve was responsible for these changes in the form of a string of announcements outlining unprecedented actions to stimulate the economy with several trillion dollars in loans. With regard to significant daily stock market changes going back to 1900 and to overall stock market volatility going back to 1985, Baker *et al.* (2020) [11] developed these points using text-based approaches. Additionally, they looked into possible explanations for the extraordinary stock market response to the COVID-19 epidemic. The evidence they gathered suggested that the primary causes of the U.S. stock market's significantly stronger response to COVID-19 than to previous pandemics in 1918–1919, 1957–1958, and 1968 were governmental restrictions on commercial activity and voluntary social distance, operating with significant effects in a service-oriented economy. The empirical relationship between COVID-19 fear and stock market volatility was examined by Li *et al.* (2020) [3]. To calculate the stock market volatility brought on by the COVID-19 pandemic, they employed AR (1) - GARCH (1,1). The findings showed that, on average, throughout the pandemic, there was an increase in COVID-19 cases of 1%, and that, as a result, the stock return and GDP growth declined by 0.8% and 0.56%, respectively. Iyke and Ho (2021) [12] determined at the type of exposure to exchange rates in South Africa before and during the COVID-19 pandemic. They demonstrated that, when compared to sectors, industries were more vulnerable to the risk of fluctuating exchange rates during the pandemic than they were before. They also demonstrated that industries and sectors are most negatively impacted by exchange rate exposure. Herwany *et al.* (2021) [13] investigated the impact of the COVID-19 pandemic on stock market returns in Indonesia found that had an overall negative impact on the stocks on the Indonesian stock exchange as measured by the average abnormal return sample.

Materials and Methods

Data Sources

This section discusses the study's methodology in terms of data and sample, research model, and variable classification. The relationship between COVID-19 and the Karachi stock exchange is investigated in this study. The data for COVID-19 was obtained from the World Health Organization (WHO), and the data for the KSE-100 index was obtained from the Karachi Stock Exchange (*https://www.psx.com.pk/).* The COVID-19's chosen period corresponds to the peak time of occurrence of cases. However, we used COVID-19 and KSE data from March 2, 2020, to November 9, 2021, excluding the value of official holidays. We examined the impact of COVID-19 on the KSE-100 index using the current data, which included descriptive statistics. Table 1 represents the variables with their classification and description.

Table 1: Specification of variables

Variable	Specification	Period	Source
KSE-100 closing	Karachi Stock Exchange	2 Mar. 2020 to 9 Nov. 2021	https://www.psx.com.pk/
Confirmed Cases	COVID-19 Active Cases	2 Mar. 2020 to 9 Nov. 2021	https://www.who.int/
Recovered	COVID-19 Recovered Cases	2 Mar. 2020 to 9 Nov. 2021	https://www.who.int/
Expired	COVID-19 Expired Cases	2 Mar. 2020 to 9 Nov. 2021	https://www.who.int/

The Quantile Regression Model

If the estimated coefficients differ significantly from zero and OLS coefficients, then QR becomes one of the most appropriate methods to use, revealing different effects across the dependent variable's distribution.

Given that the distribution function of any real-valued random variable X can be described as

$$F(x) = Pr(X \leq x), \quad (1)$$

the θ^{th} quantile, for $0 < \theta < 1$, is defined as

$$Q(\theta) = \text{Inf}\{x: F(x) \geq \theta\}, \quad (2)$$

where $\{X\}$ is a random variable, and the probability distribution function in Eq. (1). An observation in the $\{\theta^{th}\}$ percentile is greater than θ% percent of the total number of observations but less than (1- θ)% percent of the total number of observations, according to the definition of quantile.

Let (y_i, x_i) be a sample from a population, with $\{i = 1,2,3, \dots, n\}$, and y_i a real outcome variable of interest and x_i a vector of regressors that includes policy variables. A linear form for general quantile regression is described by Koenker and Bassett (1978) [14]:

$$y_i = x_i\beta_\theta + \varepsilon_\theta, \quad (3)$$

for $i = 1,2,3, \dots, n$, where β is a $(k \times 1)$ vector of coefficients, $\{x_i\}$ is the column vector corresponding to the transposition of the i^{th} row of the $\{X_{n\times k}\}$ matrix of explanatory variables, $\{y_i\}$ is the i^{th} dependent variable observation, and ε_θ is the unknown error term in the presence of $\{x\}$, the i^{th} conditional quantile of $\{y\}$ can be rewritten as

$$\text{Qunant}_\theta = (y_i|x_i) = x'\beta_\theta. \quad (4)$$

The continuous increase in the conditional distribution of $\{y\}$ given $\{x\}$ is traced out. The conditional quantile of $\{y_i\}$, conditional on $\{x_i\}$, is assumed to satisfy $\text{Qunant}_\theta = x'\beta_\theta$, for several different values of θ, $\theta\epsilon(0,1)$, resulting in $\text{Qunant}_\theta = (y_i|x_i) = 0$. This allows for parameter heterogeneity across different types of regressors using quantile regression. As a result, the quantile regression estimator can be used to solve the minimization problem described below:

$$\min_{\beta\epsilon\mathcal{R}^K}\left[\sum_{i\epsilon\{i:y_i\}>x_i\beta}\theta|y_i - x'\beta| + \sum_{i\epsilon\{i:y_i\}>x_i\beta}(1-\theta)|y_i - x'\beta|\right]. \quad (5)$$

The quantile function is a weighted sum of the absolute value of the residuals. Where the weights are symmetric for the median regression case in $\theta = 1/2$, the minimization problem above reduces to $\min_{\beta\epsilon\mathcal{R}^K}\sum_i^n|y_i - x'\beta|$, otherwise, it's asymmetric. By changing the value of parameter between 0 and 1, we may produce the whole conditional distribution of dependent variable say - Y given independent variable(s) say - Xs. The marginal change in the dependent variable as a result of a marginal change in the policy variable can be deduced from the partial derivative of the conditional quantile of Y with respect to one of the regressors, the coefficients of the policy variable. Because we have one for each, the quantile regression approach enables us to determine the effects of the covariates on the regress and at various percentiles on the distribution of the study variable. One appealing quality of the quantile regression estimator is its resilience in accounting for the existence of outlier observations on the dependent variable, for more details, Koenker and Bassett (1978) [14].

Econometric Model

Most studies, however, including Ding *et al.* (2021) [15], Indrastuti *et al.* (2021) [16], and Nurcahyono *et al.* (2021) [17]. This illustrates how COVID-19 has affected all enterprises and corporate firms' equity on a global scale. As a result, this study assumes that COVID-19 has a detrimental effect on the KSE-100 index based on prior research.

In light of earlier discussion and the studies by Li *et al.* (2020) [3] and Ding *et al.* (2021) [15], the general model developed is as follows:

$$KSE - 100_t = f(Confirmed\ Cases_t, Recovered\ Cases_t, Expired\ Cases_t) \quad (6)$$

The following describes the regression model that was developed from the general model mentioned above:

$$KSE - 100_t = \beta_0 + \beta_1\ \text{Covid} - 19\ \text{Confirmed Cases}_t + \beta_2\ \text{Covid} - 19\ \text{Recovered Cases}_t + \beta_3\ \text{Covid} - 19\ \text{Expired Cases}_t + \varepsilon. \quad (7)$$

COVID-19 new cases are denoted by confirmed cases, and COVID-19 deaths are represented by expired cases, where the dependent variable is the KSE-100 index closing value of the stocks for companies with large market capitalization, denoted by (KSE-100), and the $'t'$ in the subscript denotes the time of each variable daily in this case.

Results and Discussion

We analyzed the descriptive statistics of the data presented in Table 2 before proceeding on to the study's main findings. The average number of COVID-19 cases reported each day was 615981.8; those that were recovered were 333661.1, and there were on average 13556 mortalities. At the same time, the KSE-100 index has a daily average value of 41967.3.

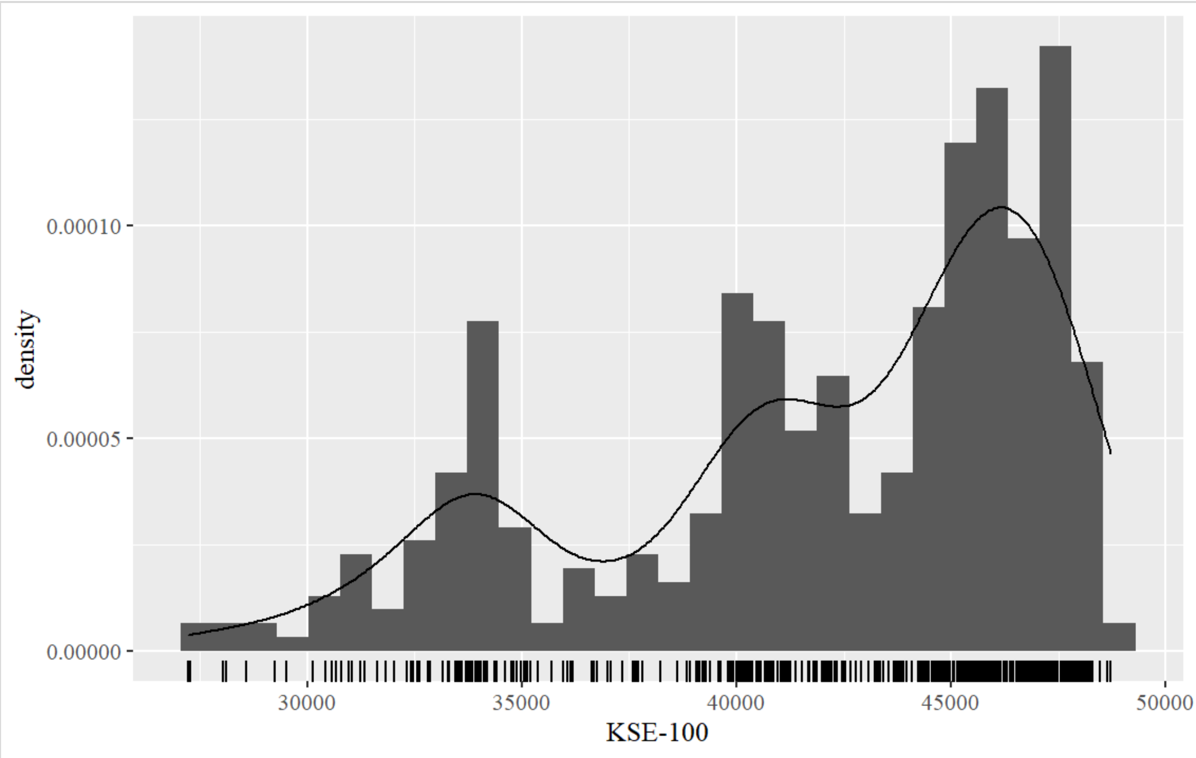

Figure 1: Histogram of KSE-100 Index Distribution

For the three COVID-19 variables, which account for 542122.50 confirmed cases, 298324 recovered cases, 11591.5 deaths, and greater as compared to mean, 43693.22 KSE-100 index, the median values are presented as being lower than the mean values. The lowest and highest (confirmed, recovered) cases of COVID-19 of during stage of COVID-19 were reported as (1938.0, 0.0) and (1287703, 952616), respectively. In COVID-19 time, KSE-100 index reached out at peak with 48726.08 index value while declined in 27228.8 index.

Table 2: Descriptive Statistics Analysis

Statistic	KSE.100	Confirmed Cases	Recovered Cases	Expired Cases
Mean	41967.3	615981.8	333661.1	13555.6
Std. deviation	5244.56	407820.90	304771.96	9286.31
Median	43693.22	542122.50	298324.00	11591.50
Min	27228.8	1938.0	0.0	26.0
Max	48726.08	1287703.00	952616.00	28793.00
Skew	-0.81	0.27	0.51	0.30
Kurtosis	-0.42	-1.21	-0.92	-1.27
Jarque-Bera	49.06	30.341	32.684	34.074
Probability	0.0000	0.0000	0.0000	0.0000

It can be seen fluctuations around the average values for all the considered variables in terms of standard deviation (SD) for confirmed cases 407820.90, recovered cases 304771.96, expired cases 9286.31 as well as for KSE-100 index 5244.56. In addition, the values for skewness and kurtosis have also been given, demonstrating the non-normality of the data. For each variable, the results of the combined skewness-kurtosis Jarque-Bera normalcy test are shown in the same Table 2. These values show that all three COVID-19 variables—confirmed, recovered, and expired cases—as well as the KSE-100 index reject the null hypothesis of data being normally distributed when skewness and kurtosis are not zero, revealing that the data for these variables are not normally distributed. The p-values for these variables are less than the 5% level of significance as a benchmark. Based violation normality assumption, the classical regression models are not appropriated to determine the nexus of COVID-19 covariates and KSE-100 index. Therefore, quantile-based regression modeling is the wise approach.

These findings point to the potential information gains from estimating the entire conditional KSE-100 index distribution rather than just the conditional mean. Furthermore, an evaluation of the estimated conditional median function with OLS estimates of the conditional mean function exposes that the tails of the data distribution affect traditional estimation techniques. These findings support the theory that the relationship between the explanatory variables all KSE-100 index has a different effect on KSE-100 index levels across quantiles.

Table 3: Parameters Estimates at different quantiles level.

Quantiles	COVID-19 Cases	Coef.	Std. Err.	t-value	P-value	[95% Conf. Interval]	
$Q_{0.10}$	Confirmed	0.0744	0.0139	5.35	<0.001	0.0470	0.1017
	Recovered	0.0061	0.0003	19.66	<0.001	0.0055	0.0067
	Expired	-2.7913	0.6086	-4.59	<0.001	-3.9877	-1.5949
$Q_{0.20}$	Confirmed	0.0710	0.0080	8.84	<0.001	0.0552	0.0868
	Recovered	0.0059	0.0004	16.18	<0.001	0.0052	0.0066
	Expired	-2.6617	0.3530	-7.54	<0.001	-3.3557	-1.9677
$Q_{0.30}$	Confirmed	0.0636	0.0063	10.04	<0.001	0.0511	0.0760
	Recovered	0.0058	0.0005	11.67	<0.001	0.0049	0.0068
	Expired	-2.3263	0.2783	-8.36	<0.001	-2.8733	-1.7792
$Q_{0.40}$	Confirmed	0.0633	0.0078	8.09	<0.001	0.0479	0.0787
	Recovered	0.0056	0.0007	8.11	<0.001	0.0043	0.0069
	Expired	-2.3087	0.3451	-6.69	<0.001	-2.9871	-1.6303
$Q_{0.50}$	Confirmed	0.0693	0.0092	7.50	<0.001	0.0511	0.0874
	Recovered	0.0064	0.0006	11.31	<0.001	0.0053	0.0075
	Expired	-2.5736	0.4007	-6.42	<0.001	-3.3612	-1.7858
$Q_{0.60}$	Confirmed	0.0646	0.0152	4.24	<0.001	0.0346	0.0946
	Recovered	0.0065	0.0009	6.90	<0.001	0.0046	0.0084
	Expired	-2.3858	0.6483	-3.68	<0.001	-3.6603	-1.1114
$Q_{0.70}$	Confirmed	0.0397	0.0167	2.38	0.018	0.0069	0.0726
	Recovered	0.0052	0.0010	5.03	<0.001	0.0032	0.0073
	Expired	-1.3393	0.7118	-1.88	0.061	-2.7385	0.0598
$Q_{0.80}$	Confirmed	0.0334	0.0192	1.74	0.082	-0.0042	0.0711
	Recovered	0.0043	0.0010	4.28	<0.001	0.0023	0.0063
	Expired	-1.1068	0.8293	-1.33	0.183	-2.7370	0.5234
$Q_{0.90}$	Confirmed	-0.0283	0.0164	-1.73	0.084	-0.0605	0.0038
	Recovered	0.0049	0.0006	7.93	<0.001	0.0037	0.0061
	Expired	1.6124	0.7161	2.25	0.025	0.2049	3.0198
OLS	Confirmed	0.0577	0.0068	8.46	<0.001	0.0443	0.0711
	Recovered	0.0061	0.0004	16.72	<0.001	0.0054	0.0068
	Expired	-2.0917	0.2999	-6.97	<0.001	-2.6814	-1.5021

The estimated coefficients are computed at different quantile levels with their 95% confidence intervals (IC) and p-value which are presented in Table 3 and Fig. 5. It can be observed that confirmed/new cases are significantly positive impact on KSE-100 index across all the quantiles i.e. $Q_{0.10}$ to $Q_{0.80}$ excepting $Q_{0.90}$ where non-significant negative impact. For instance, when investigated the impact of confirmed cases at lower level of quantile - $Q_{0.10}$, its coefficient value is 0.0744 with 95% IC (0.0470-0.1017) with $p<0.001$ which means that a unit increase in COVID-19 confirmed cases significantly increased the KSE-100 index by 0.0744 units. Similarly, for middle ($Q_{0.50}$), upper ($Q_{0.80}$) quantiles and OLS estimates with 95% ICs, 0.0693 (0.0511 - 0.0874), 0.0334 (-0.0042 - 0.0711), and 0.0577 (0.0443 - 0.0711), respectively, increasing the KSE-100 index.

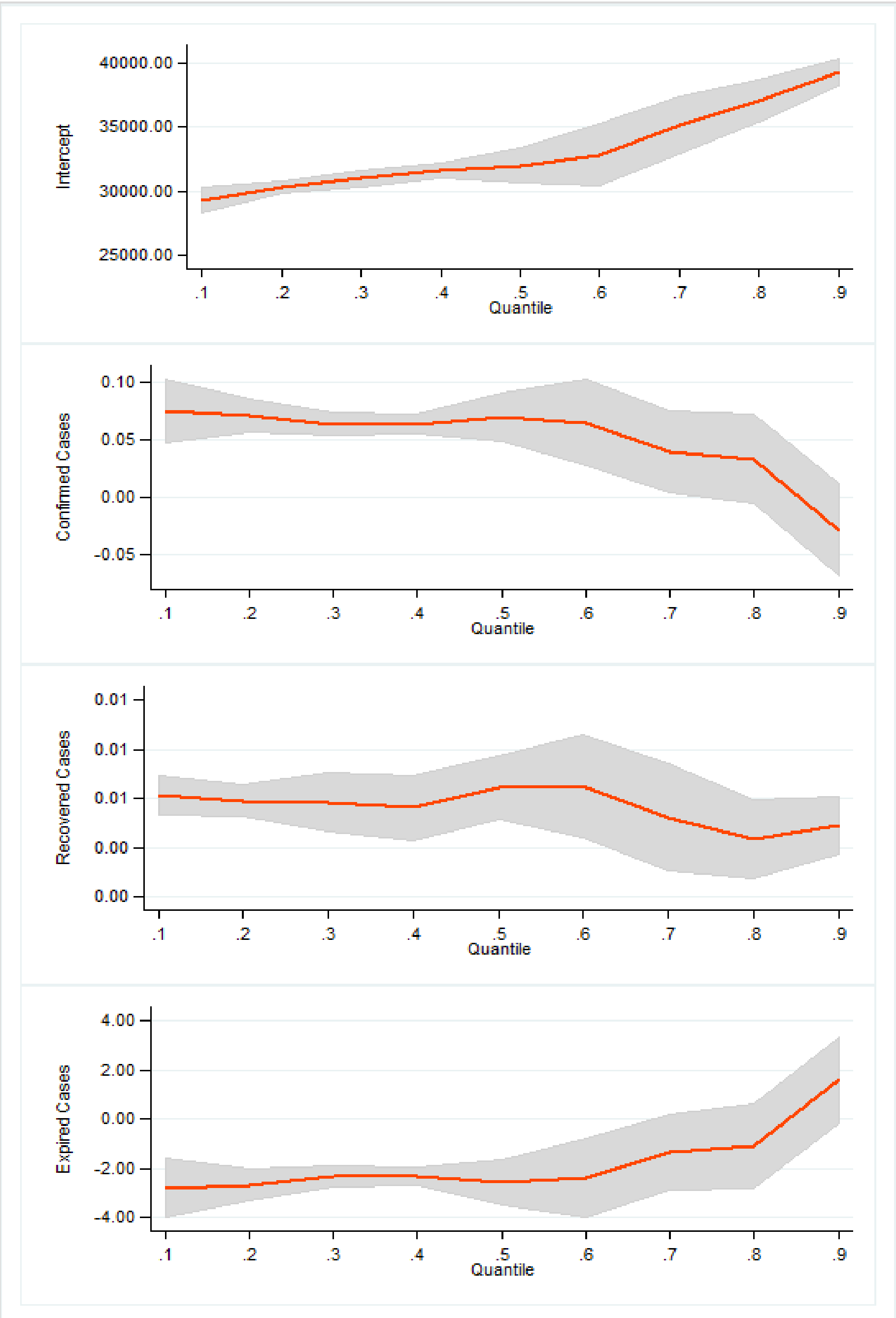

Figure 2: Plot of the estimated parameters along different quantiles with 95% confidence

A throughout from $Q_{0.10}$ to $Q_{0.90}$ as well as OLS results showed the significantly positive impact of COVID-19 recovered cases in increasing the KSE-100 index. For the brevity of discussion, three different levels of the amount of increment in KSE-100 index due to recovered cases courted here, see at $Q_{0.20}$ noted 0.0059 with 95% CI (0.0052 – 0.0066), at $Q_{0.60}$ noted 0.0065 95% CI (0.0046 - 0.0086), at $Q_{0.80}$ 0.0043 noted 95% CI (0.0023-0.0063), and at OLS noted 0.0061 95% CI (0.0054 – 0.0068), respectively. In contrast of the above results, only the expired cases contributing the declination of KSE-100 index which were significant at the below $Q_{0.70}$ quantiles while above not significant behaves. OLS estimate also showing the significant negative behavior. For instance, representing in form of ($Q_{0.30}$, $Q_{0.60}$, $Q_{0.90}$, OLS) noted as (-2.3263, -2.3858, -1.1068, -1.5021) which is highly decreasing trend with the respective quantiles of the values of KSE-100 index in COVID-19 pandemic days. Hence, it is concluded that both the COVID-19 confirmed and recovered cases are secure to the KSE-100 index while hazardous due to COVID-19 expired cases. Our empirical results are consistent with Waheed *et al.* (2020) [18] studied that COVID-19 confirmed cases positively influences the stock market. In addition, we explored the recovered cases positively while expired cases negatively associated with the KSE-100 index.

The impact of COVID-19 on the KSE-100 index in Pakistan, which is one of the most highly valued developing stock markets, is investigated in this study. The importance of studying the dynamics of the Pakistan stock market cannot be overstated. It explains how investors behave in developing economies and what actions are required to recover investments made in developing stock markets.

Conclusion

This article examines the quantiles-based impact of COVID-19 on the stock market performance of the Pakistan main stock market - Karachi stock exchange. Studies from the past have demonstrated that the pandemic is negatively affecting stock markets in developed economies. This study used of daily data from 2 March 2020 to 9 November 2021 and performed econometric techniques, such as quantile regression and OLS as a robust regression model, to determine whether the COVID-19 confirmed, recovered, and expired cases influence the KSE-100 index performance. On the other hand, the stock market of developing economies, such as Pakistan, has reported an opposite trend in terms of COVID-19 confirmed and recovered cases significantly increasing the performance of the KSE-100 index while expired cases significantly decreasing the performance of the KSE-100 index across all the quantile levels. The results are robust, which leads to offering useful policy implications that highlight the need to update health-finance-related regulations and financial literacy programs to address such situations in the future.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The authors received no financial support for the research, authorship, and/or publication of this study.

References

WHO | Coronavirus disease (COVID-19) outbreak [Internet]. 2020. Available from: https://www.who.int/emergencies/diseases/novel-coronavirus-2019.

Guardian, T. (2020, January 23). Coronavirus: panic and anger in Wuhan as China orders city into lockdown. Retrieved from The Guardian: https://www.theguardian.com/world/2020/jan/23/coronavirus-panic-and-anger-in-wuhan-aschina-orders-city-into-lockdown.

Li, C., Su, C. W., Altuntaş, M., & Li, X. (2022). COVID-19 and stock market nexus: evidence from Shanghai Stock Exchange. *Economic Research-Ekonomska Istraživanja*, 35(1), 2351-2364.

Li, W., Chien, F., Kamran, H. W., Aldeehani, T. M., Sadiq, M., Nguyen, V. C., & Taghizadeh-Hesary, F. (2022). The nexus between COVID-19 fear and stock market volatility. *Economic research-Ekonomska istraživanja*, *35*(1), 1765-1785.

He, Q., Liu, J., Wang, S., & Yu, J. (2020). The impact of COVID-19 on stock markets. *Economic and Political Studies*, *8*(3), 275-288.

Gao, X., Ren, Y., & Umar, M. (2021). To what extent does COVID-19 drive stock market volatility? A comparison between the US and China. *Economic Research-Ekonomska Istraživanja*, *35*(1), 1686-1706.

Zhang, N., Wang, A., Haq, N. U., & Nosheen, S. (2022). The impact of COVID-19 shocks on the volatility of stock markets in technologically advanced countries. *Economic Research-Ekonomska Istraživanja*, *35*(1), 2191-2216.

Ashraf, B. N. (2020). Stock markets' reaction to COVID-19: Cases or fatalities. *Research in International Business and Finance*, *54*, 101249.

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.

Cox, J., Greenwald, D. L., & Ludvigson, S. C. (2020). *What explains the COVID-19 stock market?* (No. w27784). National Bureau of Economic Research.

Baker, S. R., Bloom, N., Davis, S. J., Kost, K., Sammon, M., & Viratyosin, T. (2020). The unprecedented stock market reaction to COVID-19. *The Review of Asset Pricing Studies*, *10*(4), 742-758.

Iyke, B. N., & Ho, S. Y. (2021). Exchange rate exposure in the South African stock market before and during the COVID-19 pandemic. *Finance Research Letters*, 102000.

Herwany, A., Febrian, E., Anwar, M., & Gunardi, A. (2021). The influence of the COVID-19 pandemic on stock market returns in Indonesia stock exchange. *The Journal of Asian Finance, Economics and Business*, *8*(3), 39-47.

Koenker, R., & Bassett Jr, G. (1978). Regression quantiles. *Econometrica: journal of the Econometric Society*, 33-50.

Ding, W., Levine, R., Lin, C., & Xie, W. (2020). Corporate immunity to the COVID-19 pandemic (No. w27055). *National Bureau of Economic Research*.

Indrastuti, D. K. (2021). Impact of Confirmed, Death, and Recovered Cases of COVID-19 Toward Stock Exchange Composite Index. *Review of Integrative Business and Economics Research*, *10*, 1-10.

Nurcahyono, N., Hanum, A. N., & Sukesti, F. (2021). The COVID-19 outbreak and its impact on stock market returns: Evidence from Indonesia. *Jurnal Dinamika Akuntansi Dan Bisnis*, *8*(1), 47-58.

Waheed, R., Wei, C., Sarwar, S., & Lv, Y. (2018). Impact of oil prices on firm stock return: Industry-wise analysis. Empirical Economics, 55(2), 765–780. https://doi.org/10.1007/s00181-017-1296-4.