Journal of Applied Economics and Business Research
JAEBR, 12(2): 80-97 (2022)

The Effect of COVID-19 on the Stock Market Performance: Empirical Evidence for Turkish Economy

Pınar Avcı [1]
Tekirdag Namik Kemal University, Turkey

Murat Çetin
Tekirdag Namik Kemal University, Turkey

Abstract

The aim of the study is to examine the relationship between the COVID-19 pandemic and stock market performance under the structural break in case of Turkey for the period from April 10, 2020 to March 19, 2021. Here, the confirmed cases, deaths, tests and recoveries during COVID-19 pandemic were carried out as the COVID-19 pandemic variables. The obtained empirical findings indicated that i) the series were integrated at I(1), ii) the series were cointegrated in the presence of structural break, iii) the confirmed number of cases and deaths reduced the stock market performance, while the confirmed number of tests and recoveries enhanced the performance of the stock market under the structural break, and iv) in the long run the bidirectional causality among the confirmed number of cases, deaths and recoveries with stock market performance and the unidirectional causality running from the confirmed number of tests to stock market performance were found. In brief, the study's empirical results could provide several policy suggestions to governments, policy makers, investors and risk managers to take several precautions that decreased the negative effects of the epidemics on the Turkish stock market performance.

Keywords: COVID-19; stock market performance; structural break; ARDL; VECM causality

JEL Codes: E44, F62, G10, C32

1.Introduction

Over two decades, the world experienced SARS in 2002-2003, MERS in 2012 and the third epidemic COVID-19 that occurred on 11 March 2019, caused by the coronavirus (Yang et al., 2020). The World Health Organization (WHO) declared the coronavirus (COVID-19) as global pandemic never seen before March 11, 2020. The COVID-19 pandemic appeared in the city of Wuhan, China in December 2019 (WHO, 2020; Wilder-Smith and Osman, 2020). Until the World Health Organization announced a Public Health Emergency of International Concern for COVID-19 on January 30, 2020, it had been confirmed 7736 cases and 179 deaths in China and 107 cases in 21 other countries (Wilder-Smith and Osman, 2020).

The COVID-19 epidemic, which spread rapidly and increased in severity in the world in 2020, had several impacts on social-economic areas such as economy (Nicola et al., 2020; Witteveen, 2020), financial market (Uddin et al., 2021; Zhang and Hamori, 2021), trade

[1] Correspondence to Pınar Avcı, Email: pavci@nku.edu.tr

(Gruszczynski, 2020) and education (Chick et al., 2020). In addition, Anh and Gan (2021) revealed that the financial sector was among the most affected sectors during the COVID-19 pandemic. The precautions taken in the COVID-19 pandemic process led to the fears of financial recession and economic crisis in countries and they influenced financial markets and economic development (Yousfi et al., 2021; Zhang and Hamori, 2021).

Turkish economy was among the countries seriously affected from COVID-19. To cope with the effects of this epidemic, The Central Bank of the Republic of Turkey took and announced several measures related to financial markets and real sector on 17 March, 31 March and 17 April 2020. The policy rate was decreased by 100 basis points from 10.75 percent to 9.75 percent on 17 March 2020. The other precautions contained supplying flexibility in Turkish Lira and foreign currency liquidity management, securing the credit flows to real sector and supporting exporters with rediscount credits. Additionally, the households and companies were supported through fiscal policy (The Central Bank of the Republic of Turkey, 2021). These developments pointed out the importance of COVID-19 pandemic in Turkish economy.

Based on the above considerations, the study aimed to investigate the relationship between the COVID-19 and stock market performance in Turkish economy from the period April 10, 2020 to March 19, 2021. There exist several reasons for choosing Turkish economy. Firstly, Turkey is well known as an emerging economy. The Turkish economy expanded by roughly 5% in the period 2001-2018. Secondly, Turkey had been most negatively affected during the pandemic. Considering the confirmed cases in the last 7 days, Turkey (189,173) was ranked fourth among USA (488,665), Russia (281,163), and UK (272,932). Following Russia (8,198), USA (7,511), Ukraine (3,942), Romania (3,062), India (2,654), Mexico (1,613) and Brazil (1,590), Turkey (1,526) was ranked as the eight biggest economy for the confirmed deaths in the last 7 days. Thirdly, there exists no studies focusing on Turkish economy. For example; Chen et al. (2009) and Chen et al. (2007) investigated the effect of SARS on the stock market performance in Taiwanese, Al-Awadhi et al. (2020) examined the relationship between the COVID-19 cases and deaths and Chinese stock market return, O'Donnel et al. (2021) studied the relationship between COVID-19 cases and deaths with China, Spain, Italy, the United Kingdom and the United States, Xu (2021) determined the relationship between the growth of COVID-19 cases and stock return in Canada and US. Thus, this study differed from previous studies and provided several contributions to the literature. In addition, there existed very few time-series studies analysing this relationship and the time series studies did not present the results with structural break. The researchers employed the Phillips Perron (PP), Augmented Dickey Fuller (ADF) tests and Vogelsang-Perron test with one structural break to check the stationarity of series. The researchers performed the ARDL bounds test and Johansen cointegration technique to detect the long-term relationship among the variables. The long-run coefficients were determined through the Fully Modified Ordinary Least Squares (FMOLS) and Canonical Cointegrating Regressions (CCR) estimators. Finally, the Vector Error Correction Model (VECM) Granger causality test was conducted to investigate the causality between the variables. The empirical results indicated the findings of five stock market performance models handled in the study and provided important policy suggestions for Turkey.

The most important innovation of this study was to examine long-term and causal effects of COVID-19 variables on stock market performance. For this reason, this study utilized the ARDL bounds testing approach to cointegration and VECM Granger causality test. Many studies are investigated and the time-series studies didn't apply such an empirical methodology. Additionally, the second innovation was that Turkey as an emerging economy was investigated in the study.

 ISSN 1927-033X

The rest of this study was organized as follows: Section 2 indicated the literature review. Section 3 clarified the data and model, Section 4 showed the methodology, Section 5 demonstrated the findings and discussion. Finally, Section 6 summarized our results and policy suggestions.

2. Literature Reviews

Some studies on epidemics such as SARS, Swine Flu, MERS, Ebola Virus, and Zika Virus revealed that these epidemics negatively influenced the stock market (Loh, 2006; Nippani and Washer, 2004; Chen et al. 2007; Chen et al., 2009; Ichev and Marinč, 2018). Loh (2006) found that the SARS declared by WHO in 2003 adversely affected the performance of the listed airline firms in Canada, China, Hong Kong, Singapore and Thailand. Nippani and Washer (2004) indicated that the SARS affected in a negative way the stock market value in China and Vietnam while it did not have a negative impact on stock market in Canada, Hong Kong, Indonesia, Philippines, Singapore and Thailand. Chen et al. (2007) and Chen et al. (2009) concluded that the SARS outbreak had a negative impact on the Taiwan stock market and Taiwanese hotel stock performance. Ichev and Marinč (2018) showed that the Ebola virus found out in 2014 was negatively correlated the stock market returns in the USA from 2014 to 2016.

The COVID-19, which also emerged in Wuhan, China, caused disruptions in global financial markets in February 2020 by affecting the real economy (Caferra and Vidal-Tomas, 2021). In this context, many researchers investigated the effect of COVID-19 on stock market performance. For example, Mazur et al. (2021) searched the impact of March 2020 crash caused by COVID-19 on the stock market performance by conducting a panel data analysis of 1,500 firms in the USA. The results determined that March 2020 shock increased the performance of firms in the food, health, software and natural gas sectors while it decreased the performance of firms in oil, entertainment and real estate sectors.

Yousfi et al. (2021) analysed the impact of the COVID-19 on the stock market and uncertainty between the first wave and second wave by utilizing the GARCH model in the USA. The findings demonstrated that COVID-19 cases and deaths damage the stock market between January 13, 2020 and 21 September, 2020. This result was similar to the findings of Yılmazkuday (2023), who investigated the impact of COVID-19 cases on the S&P 500 index in the USA between January, 21st 2020 and August, 6th 2020 by applying the SVAR approach and revealed that a 1% increase in the daily COVID-19 cases reduced the S&P 500 index by 0.01%. Xu (2021) examined whether the growth rate of COVID-19 cases influenced the stock markets return in the USA over the period January 21-July 2, 2020 and in Canada between January 27 and July 2, 2020 through the GARCH model and VAR approach. The findings showed that the stock market returns were negatively related to the growth in COVID-19 cases. He et al. (2020a) searched the effects and spreads of COVID-19 on the China, Japan, the USA, Spain, Italy, Germany, France and South Korea stock markets from June 1, 2019 to March, 16-2020. By utilizing the conventional *t*-test and nonparametric Mann-Whitney tests, they indicated that this pandemic reduced the stock markets returns and its spread impact was directional among countries.

Takyi and Bentum-Ennin (2021) studied the effect of COVID-19-stock market performance link for 13 African countries from 1st October 2019 to 30th June 2020. The Bayesian posterior estimates showed that the COVID-19 decreased the performance of stock market between 2.7% and 21% in African countries. These results were similar to the findings of Guo et al. (2021) for 21 countries by applying the FARM method and detailed dynamic network model. Sharma et al. (2021) explored the link among COVID-19 cases, stock market return, temperature and exchange rates in the most influenced 15 countries between February 1, 2020 and May 13, 2020. The study revealed that COVID-19 cases influenced the stock market returns and exchange rates in a negative way in the long run. Uddin et al. (2021) investigated the impact of COVID-19 on the stock market volatility by including economic factors such as economic strength, corporate governance level, monetary policy ratio, quality of health system and density of capitalism for 34 developed and developing countries. The findings of GARCH model showed that an increase in COVID-19 cases and deaths decreased the stock market returns.

Ashraf (2020a) looked into the link between the COVID-19 cases and stock market returns with the panel daily data from 43 countries over the period January 22, 2020-April 17, 2020. The findings obtained from the study specified the presence of negative link between the variables. This finding was supported by Ashraf (2020b) for 64 countries. Topcu and Gulal (2020) examined the effect of COVID-19 contagious on the stock market return for 26 developing countries over the period March 10-April 30, 2020. Regression results showed that the COVID-19 cases had an adverse impact on stock market. Similar findings were reported by Al-Awadhi et al. (2020).

By using the panel fixed effect regression model, Erdem (2020) revealed that an increase in the total number of cases and deaths decreased the stock market performance of 75 countries over the period January 20-April 30, 2020. These findings were confirmed by Harjoto et al. (2021), who used the daily data from 53 developing and 23 developed countries between January 14, 2020 and August 20, 2020. Finally, Salisu et al. (2020) sought the effect of uncertainty and fear of the COVID-19 pandemic on the emerging stock market by utilizing the panel data from 24 emerging economies and 21 developed economies over the period May 10-June 17 2020. The study demonstrated that the uncertainty and fear of COVID-19 negatively affected the stock market returns.

These previous empirical studies investigating the relationship between COVID-19 or other pandemics and stock market performance also generally suggested that there existed a lot of panel data researches and pandemics were negatively correlated with stock market performance.

3. Materials and Methods

3.1 Model and data

This study's aim was to examine the relationship between the COVID-19 pandemic and stock market performance in case of Turkey from the period April 10, 2020 to March 19, 2021 using the weekly data. Here, the confirmed cases, deaths, tests and recoveries during COVID-19 pandemic were employed as the COVID-19 pandemic variables. Following Nippani and Washer (2004) for China and Vietnam, Loh (2006) for Canada, China, Hong Kong, Singapore and Thailand, Ichev and Marinč (2018) for USA, Yılmazkuday (2023) for USA and Yousfi et al. (2021) for USA, the advanced log-linear regression specifications were utilized to indicate the link between the variables. These models were as follows:

$$lnISE_t = \delta_0 + \delta_1 lnTCS_t + \delta_2 lnTST_t + \mu_t \quad (1)$$
$$lnISE_t = \delta_0 + \delta_1 lnTCS_t + \delta_2 lnRCV_t + \mu_t \quad (2)$$
$$lnISE_t = \delta_0 + \delta_1 lnTCS_t + \delta_2 lnRCV_t + \delta_3 lnTST_t + \mu_t \quad (3)$$
$$lnISE_t = \delta_0 + \delta_1 \delta_1 lnTCS_t + \delta_2 lnRCV_t + \delta_3 lnTDH_t + \mu_t \quad (4)$$

$$lnISE_t = \delta_0 + \delta_1 lnTCS_t + \delta_2 lnRCV_t + \delta_3 lnTST_t + \delta_4 lnTDH_t + \mu_t \quad (5)$$

Where ISE was the Istanbul Stock Exchange Index as an indicator of the stock market performance (Ashraf, 2020b), TCS represented the total number of confirmed cases (Bash, 2020; Baig et al., 2021), TDH was the total number of confirmed deaths (Baig et al., 2021; Uddin et al. 2021), RCV was the total number of recoveries (Cao et al. 2021; Sarkodie et al., 2022), TST was the total number of confirmed tests (Anser et al., 2021). This study used only COVID-19 variables because several studies such as Al-Awadhi et al. (2020), Erdem (2020), Harjoto et al. (2021) and Xu et al. (2021) didn't include macroeconomic variables in their models as control/explanatory variables. In addition, the weekly macroeconomic data were not available in Turkish economy.

t was the time and μ was the residual term. δ_0 was the constant, δ_1, δ_2, δ_3 and δ_4 were the long-run coefficients for the confirmed cases, deaths, tests and recoveries, respectively. The logarithmic values of each of the variables were integrated in the analysis to obtain the elasticity coefficients. The reason was that the logarithmic values provided more efficient and reliable empirical findings (Shahbaz et al., 2012). The study covered the weekly data for ISE index and COVID-19 variables from April 10, 2020 to March 19, 2021. The reason was that the patients launched to recover on April 4, 2020 in Turkey. The weekly data was gathered from the Electronic Data Delivery System (2021) and the COVID-19 Information Page (2021) database. Table 1 demonstrated the descriptive statistics and correlations of variables. It also summarized the correlation matrix of series used in the study. The total number of confirmed cases and deaths have a negative correlation with stock market performance while the total number of confirmed recoveries and tests are positively correlated with it as expected. The trend of the variables was indicated in Fig.1.

Table 1. Descriptive statistics and correlations

Statistics/Variables	$lnISE_t$	$lnTCS_t$	$lnRCV_t$	$lnTST_t$	$lnTDH_t$
Mean	8.208	9.299	9.825	13.303	6.061
Median	8.241	9.2140	9.429	13.549	6.163
Std.dev.	0.310	0.647	1.047	0.644	0.841
Min.	8.672	10.734	12.288	14.150	7.473
Max.	7.606	8.399	7.569	12.016	4.709
Skewness	-0.169	0.631	0.569	-0.413	-0.151
Kurtosis	1.863	2.582	2.597	1.667	1.917
Obs.	50	50	50	50	50
$lnISE_t$	1				
$lnTCS_t$	-0.211	1			
$lnRCV_t$	0.683	-0.034	1		
$lnTST_t$	0.906	0.114	0.616	1	
$lnTDH_t$	0.542	0.464	0.672	0.661	1

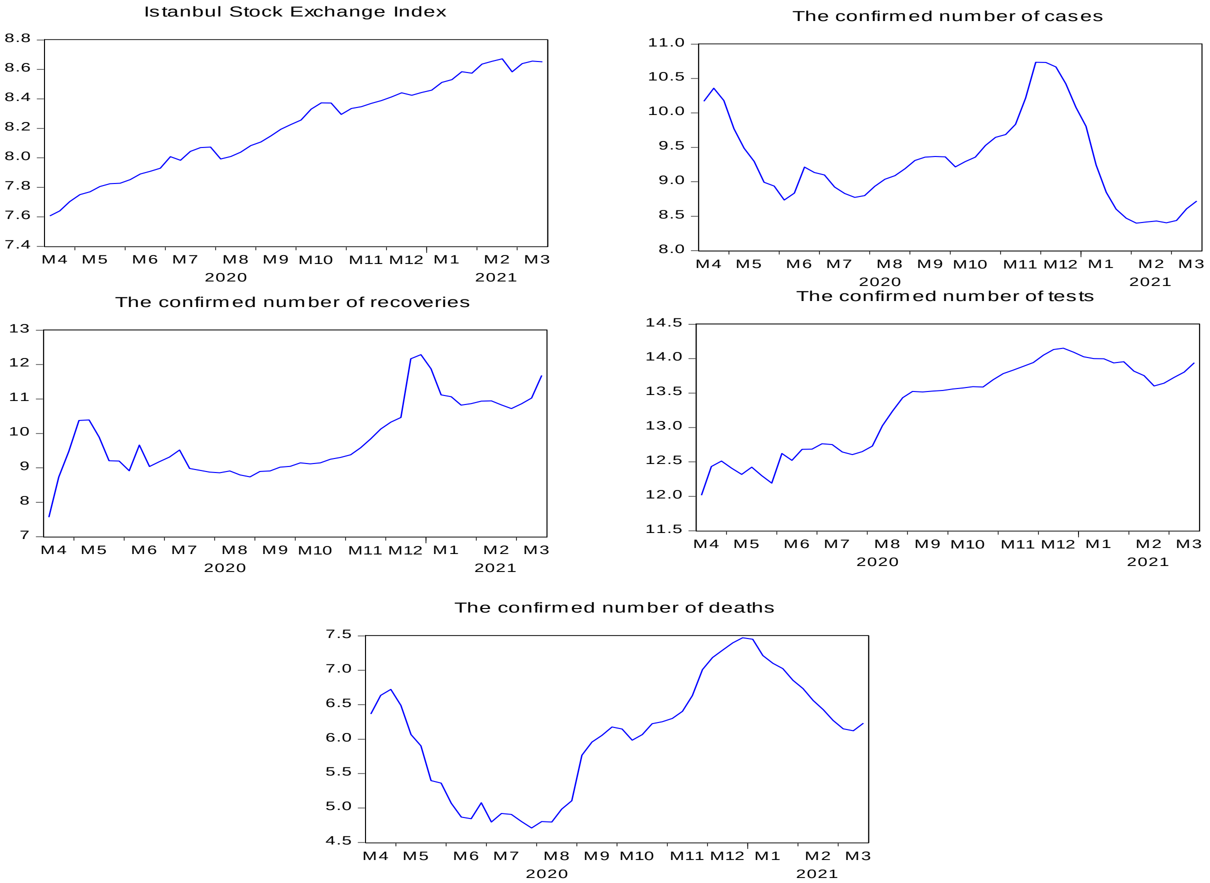

Fig.1. The plots of series (April10, 2020-March19, 2021)

3.2 Methodology

The previous studies utilized different methods. For examples; Chen et al. (2009), Chen et al. (2007), Al-Awadhi et al. (2020), O'Donnel et al. (2021) and Xu (2021) used GARCH approach, an event-study approach, panel data analysis, Stepwise multiple regression analysis and structural GARCH-in-Mean VAR method, respectively. But, the researchers utilized the time-series techniques with structural break in this study. A four-step methodology was applied to investigate the link between the variables. In the first step, not only the ADF (Dickey and Fuller, 1981) and PP (Phillips and Perron, 1988) tests but also Vogelsang-Perron (1998) test considering one structural break were used to detect whether the variables include the unit root. The PP and ADF tests did not take into account the structural break, which reduced the reliability of the results (Shahbaz et al., 2014). The Vogelsang-Perron test suggested two different model: Additive Outlier (AO) model and Innovation Outlier (IO) model. The break in the AO model was sudden while in the IO model the break occurred slowly (Vogelsang and Perron, 1998). In this study, the AO model was employed to check the stationarity of variables.

The second step was to implement the ARDL bounds test and Johansen cointegration technique to detect the long-run linkage between the stock market performance and independent variables. The ARDL bounds test developed by Pesaran et al. had many advantages compared with other cointegration approaches. This cointegration procedure considered the levels of variables. The regressors could be $I(0)$ or $I(1)$ or a mixture of both. This approach was suitable for small samples and could be employed to analyze the short and long-term dynamics through the Unrestricted Error Correction Model (UECM) (Pesaran et al., 2001). The UECM was formulated as follows:

$$InISE_t = \alpha_0 + \sum_{i=1}^{p} \alpha_{1i}\, \Delta InISE_{t-i} + \sum_{i=0}^{q} \alpha_{2i}\, \Delta lnTCS_{t-i} + \sum_{i=0}^{q} \alpha_{3i}\, \Delta lnRCV_{t-i} + \sum_{i=0}^{q} \alpha_{4i}\, \Delta lnTST_{t-i} + \sum_{i=0}^{q} \alpha_{5i}\, \Delta lnTDH_{t-i} + \beta_1 InISE_{t-1} + \beta_2 lnTCS_{t-1} + \beta_3 lnRCV_{t-1} + \beta_4 lnTST_{t-1} + \beta_5 lnTDH_{t-1} + \beta_6 D_{9/18/2020} + u_t \quad (6)$$

Here, α_0 was constant term, Δ was the first difference operator of variables, u_t presented error term and D showed the structural break dummy variable. The optimal lag length was designated through the Akaike Information Criteria(AIC). Null hypothesis was $H_0\!: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$ while alternative hypothesis was $H_1\!: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$ to analyse the existence of cointegration among the variables. The calculated F-statistic was compared with the upper and lower critical bounds (UCB and LCB) to check the long-run relationship among stock market performance and the confirmed cases, recoveries, tests and deaths. If the F statistic exceeded the UCB, there existed cointegration between the series by rejecting the null hypothesis. If F-statistic was lower than the LCB, there existed no cointegration between the variables. When F-statistic was between these bounds, it was not commented about the presence of cointegration (Pesaran et al., 2001). The diagnostics tests such as Breusch-Godfrey LM test for autocorrelation, ARCH LM test for heteroskedasticity and Ramsey RESET for model specification were conducted to check the suitability of each ARDL model (Saboori and Sulaiman, 2013). The Johansen cointegration technique suggested by Johansen (1988) was also implemented to examine the cointegration among the variables.

In the third step, FMOLS and CCR estimators were used because appropriate findings for all models could not be obtained with the ARDL estimator. The FMOLS (Philips & Hansen, 1990) and CCR (Park, 1992) estimators were used to specify the long-term coefficients of series in all models. These techniques required that the series were stationary at first difference and solve the problems such as serial correlation and endogeneity that revealed from the existence of cointegrating (Tursoy and Faisal, 2018). The FMOLS dealt with the problems of neglected variables and permitted heterogeneity of the long-term coefficients (Agbola, 2013). It was residual-based test and provided efficient and robust results in small samples. CCR estimator also allowed asymptotic Chi-square test and depended on transformation of the series in the cointegration relationship. Thus, the researchers used the FMOLS and CCR estimators as reliable results were obtained from these techniques in small samples (Merlin and Chen, 2021).

In the final step, The VECM Granger causality approach suggested by Engle and Granger (1987) was employed to find the causality linkage among variables. The VECM equation was as follows:

$$(1-L)\begin{bmatrix} lnISE_t \\ lnTCS_t \\ lnRCV_t \\ lnTST_t \\ lnTDH_t \end{bmatrix} \begin{bmatrix} b_1 \\ b_2 \\ b_3 \\ b_4 \\ b_5 \end{bmatrix} + \sum_{i=1}^{p}(1-L) \begin{bmatrix} c_{11i}c_{12i}c_{13i}c_{14i}c_{15i} \\ c_{21i}c_{22i}c_{23i}c_{24i}c_{25i} \\ c_{31i}c_{32i}c_{33i}c_{34i}c_{35i} \\ c_{41i}c_{42i}c_{43i}c_{44i}c_{45i} \end{bmatrix} x \begin{bmatrix} lnISE_{t-1} \\ lnTCS_{t-1} \\ lnRCV_{t-1} \\ lnTST_{t-1} \\ lnTDH_{t-1} \end{bmatrix} + \begin{bmatrix} \beta \\ \theta \\ \delta \\ \gamma \end{bmatrix} ECT_{t-1} + \begin{bmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \\ u_{4t} \\ u_{5t} \end{bmatrix} \quad (7)$$

4.Results and Discussion

The first step in the methodology was to check the stationary properties of variables. The results of conventional unit root tests as ADF and PP were showed in Table 2 while Table 3 demonstrated the findings of Vogelsang-Perron unit root test with structural break. It was obtained that stock market performance, the confirmed cases, deaths, tests and recoveries were nonstationary at their level but stationary at the first difference. Thus, the results revealed that the series were integrated at I*(1)*.

Table 3 also demonstrated the structural break times for stock market performance, the confirmed cases, deaths, tests and recoveries were 9/18/2020, 11/06/2020, 12/04/2020, 11/13/2020 and 9/25/2020, respectively. The break date on August 18, 2020 pointed out the decision of the Central Bank of the Republic of Turkey to keep the interest rates constant in this period (The Central Bank of the Republic of Turkey, 2021).

Table 2. ADF and PP tests

Regressor	ADF	PP	Result
PanelA: Level			
$lnISE_t$	-3.064	-3.136	-
$lnTCS_t$	-3.084	-1.936	-
$lnRCV_t$	-2.255	-2.484	-
$lnTST_t$	-1.884	-1.777	-
$lnTDH_t$	-2.582	-1.835	-
PanelB: First difference			
$\Delta lnISE_t$	-7.387^{***}	-7.799^{***}	I(1)
$\Delta lnTCS_t$	-3.182	-3.412^{*}	I(1)
$\Delta lnRCV_t$	-5.559^{***}	-6.495^{***}	I(1)
$\Delta lnTST_t$	-3.219^{*}	-6.577^{***}	I(1)
$\Delta lnTDH_t$	-4.322^{***}	-4.585^{***}	I(1)

Note: ***, ** and * show the significant at 1%, 5% and 10% level of significance, respectively.

Table 3. Vogelsang-Perron test

Models	Additive outlier model		
Variables	t-statistic	Time break	Result
Panel A: Level			
$lnISE_t$	-3.787(0)	9/18/2020	-
$lnTCS_t$	-4.545(1)	11/06/2020	-
$lnRCV_t$	-4.535(2)	12/04/2020	-
$lnTST_t$	-4.121(2)	11/13/2020	-
$lnTDH_t$	-3.285(2)	9/25/2020	-
PanelB: First difference			
$\Delta lnISE_t$	$-8.638(0)^{***}$	8/07/2020	I(1)
$\Delta lnTCS_t$	$-5.755(0)^{***}$	12/11/2020	I(1)
$\Delta lnRCV_t$	$-6.390(0)^{***}$	1/01/2021	I(1)
$\Delta lnTST_t$	$-7.318(0)^{***}$	12/18/2020	I(1)
$\Delta lnTDH_t$	$-6.271(0)^{***}$	9/04/2020	I(1)

Note: ***shows the significant at 1%level of significance.

In the second step, the ARDL bounds test in the presence of the structural break and Johansen cointegration procedure were performed for cointegration analysis among the stock market performance and independent variables. In the ARDL process, it was very important to determine the optimal lag lengths with VAR model by using the AIC. The results presented in Table 4 indicated that the optimal lag length was found as 1 for Model (4) but as 2 for Models (1), (2), (3) and (5).

 ISSN 1927-033X

Table 4. Optimal lag length

Panel A: Model1	VAR lag order selection				
Lag length	LR	FPE	AIC	SIC	HQ
0	NA	0.001051	1.655737	1.773831	1.700177
1	338.9891	5.82e-07	-5.844751	-5.372373	-5.666992
2	38.62865*	3.27e-07*	-6.427489*	-5.600827*	-6.116410*
3	9.560151	3.75e-07	-6.302893	-5.121947	-5.858495
PanelB: Model2					
Lag length	LR	FPE	AIC	SIC	HQ
0	NA	0.019093	4.555155	4.673250	4.599595
1	366.4922	5.57e-06	-3.584940	-3.112562*	-3.407181*
2	19.55044*	5.04e-06*	-3.690722*	-2.864061	-3.379644
3	4.769699	6.59e-06	-3.436654	-2.255709	-2.992257
PanelC: Model3					
Lag length	LR	FPE	AIC	SIC	HQ
0	NA	0.000579	3.896628	4.054087	3.955881
1	417.5978	5.51e-08	-5.365326	-4.578029*	-5.069061
2	35.54977*	4.34e-08*	-5.619995*	-4.202861	-5.086718*
3	20.62859	4.87e-08	-5.545867	-3.498895	-4.775578
PanelD: Model4					
Lag length	LR	FPE	AIC	SIC	HQ
0	NA	0.002336	5.292197	5.449656	5.351450
1	450.2587*	1.02e-07*	-4.747397*	-3.960100*	-4.451132*
2	22.34269	1.14e-07	-4.654512	-3.237377	-4.121234
3	14.06632	1.55e-07	-4.387376	-2.340404	-3.617087
PanelE: Model5					
Lag length	LR	FPE	AIC	SIC	HQ
0	NA	6.61e-05	4.565392	4.762216	4.639458
1	513.5061	7.02e-10	-6.895317	-5.714372*	-6.450920*
2	43.48561*	6.30e-10*	-7.039421*	-4.874355	-6.224692
3	26.18446	8.65e-10	-6.820251	-3.671064	-5.635191

Note: * shows optimal lag length.

Table 5 showed the findings of the ARDL bounds test under the structural break for all models. The empirical findings stated that the *F*-statistics computed by the ARDL bounds test were 8.187, 4.290, 6.597, 3.705 and 5.517, respectively. These values were larger than upper critical values for all models at different significance levels. This meant that there existed the long-term relationship between the stock market performance and the confirmed cases, deaths, tests and recoveries in the existence of structural break by rejecting the null hypothesis of no cointegration. The estimated ECT coefficients for five models were determined as -0.233, -0.096, -0.249, -0.085 and -0.278, respectively. Since the coefficients were negative sign and statistically significant, these findings confirmed the cointegration between the variables used in all models. The Table 5 also showed the results of diagnostics tests that included Breusch-Godfrey LM test, ARCH LM test and Ramsey RESET employed to detect the reliability of all ARDL models. The results of diagnostic tests showed that it was rejected null hypothesis of autocorrelation, heteroscedasticity and model specification in all models. This meant that all models didn't have the problems of autocorrelation and heteroscedasticity. It is possible to evaluate the findings of adjusted R^2. The adjusted R^2 for ARDL models are between 98.70% and 98.90%. This implies that the independent variables in Model 1, 2, 3, 4, and 5 jointly explain 98.90, 98.70, 98.90, 98.70 and 98.90 percent variations in the stock market performance, respectively. In addition, the *F*-statistics results showed that there was joint significance of all explanatory variables in the models. Thus, these findings revealed that the ARDL models were very suitable.

Table 5. ARDL bounds

Estimated Models	*Model1*	*Model2*	*Model3*	*Model4*	*Model5*
F-Statistics	8.187***	4.290**	6.597***	3.705**	5.517***
Lag order	1, 0, 1	1, 0, 0	1, 0, 0, 1	1, 0, 0, 0	1, 1, 0, 1, 1
Structural break	9/18/2020	9/18/2020	9/18/2020	9/18/2020	9/18/2020
Critical values	1%level	5%level	1%level	5%level	1%level
Lower bounds	4.13	3.10	3.65	2.79	3.29
Upper bounds	5.00	3.87	4.66	3.67	4.37
(ECt-1)(t-ratio)	-0.233(-5.919)***	-0.096(-4.281)***	-0.249(-6.010)***	-0.085(-4.500)***	-0.278(-6.111)***
Result	Cointegration	Cointegration	Cointegration	Cointegration	Cointegration
Diagnostic tests					
R^2	0.990	0.988	0.991	0.988	0.991
Adj.R^2	0.989	0.987	0.989	0.987	0.989
F-istatistic	942.954***	943.510***	777.977***	759.552***	523.691***
Breusch-GodfreyLM test	0.250	0.445	0.211	0.314	0.386
ARCH LM test	0.895	0.622	0.847	0.735	0.925
Ramsey RESET	0.119	0.544	0.154	0.219	0.152

Note:***and** show the significant at 1% and 5%level of significance, respectively.

The Johansen cointegration test was also performed to check the long-term relationship between the variables for all models. The empirical results reported in Table 6 indicated that there existed at least one cointegration vector in Models (1), (2), (3) and (4) and at least two cointegration vectors in Model (5). This expressed the presence of cointegration among the stock market performance and independent variables. Hence, the findings of Johansen cointegration test supported the results of ARDL bounds test.

In the third step of the methodology, the FMOLS and CCR techniques by Phillips and Hansen (1990) and Park (1992) were applied to estimate the long-term coefficients of independent variables in all models. Table 7 and 8 revealed the FMOLS and CCR estimates, respectively. The findings encompassed the long-run effect of the confirmed cases, deaths, tests and recoveries on the stock market performance under the structural break. It was seen that the empirical results were very similar for all models.

Firstly, the findings of Model (1) provided in Table 7 were evaluated. The coefficient of the cases was obtained to be -0.186 at 1% significance level. This stated that there existed the negative relation between the confirmed cases and stock market performance. This implied that a 1% increase in the confirmed cases decreased stock market performance by 0.186% for Turkish economy in the long-term. This finding was similar to the results of Models (2), (3), (4), (5). Our finding coincided with the results of Zaremba et al. (2021), who found that total number of cases in the global epidemic had a negative impact on 67 stock markets by utilizing the panel regression model over the period January 1-April 28, 2020 and Ftiti et al. (2021), who revealed that growth in the deaths and cases of COVID-19 pandemic influenced the Shanghai financial market in China in a negative way from December 31, 2019 to April 7, 2020. Our results were line with studies, for example, Al-Awadhi et al. (2020) on Chinese stock market, Anh and Gan (2021) on the Vietnam stock market, Ashraf (2020a) on 43 countries, Bash (2020) on 30 countries, He et al. (2020b) on Shanghai stock market, Takyi and Bentum-Ennin (2021) on African countries, O'Donnell (2021) on China, Italy, Spain, the UK, the US and the World stock markets index, Fernandez-Perez et al. (2021) on 63 countries, Narayan et al. (2022) on the Australian stock market, and Xu (2021) on Canada and the US stock market returns. On the contrary, our finding seemed to conflict with the results of He et al. (2020b), who revealed that the COVID-19 outbreak positively affected the Shenzhen stock market using the daily data from 2,895 listed firms over the period 3 June 2019-13 March 2020.

Table 6. Johansen cointegration test

PanelA: Model1	VAR lag order selection criteria.	
Hypothesized no.of CE(s)	*Trace Statistic*	*Max-Eigen Statistic*
R=0	40.809*	24.869*
R≤1	15.940	12.569
R≤2	3.370	3.370
PanelB: Model2		
Hypothesized no.of CE(s)	*Trace Statistic*	*Max-Eigen Statistic*
R=0	28.008*	18.316
R≤1	9.692	7.477
R≤2	2.214	2.214
PanelC: Model3		
Hypothesized no.of CE(s)	*Trace Statistic*	*Max-Eigen Statistic*
R=0	73.192***	33.920**
R≤1	39.271	24.234*
R≤2	15.037	9.940
R≤3	5.097	5.097
PanelD: Model4		
Hypothesized no.of CE(s)	*Trace Statistic*	*Max-Eigen Statistic*
R=0	74.614***	36.275**
R≤1	38.339	20.854
R≤2	17.484	13.460
R≤3	4.023	4.023
PanelE: Model5		
Hypothesized no.of CE(s)	*Trace Statistic*	*Max-Eigen Statistic*
R=0	131.840***	55.367***
R≤1	76.473***	31.429*
R≤2	45.043**	22.924
R≤3	22.119	13.794
R≤4	8.324	8.324

Note:***,**and* indicate the significant at 1%, 5% and 10% level of significance, respectively.

The researchers detected that the coefficients of the confirmed tests were positive at 1% significance level in Models (1), (3) and (5) (Table 7). The long-term elasticities of this variable were found to be 0.269 for Model (1), 0.275 for Model(3) and 0.289 for Model (5) respectively. According to these findings, the confirmed tests were positively linked with the stock market performance in Turkish economy in the long-run meaning that %1 rise in the confirmed tests increased the stock market performance by 0.269%, 0.275% and 0.289% in Models (1), (3), and (5), respectively.

It was determined that the coefficients of the confirmed recoveries were positive at %1 significance level for Models (2), (3), (4) and (5). It implied that there existed a positive link between the confirmed recoveries and stock market performance in the long-run. A %1 rise in the confirmed recoveries led to an enhance in stock market performance by 0.072, 0.044, 0.123 and 0.083, respectively. Our finding was in line with the results of Cao et al. (2021), who examined the link between 14 stock market index and COVID-19 through the panel regression

 ISSN 1927-033X

model from the period January 21-June 30, 2020 and found that the number of the confirmed recoveries influenced the stock market performance in a positive way.

The researchers found that the coefficients of the confirmed deaths were negative at %1 significance level for Models (4) and (5). It indicated that in the long run the stock market performance was negatively affected by the confirmed deaths. A %1 increase in the confirmed deaths caused a reduce in the stock market performance by 0.064 and 0.090, respectively, which indicated that the COVID-19 deaths were harmful for the stock market performance. Our finding coincided with the results of Ali (2020), who revealed that the COVID-19 deaths negatively affected stock market return by using the GARCH model for China, the USA, the UK, Italy, Spain, France, Germany, Switzerland, South Korea and Europe and Asia over the period January 1, 2020 March 20, 2020. Similar findings were detected by Al-Awadhi et al. (2020), Ashraf (2020b), Phan and Narayan (2020), Harjoto et al. (2021) and Uddin et al. (2021)

Finally, Table 7 shows the results of diagnostic test of FMOLS estimator for all models. The adjusted R^2 for all models are between 83.3% and 94.7%. This means that the independent variables in Model 1, 2, 3, 4, 5 jointly explain 93.4, 84.4, 94.4, 83.3 and 94.7 percent variations in the stock market performance, respectively.

Table 7. FMOLS estimates

Variables	Model1	Model2	Model3	Model4	Model5
Constant	6.202***	9.029***	5.747***	8.439***	5.181***
$lnTCS_t$	-0.186***	-0.190***	-0.188***	-0.139***	-0.133***
$lnRCV_t$		0.072**	0.044**	0.123***	0.083***
$lnTST_t$	0.269***		0.275***		0.289***
$lnTDH_t$				-0.064	-0.090**
Dummy	0.282***	0.469**	0.201***	0.493***	0.246***
Diagnostic tests					
R^2	0.938	0.854	0.948	0.847	0.952
Adj.R^2	0.934	0.844	0.944	0.833	0.947
SE of regression	0.077	0.118	0.071	0.122	0.069
SSR	0.268	0.631	0.222	0.661	0.206

Note: The optimal lag length is selected based on AIC. ***,** and* represent significance at 1%, 5% and 10%, respectively.

It was also carried out the CCR estimator to check the reliability of the findings obtained from the FMOLS estimator. Table 8 summarized the long-term findings of the CCR estimator. The findings were similar to the results of the FMOLS estimator. In this context, the confirmed cases and deaths affected stock market performance in a negative way while the confirmed recoveries and tests positively influenced it.

Table 8. CCR estimates

Variables	Model1	Model2	Model3	Model4	Model5
Constant	5.966***	8.703***	5.538***	8.596***	5.321***
$lnTCS_t$	-0.169***	-0.168***	-0.172***	-0.129***	-0.131***
$lnRCV_t$		0.086**	0.055**	0.128***	0.082***
$lnTST_t$	0.275***		0.273***		0.270***
$lnTDH_t$				-0.120**	-0.071*
Dummy	0.275***	0.448**	0.188***	0.557***	0.245***
Diagnostic tests					
R^2	0.942	0.858	0.950	0.843	0.955
Adj.R^2	0.938	0.849	0.946	0.829	0.949
SE of regression	0.074	0.116	0.069	0.124	0.067
SSR	0.248	0.614	0.213	0.678	0.194

Note: The optimal lag length is selected based on AIC. ***,** and* represent significance at 1%, 5% and 10%, respectively.

Table 9 reported the results of the VECM Granger causality analysis under the structural break for all models. There existed the bi-directional long-run causality among the confirmed cases and stock market performance for Models (1) and (3), while the uni-directional causality between the confirmed cases and stock market performance was determined for Models (2), (4) and (5). Similarly, Sharif et al. (2020) suggested the causality running from the number of the cases to USD stock market index by using the wavelet-based causality approach over the period January 21-March 30, 2020.

The long-run results showed that the confirmed tests caused the stock market performance for Model (1) and this result coincided with the findings of Models (3) and (5). In addition, there existed the bi-directional causality between the confirmed recoveries and stock market performance for Model (3). A similar causality linkage was also obtained for Models (4) and (5). The findings for Models (4) and (5) presented the bi-directional causal linkage between the confirmed deaths and stock market performance in the long run.

Table 9. Causality analysis

PanelA: Model1	Independent variable Short-run(*F*-statistic)				Long-run (*p*-value)
Dependent variable	ΔlnISE	ΔlnTCS	ΔlnTST	Dummy	
ΔlnISE	-	-1.006 (0.338)	0.436 (0.665)	0.414 (0.680)	-0.200^{***} (0.002)
ΔlnTCS	-0.131 (0.896)	-	-1.182 (0.243)	-0.466 (0.534)	-0.169^{***} (0.004)
ΔlnTST	-1.771^{*} (0.083)	3.047^{***} (0.004)	-	-1.519 (0136)	-0.012 (0.890

PanelB: Model2	Independent variable Short-run(*F*-statistic)				Long-run (*p*-value)
Dependent variable	ΔlnISE	ΔlnTCS	ΔlnRCV	Dummy	
ΔlnISE	-	-0.150 (0.881)	0.399 (0.691)	0.414 (0.680)	-0.042 (0.384)
ΔlnTCS	0.219 (0.827)	-	0.483 (0.631)	1.401 (0.168)	-0.122^{***} (0.006)
ΔlnRCV	0.234 (0.797)	1.562 (0.222)	-	0.754 (0.455)	-0.152 (0.240)

PanelC: Model3	Independent variable Short-run(*F*-statistic)					Long-run (*p*-value)
Dependent variable	ΔlnISE	ΔlnTCS	ΔlnRCV	ΔlnTST	Dummy	
ΔlnISE	-	0.105 (0.916)	0.437 (0.663)	0.340 (0.735)	0.666 (0.508)	-0.261^{***} (0.000)
ΔlnTCS	-0.060 (0.951)	-	0.017 (985)	-1.040 (0.304)	0.630 (0.532)	-0.159^{**} (0.022)
ΔlnRCV	0.980 (0.332)	-0.853 (0.398)	-	3.290^{***} (0.002)	4.420 (0.163)	-0.194^{**} (0.066)
ΔlnTST	-1.750^{*} (0.087)	2.845^{***} (0.006)	-0.064 (0.949)	-	-1.491 (0.143)	-0.024 (0.800)

PanelD: Model4	Independent variable Short-run(*F*-statistic)	Long-run (*p*-value)

Table 9. Causality analysis (cont)

Dependent variable	ΔlnISE	ΔlnTCS	ΔlnRCV	ΔlnTDH	Dummy	
ΔlnISE	-	-0.269 (0.789)	-0.598 (0.552)	2.384** (0.021)	0.840 (0.405)	-0.093** (0.031)
ΔlnTCS	-0.168 (0.867)	-	0.029 (0.976)	-1.451 (0.154)	0.454 (0.651)	-0.054 (0.402)
ΔlnRCV	0.642 (0.524)	0.710 (0.481)	-	-0.102 (0.918)	0.099 (0.921)	-0.223** (0.068)
ΔlnTDH	1.258 (0.215)	2.882*** (0.006)	-0.203 (0.839)	-	1.621 (0.112)	-0.179*** (0.009)

PanelE: Model5	Independent variable Short-run(F-statistic)						Long-run (p-value)
Dependent variable	ΔlnISE	ΔlnTCS	ΔlnRCV	ΔlnTST	ΔlnTDH	Dummy	
ΔlnISE	-	0.079 (0.936)	0.289 (0.774)	0.248 (0.805)	0.431 (0.668)	0.341 (0.734)	-0.263*** (0.001)
ΔlnTCS	-0.245 (0.807)	-	0.236 (0.814)	-0.581 (0.564)	-1.786* (0.081)	0.308 (0.759)	-0.124 (0.121)
ΔlnRCV	0.855 (0.397)	-0.052 (0.958)	-	3.177*** (0.002)	-0.369 (0.713)	1.035 (0.306)	-0.207* (0.073)
ΔlnTST	-1.715* (0.093)	2.150 (0.037)	-0.156 (0.876)	-	0.291 (0.771)	-1.497 (0.142)	-0.038 (0.728)
ΔlnTDH	1.407 (0.166)	2.345** (0.024)	-0.317 (0.752)	2.147** (0.037)	-	2.301 (0.026)	-0.197*** (0.003)

Note: ***, **and* show significance at 1%, 5% and 10%, respectively.

5.Conclusions

The novel coronavirus (COVID-19) epidemic announced by the WHO has seriously affected the world financial markets. For this reason, the empirical literature intensified on the link between the COVID-19 and stock market performance. However, there were very limited studies examining this relationship for Turkish economy. This study examined the link among the COVID-19 pandemic and stock market performance under the structural break in Turkish economy by using the weekly data from period April 10, 2020 to March 19, 2021. Firstly, the ADF, PP and Vogelsang-Perron tests were employed to check stationarity of the variables. Secondly, the presence of the long-term relationship among the variables was investigated by the ARDL bounds test and Johansen cointegration technique. Thirdly, the FMOLS and CCR estimation techniques were employed to determine the long-run elasticity for all models. Lastly, the causality relationship among variables was tested with the VECM Granger causality approach.

The findings revealed that the variables were integrated at $I(1)$. The findings also revealed the cointegration in the presence of structural break. The long-run estimates pointed out the results with structural break. The confirmed cases and deaths were harmful to the stock market performance while the confirmed tests and recoveries improved the performance of the stock market. It was detected the bidirectional causality among the confirmed cases, deaths and recoveries with stock market performance in the long term and the unidirectional causality running from the confirmed tests to stock market performance. As a result, this implied that the COVID-19 pandemic caused stock market performance and COVID-19 was negatively correlated with the stock market performance in the study. This results were supported by the findings of Ashraf (2020a), Topcu and Gulal (2020), Yılmazkuday (2023), Harjoto et al. (2021) and Yousfi et al. (2021). At the same time, this result was similar to the findings of Loh (2006) for the SARS, Nippani and Washer (2004) for the SARS, Chen et al. (2007;2009) for the SARS and Ichev and Marinč (2018) for the EBOLA., which the stock market performance was adversely affected by the pandemic disasters.

The pandemic diseases such as SARS, EBOLA, COVID-19 affected not only people's health but also the economies of countries. Some studies provided different suggestions. For example, Anh and Gan. (2021) advised governments must be proactive in hindering the virus outbreak to overcome the crisis, help the stock market performance recover and boost investor confidence. It was proposed by Ftiti et al. (2021) that the health system should become an international target to achieve more positive and permanent in regarding to health and economic results in the future. Uddin et al. (2021) recommended that governments and policy makers faced with the economic fluctuations generated from the global pandemic must stress the adoption and application of the right economic policies using efficient economic factors. Thus, based on recommendations from previous researchers, the present study's empirical results could provide advises to governments, policy makers, investors and risk managers to take several precautions that decreased the negative effects of the epidemics on economy. Firstly, the governments have to struggle in preventing the pandemic to cope with the crisis and improve the stock market performance. Secondly, the health system has to become an international target by strengthening to achieve positive and persistent results in terms of health and economy. Thirdly, the several measures related to COVID-19 such as acceleration of vaccination, increasing the number of tests and extension of the quarantine period should be urgently taken by governments. Finally, according to the recommends of Chen et al. (2009), government and policy makers have to prop and encourage the development of all sectors and protect these sectors against the possible effects of epidemics.

The main weakness of the study was that it only dealt with Turkish economy. Therefore, the stock market performances of different countries could be compared by considering more countries in the future studies during the COVID-19. At the same time, the future studies could use several series such as the number of vaccinations, country profile, political responses, mortality risk, share of positive tests as COVID-19 variables to investigate in detail the effects of COVID-19 on economy.

References

Agbola FW, 2013. Does human capital constrain the impact of foreign direct investment and remittances on economic growth in Ghana?. *Applied Economics* 45:19, 2853-2862.

Al-Awadhi AM, 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, 1-5.

Ali M, Alam N, Rizvi SAR, 2020. Coronavirus (COVID-19)-An epidemic or pandemic for financial markets. *Journal of Behavioral and Experimental Finance* 27, 1-6.

Anh DLT, Gan C, 2021. The impact of the COVID-19 lockdown on stock market performance: evidence from Vietnam. *Journal of Economic Studies* 48:4, 836-851.

Anser MK, Khan MA, Zaman K, Nassani AA, Askar SE, Qazi Abro MM, Kabbani A, 2021. Financial development during COVID-19 pandemic: the role of coronavirus testing and

 ISSN 1927-033X

functional labs. *Financial Innovation* 7:9.

Ashraf BN, 2020a. Stock markets' reaction to Covid-19: Moderating role of national culture. *Finance Research Letters*.

Ashraf BN, 2020b. Stock markets'reaction to COVID-19: Cases or fatalities?.*Research in International Business and Finance* 54, 1-7.

Baig AS, Butt HA, Haroon O, Rizvi SAR, 2021. Deaths, panic, lockdowns and US equity markets: The case of COVID-19 pandemic. *Finance Research Letters* 38,1-9.

Bash A, 2020. International evidence of COVID-19 and stock market returns: An event study analysis. *International Journal of Economics and Financial Issues* 10:4, 34-38.

Caferra R, Vidal-Tomas DV, 2021. Who raised from the abyss? A comparison between cryptocurrency and stock market dynamics during the COVID-19 pandemic. *Finance Research Letters,* 1-9.

Cao KH, Li QL, Liu Y, Woo CK, 2021. Covid-19's adverse effects on a stock market index. *Applied Economics Letters* 28:14, 1157-1161.

Chen MH, (Shawn) Jang SC, Kim WG, 2007. The impact of SARS outbreak on Taiwanese hotel stock returns: An event study approach. *International Journal of Hospitality Management* 26:1, 200-212.

Chen CD, Chen CC, Tang WW, Huang BY, 2009. The positive and negative impacts of the SARS outbreak: A case of the Taiwan. *The Journal of Developing Areas* 43:1, 281-293.

Chick RC, Clifton GT, Peace KM, Propper BW, Hale DF, Alseidi AA, Vreeland TJ, 2020. Using technology to maintain the education of residents during the COVID-19 pandemic. *Journal of Surgical Education* 77:4,729-732.

Dickey DA, Fuller WA, 1981. Likelihood ratio statistics for autoregressive time series with a unit root. *Econometrica* 49:4, 1057-1072.

Engle RF, Granger CWJ, 1987. Cointegration and error correction: representation, estimation and testing. *Econometrica* 55:2, 251–276.

Erdem O, 2020. Freedom and stock market performance during Covid-19 outbreak. *Finance Research Letters* 36,1-7.

Fernandez-Perez A, Gilbert A, Indriawan I, Nguyen NH, 2021. COVID-19 pandemic and stock market response: A culture effect. *Journal of Experimental Finance* 29,1-10.

Ftiti Z, Ameur HB, Louhichi W, 2021. Does non-fundamental news related to COVID-19 matter for stock returns? Evidence from Shanghai stock market. *Economic Modelling* 1-9.

Gruszczynski L, 2020. The COVID-19 pandemic and international trade: Temporary turbulence or paradigm shift?. *European Journal of Risk Regulation* 11:2, 337 – 342.

Guo Y, Li P, Li A, 2021. Tail risk contagion between international financial markets during COVID-19 pandemic. *International Review of Financial Analysis* 73, 1-10.

Harjoto MA, Rossi F, Lee R, Sergi BS, 2021. How do equity markets react to COVID-19? Evidence from emerging and developed countries. *Journal of Economics and Business* 115, 1-15. https://doi.org/10.1016/j.jeconbus.2020.105966

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

He P, Sun Y, Zhang Y, Li T, 2020b. COVID–19's impact on stock prices across different sectors-An event study based on the Chinese stock market. *Emerging Markets Finance and Trade* 56:10, 2198-2212.

Ichev R, Marinč M, 2018. Stock prices and geographic proximity of information: Evidence from the Ebola outbreak. *International Review of Financial Analysis* 56, 153-166. https://doi.org/10.1016/j.irfa.2017.12.004

Johansen S, 1988. Statistical Analysis of Cointegration Vectors. *Journal of Economic Dynamics and Control* 12, 231-254.

Loh E, 2006. The impact of SARS on the performance and risk profile of airline stocks.

 ISSN 1927-033X

International Journal of Transport Economics / Rivista Internazionale Dieconomia dei Trasporti 33:3, 401-422.
Mazur M, Dang M, Vega M, 2021. COVID-19 and the march 2020 stock market crash. Evidence from S&P1500. *Finance Research Letters* 38, 1-8.
Merlin ML, Chen Y, 2021. Analysis of the factors affecting electricity consumption in DR Congo using fully modified ordinary least square (FMOLS), dynamic ordinary least square (DOLS) and canonical cointegrating regression (CCR) estimation approach. *Energy*, 232.
Narayan PK, Gong Q, Ahmed HJA, 2022. Is there a pattern in how COVID-19 has affected Australia's stock returns?. *Applied Economics Letters*, 29:3, 179-182.
Nicola N, Alsafi Z, Sohrabi C, Ahmed K, Al-Jabir A, Iosifidis C, Agha M, Agha R, 2020. The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery* 78, 185-193.
Nippani S, Washer KM, 2004. SARS: a non-event for affected countries' stock markets?. *Applied Financial Economics* 14:15, 1105-1110.
O'Donnell N, Shannon D, Sheehan B, 2021. Immune or at-risk? Stock markets and the significance of the COVID-19 pandemic. *Journal of Behavioral and Experimental Finance* 30, 1-10.
Park JY, 1992. Canonical cointegrating regressions. *Econometrica* 60:1, 119-143.
Pesaran MH, Shin Y, Smith RJ, 2001. Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics* 16, 289-326.
Phan DHB, Narayan PK, 2020. Country responses and the reaction of the stock Market to COVID-19 a preliminary exposition. *Emerging Markets Finance and Trade* 56:10, 2138-2150.
Phillips PCB, Hansen BE, 1990. Statistical inference in instrumental variables regression with I(1) processes. *The Review of Economic Studies* 57:1, 99-125.
Phillips PCB, Perron P, 1988. Testing for a unit root in a time series regression. *Biometrika* 75:2, 335-346.
Saboori B, Sulaiman J, 2013. CO2 emissions, energy consumption and economic growth in Association of Southeast Asian Nations (ASEAN) countries: A cointegration approach. *Energy* 55, 813-822.
Salisu AA, Sikiru AA, Vo XV, 2020. Pandemics and the emerging stock markets. *Borsa Istanbul Review* 20:S1, S40-S48.
Sarkodie SA, Ahmed MY, Owusu PA, 2022. COVID-19 pandemic improves market signals of cryptocurrencies-Evidence from bitcoin, bitcoin cash, ethereum, and litecoin. *Finance Research Letters* 44,
Shahbaz M, Lean HH, Shabbir MS, 2012. Environmental Kuznets curve hypothesis in Pakistan: cointegration and Granger causality. *Renew. Sustain. Energy Rev*. 16:5, 2947–2953.
Shahbaz M, Sbia R, Hamdi H, Ozturk I, 2014. Economic growth, electricity consumption, urbanization and environmental degradation relationship in United Arab Emirates. *Ecological Indicators* 45, 622-631.
Sharif A, Aloui C, Yarovaya L, 2020. COVID-19 pandemic, oil prices, stock market, geopolitical risk and policy uncertainty nexus in the US economy: Fresh evidence from the wavelet-based approach. *International Review of Financial Analysis* 70, 1-9.
Sharma GD, Tiwari AK, Jain M, Yadav A, Erkut B, 2021. Unconditional and conditional analysis between covid-19 cases, temperature, exchange rate and stock markets using wavelet coherence and wavelet partial coherence approaches. *Heliyon* 7:2, 1-30.
Takyi PO, Bentum-Ennin I, 2021. The impact of COVID-19 on stock market performance in Africa: A Bayesian structural time series approach. *Journal of Economics and Business*.
The Electronic Data Delivery System- The Central Bank of the Republic of Turkey 2021.

 ISSN 1927-033X

https://evds2.tcmb.gov.tr/
The Republic of Turkey Ministry of Health-COVID-19 Information Page 2021. https://covid19.saglik.gov.tr/
Topcu M, Gulal OS, 2020. The impact of COVID-19 on emerging stock markets. *Finance Research Letters* 36, 1-4.
Tursoy T, Faisal F, 2018. The impact of gold and crude oil prices on stock market in Turkey: Empirical evidences from ARDL bounds test and combined cointegration. *Resources Policy* 55, 49-54.
Uddin M, Chowdhury A, Anderson K, Chaudhuri K, 2021. The effect of COVID-19 pandemic on global stock market volatility: Can economic strength help to manage the uncertainty?. *Journal of Business Research* 128, 31-44.
Vogelsang TJ, Perron P, 1998. Additional Tests for a Unit Root Allowing for a Break in the Trend at an Unknown Time. *International Economic Review* 39:4, 1073-1100.
WHO, 2020. World Health Organization characterizes COVID-19 as a pandemic. Retrieved from https://www.paho.org/en/news/11-3-2020-who-characterizes-covid-19-pandemic
Wilder-Smith, A. and Osman, S. 2020. Public health emergencies of international concern: a historic overview. Journal of Travel Medici*ne* 27:8, 1-13.
Witteveen D, 2020. Sociodemographic inequality in exposure to COVID-19-induced economic hardship in the United Kingdom. *Research in Social Stratification and Mobility* 69.
Yang Y, Peng F, Wang R, Guan K, Jiang T, Xu G, Sun J, Chang C, 2020. The deadly coronaviruses: The 2003 SARS pandemic and the 2020 novel coronavirus epidemic in China. *Journal of Autoimmunity* 109, 1-16.
Xu L, 2021. Stock Return and the COVID-19 pandemic: Evidence from Canada and the US. *Finance Research Letters* 38, 1-7.
Yilmazkuday H, 2023. COVID-19 Effects on the S&P 500 Index. *Applied Economics Letters* 30:1, 7–13.
Yousfi M, Zaied YB, Cheikh NB, Lahouel BB, Bouzgarrou H, 2021. Effects of the COVID-19 pandemic on the US stock market and uncertainty: A comparative assessment between the first and second waves. *Technological Forecasting & Social Change* 167.
Zaremba A, Kizys R, Tzouvanas P, Aharon DY, Demir E, 2021. The quest for multidimensional financial immunity to the COVID-19 pandemic: Evidence from international stock markets. *Journal of International Financial Markets, Institutions and Money* 71, 1-30.
Zhang W, Hamori S, 2021. Crude oil market and stock markets during the COVID-19 pandemic: Evidence from the US, Japan, and Germany. *International Review of Financial Analysis* 74.

 ISSN 1927-033X