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The Effect of COVID-19 Pandemic on Stock Market: An Empirical Study in Saudi Arabia*

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Abstract

The objective of the study is to investigate the impact of the COVID-19 pandemic on Saudi Arabia stock market. The study relied on the data of the daily closing stock market price index Tadawul All Share Index (TASI), and the number of daily cases infected with COVID-19 during the period from March 15, 2020, to August 10, 2020. The study employs the Vector Auto-Regressive (VAR) model, the Impulse Response Function (IRF) and Autoregressive Conditional Heteroscedasticity (ARCH) models. The results of the correlation matrix and the Impulse Response Function (IRF) show that stock market returns responded negatively to the growth in COVID-19 infected cases during the pandemic. The results of ARCH model confirmed the negative impact of COVID-19 pandemic on KSA stock market returns. The results also showed that the negative market reaction was strong during the early days of the COVID-19 pandemic. The study concluded that stock market in KSA responded quickly to the COVID-19 pandemic; the response varies over time according to the stage of the pandemic. However, the Saudi government's response time and size of the stimulus package have played an important role in alleviating the impacts of the COVID-19 pandemic on Saudi Arabia Stock Market.

Keywords: COVID-19, Stock Market Returns, Saudi Arabia Stock Market

JEL Classification Code: E44, G01, G15, G41, N25

1. Introduction

During December 2019, the world became aware of a new global threat called coronavirus, which the World Health Organization (WHO) declared a COVID-19 a pandemic on March 11, 2020. COVID-19 pandemic changed the lives of millions of people around the world as reflected in the number of people infected and dying. Countries responded by locking down economic activities, strict quarantine policies, imposing travel bans, and implementing stimulus packages to cushion the unprecedented slowdown in economic activity and loss of jobs (Phan & Narayan, 2020). The Efficiency Market Hypothesis (EMH) states that stock prices, in general, quickly reserve all available information. However, proponents of behavioral finance assume that, because investors are not always rational, they may exaggerate or react to information due to their psychological biases (Rahman et al., 2021). Uncertainty and risk are important aspects of the process of decision-making in the financial markets. Accordingly, economic logic indicates that the bad news in the stock markets may affect the process of capital accumulation in the financial sector; therefore, if this news increases the risks in investment operations, the potential effect will be to reduce the value and number of transactions in the stock market and then the stock returns, especially when the news contains risks on a global scale (Ashraf, 2020).

The COVID-19 pandemic has affected global financial markets. Continuous revisions of economic growth forecasts and heightened risk aversion, combined with extreme uncertainty about the future development of the pandemic, have resulted in extreme volatility in stock markets and

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other markets for risky assets. At the end of February 2020, the financial markets entered a phase of risk aversion with significantly increasing volatility across the markets. Stock markets began to decline rapidly, losing about 30% of its market value within weeks, with the sell-off speeding up faster than the global financial crisis of 2008. Overall, stock markets have responded negatively to COVID-19 pandemic and have recovered somewhat after the bailout program was announced (Rahman, et al. 2021). Therefore, assessing the impact of the COVID-19 pandemic on stock markets is imperative.

The preventive policies taken by governments related to COVID-19 have affected the stock market, especially shutdown policies, where closing the workplace disrupts decision-making processes in many financial institutions, which does not allow for quick reactions and swift trading. Some financial institutions may be shutdown, therefore, in the event of a shortage of electronic infrastructure; traders may not be able to conduct transactions. Of course, the role of these would at least partially diminish if a large portion of trade was automated and the economy was digitally advanced; thus, the potential impact may be stronger in emerging markets than in developed countries. It is worth noting that even if business premises are not completely closed, soft regulations may also have an indirect effect on the financial markets (Zaremba et al., 2021). Moreover, policies related to COVID-19 can affect the stock market through policy responses to changes in the future economic environment, and deteriorating economic conditions may lead to changes in companies' cash flow expectations and an increase in the risk premium, so investors are less willing to do so, allocating their money to risky assets, such as stocks. Investors can also be influenced by behavioral and psychological factors. This means that investors are reluctant to monitor their portfolios when there is bad news about government restrictions. In addition, individuals who have suffered several consecutive periods of losses become more loss avoidant. According to this type of thinking, trading activity in the stock market decreases (Zaremba et al., 2021).

Saudi Arabia's response to the COVID-19 pandemic was aided by sustained investments in healthcare and digital infrastructure, favorable demographics, and strong macroeconomic indicators prior to the outbreak. The Saudi stock exchange (Tadawul) announced on March 25, 2020, a temporary reduction of trading hours effective from 26 March 2020 to ensure efficiency and fairness in the market during this exceptional period. On March 14, the Saudi Central Bank announced Private Sector Financing Support program with a total value of SAR 50 billion, aimed at supporting the private sector and enabling it to promote economic growth. The central bank program consists of three main elements, the first of which is 'Supporting SME Finance. This is to be achieved through: (1) Deferred Payments Program: depositing around SAR 30 billion in banks and finance companies to delay the repayments for a period of six months); (2) Funding for Lending Program: granting SAR 13.2 billion for banks and finance companies to grant loans to support business continuity and employment; and (3) Loan Guarantee Program: depositing SAR 6 billion to enable banks and insurance companies to relieve SMEs from finance costs. In addition to the government role, bank credit facilities in various economic sectors play an important role in promoting economic growth in Saudi Arabia (Alzyadat, 2021).

This study contributes to the existing literature by presenting an attempt to investigate the impact of COVID-19 pandemic on the stock market in Saudi Arabia during the period from March 15, 2020, to August 10, 2020, using Vector Auto-Regressive (VAR) model and Autoregressive Conditional Heteroscedasticity ARCH models.

2. Literature Review

The coronavirus (COVID-19) as a global pandemic, its characteristics are that it has an unknown etiology, no targeted drugs, and a lack of sufficient experience in treatment methods. All countries are responding to this pandemic, which is causing great losses to the global economy and financial markets (Aslam et al., 2020). Therefore, studying the impact of the pandemic on the economy is a hot topic that has recently piqued researchers interest (Liu et al., 2020). Stock market can be a powerful tool for the economy. It provides a unique view of the expected future of a company and the economy. That is because the value of a firm derives from all future expected cash flows, discounted to the present to adjust for time and uncertainty (Wagner, 2020).

There is a quickly growing literature about the impact of COVID-19 on the stock market. While the dynamic of stock markets during the pandemic might looks random, irrational, or even insane at first glance, on closer inspection it becomes clear that they did not react blindly (Capelle-Blancard & Desroziers, 2020). Stock market movements during COVID-19 were more reflective of sentiment than substance (Cox et al., 2020).

Several studies have confirmed that the COVID-19 pandemic has caused an unprecedented economic and financial crisis. Global financial market risks have increased dramatically in response to the COVID-19 pandemic (Zhang et al., 2020).

Most empirical studies confirmed the negative response of the stock market indices to the spread of the COVID-19 pandemic (Cao et al., 2020; Ashraf, 2020; Alber, 2020; Rahman et al., 2021; Ahmar & del Val, 2020; Anh & Gan, 2020; Eleftheriou & Patsoulis, 2020; Shujan et al., 2020; Camba & Camba Jr, 2020). Moreover, Khan et al. (2020) showed that the growth rate of weekly new cases of

COVID-19 negatively predicts the returns in stock markets of sixteen countries. He et al. (2020a) analyzed the daily returns data from stock markets in China, Italy, South Korea, France, Spain, Germany, Japan and the USA. The study showed that COVID-19 has a negative, but short-term impact on stock markets of affected countries. In addition, the study concluded that there is no evidence that COVID-19 has negatively affected stock markets in these countries more than it has affected the global average. On the other hand, Waheed et al. (2020) concluded that the Pakistani stock market index, achieved a positive increase in stock returns, the reason to the timely intervention of the Pakistani government that protected investors from an absolute disaster for the stock market.

Khanthavit (2020) estimated the COVID-19 effects for the Chinese stock market returns compared to 10 markets – five most affected countries (United States, India, Brazil, Russia, and France) and five best recovering countries (Hong Kong, Australia, Singapore, Thailand, and South Korea). The study concluded that the COVID-19-induced returns replace the pre-COVID-19 normal returns; it is also negatively auto-correlated and highly volatile. The COVID-19-induced returns are new normal returns in the COVID-19 period.

The COVID-19 pandemic has different impacts on different stock markets; Ngwakwe (2020) revealed that the Dow Jones Industrial Average showed a significant reduction in mean stock value during the COVID-19 period, The China Stock Exchange Composite Index experienced a significant increase in mean stock values during the pandemic, higher than it had been before the pandemic. The S&P 500 and the Euronext 100 indices showed a non-significant difference in mean stock price during the pandemic. Liu et al. (2020) evaluated the short-term impact of the COVID-19 pandemic on 21 leading stock market indices in major effected countries including Japan, Korea, Singapore, USA, Germany, Italy, and the UK. The results indicated that the stock markets in major affected countries fell quickly after the outbreak. In addition, countries in Asia experienced more negative abnormal returns compared to other countries. Topcu and Gulal (2020) revealed that the negative impact of pandemic on emerging stock markets has gradually fallen and begun to taper off by mid-April.

The impact of the outbreak has been the highest in Asian emerging markets whereas emerging markets in Europe have experienced the lowest impact. The study also found that the governments' response time and the size of the stimulus package to be important in offsetting the effects of the pandemic. Onali (2020) indicates that changes in the number of cases and deaths in the USA and six other countries that affected by the COVID-19 have no impact on USA stock market returns, regardless of the number of cases reported in China. There is evidence of a positive effect, for some countries, on the conditional heterogeneity of Dow Jones and S&P500 returns. The results also indicate that the number of deaths reported in Italy and France has a negative effect on stock market returns, and has a positive effect on VIX returns. Gil-Alana and Claudio-Quiroga (2020) studied the impact of the COVID-19 pandemic on three stock markets: namely, the Korean SE Kospi Index, the Japanese Nikkei 225, and the Chinese Shanghai Shenzhen CSI 300 Index. The results indicate that mean reversion and thus transitory effects of shocks occur in the Nikkei 225 index, the shocks are permanent for the SE Kospi and CSI 300 indices.

Some studies have shown that stock markets respond quickly to the COVID-19 pandemic, this response varies over time depending on the stage of the pandemic. Ashraf (2020) showed negative market reaction was strong during early days of confirmed cases and then between 40 and 60 days after the initial confirmed cases. Ali et al. (2020) suggested that the Chinese market has stabilized while the global markets have gone into a free fall especially in the later phase of the COVID-19 spread. Alber (2020) indicated that stock market returns seem to be sensitive to COVID-19 cases more than deaths, and to COVID-19 cumulative indicators more than new ones. Sansa (2020) revealed that there is a positive significant relationship between the COVID-19-confirmed cases and the financial markets (Shanghai stock exchange and New York Dow Jones) from March 1, 2020, to March 25, 2020 in China and USA. Alam et al. (2020) investigates the impact of the lockdown period caused by the COVID-19 on the stock market of India. The results indicate that the market reacted positively with significantly positive average abnormal returns during the present lockdown period, and investors anticipated the lockdown and reacted positively, whereas in the pre-lockdown period investors panicked. The study confirms that the lockdown had a positive impact on the stock market performance until the situation improves in India. Gormsen and Koijen (2020) showed that stock markets in the USA and the European Union did not respond strongly to the outbreak in China. Stock markets fell sharply on February 20 once it became apparent that the outbreak had spread to Italy, South Korea and Iran. Khan et al. (2020) revealed that investors in stock markets in 16 countries do not react to media news of COVID-19 in the early stage of the pandemic. The Chinese government's drastic measures to contain the spread of the pandemic have regained investor confidence in the Shanghai stock market.

Volatility is crucial to the financial markets. Some studies have attempted to understand the impact of the COVID-19 pandemic on financial market volatility include a study by Yousef (2020), which investigates the impact of the (COVID-19) on stock market volatility for the major G7 stock market indices, i.e., the S&P500 index for the USA, the FTSE100 index for the UK, the S&P/TSX index for Canada, the DAX index for Germany, the CAC40 index for

France, the FTSE MIB Index for Italy, and the Nikkei 225 index for Japan. The results reveal that the COVID-19 has increased stock market volatility in all countries. Baek et al. (2020) confirmed the significant impact of COVID-19 on USA stock market volatility. Moreover, the results showed that volatility is sensitive to both negative and positive COVID-19 information, but the negative news is more impactful. A study by Ambros et al. (2020) also proved that changes in the news of COVID-19 increase the volatility in the European stock markets. Jelilov et al. (2020) showed that COVID-19 increases volatility in Nigeria stock market. Bora and Basistha (2021) revealed that the stock market in India has experienced volatility during the COVID-19 pandemic. Sharma (2020) examined whether the COVID-19 pandemic has changed the common denominators of volatility in five developed Asian economies, Hong Kong, Japan, Russia, Singapore, and South Korea. The study found that commonalities in volatility during the COVID-19 period more pronounced in the case of Singapore compared to the other four economies.

In addition, Zaremba et al. (2021) demonstrated that governments' responses to the COVID-19 pandemic, especially the non-pharmaceutical interventions, increase stock market volatility in 67 countries around the world. Just and Echaust (2020) investigate the relationship between US stock market returns (S&P500) and the indicators of the market, namely, implied volatility, implied correlation, and liquidity. It also considers the short-range dependence between both total confirmed cases and deaths in twelve countries and market movements. The study found the structural break between stock market returns and key stock market indicators. Engelhardt et al. (2021) concluded that the increasing number of announcements of COVID-19 cases leads to increased volatility in global financial markets, also the stock market volatility in response to case announcements is much less in countries with high confidence, so community confidence in the government plays an important role in curbing stock market volatility. Alzyadat et al. (2021) estimated the conditional volatility in the Saudi Arabia stock market returns. The study distinguished the period before and during the COVID-19 pandemic. The study results revealed evidence of an asymmetric inverse effect during the period before the COVID-19 pandemic. It also revealed strong evidence of the impact of the news when the COVID-19 pandemic began.

Some studies have examined the effects of COVID-19 pandemic on stock market sectoral indices. For example He et al. (2020b) evaluate the impact of COVID-19 on stock prices of various Chinese sectors, the results showed that the COVID-19 pandemic has a severe impact on traditional sectors, such as transportation, mining, and electricity. In contrast, it has created opportunities for high-tech fields. Other sectors such as manufacturing, information technology, education, and health have responded positively to the pandemic. Ozturk et al. (2020) analyzes the effects of the COVID-19 pandemic on the Turkish stock market. The study found that the most adversely affected sectors were metal products, machinery and sports, insurance and banking sectors. Despite the substantial economic downturn, food-beverage, wholesale and retail trade and real estate investment sectors have been the less affected industries from the pandemic.

Mazur et al. (2020) investigate the US stock market performance during the crash of March 2020 triggered by COVID-19 pandemic. The study showed that natural gas, food, healthcare, and software stocks earn high positive returns, whereas stock values in petroleum, real estate, entertainment, and hospitality sectors fall dramatically. Moreover, loser stocks exhibit extreme asymmetric volatility that correlates negatively with stock returns. Firms react in a variety of different ways to the COVID-19 pandemic. Elsayed and Elrhim (2020) investigated the effects of COVID-19 pandemic on sectoral indices of the Egyptian stock market. The results indicated that the sectoral stock market returns are more sensitive to the cumulative indicators of mortality compared to daily deaths cases, as well as the new infected cases more than the cumulative COVID-19 infected cases. Saputra et al. (2021) found that there was a difference in the average trading volume activity and the average trading frequency activity in pharmaceutical stocks before and after the announcement of the first case of COVID-19 in Indonesia. Huo and Qiu (2020) shows that the stocks with lower institutional ownership react strongly to COVID-19 pandemic in China's stock market. Moreover, Rahman et al. (2021) emphasized that smaller, less profitable and valuable portfolios are the hardest hit during the pandemic. It also indicated a significant increase in correlation between returns across stocks, sectors and markets during the pandemic period.

Finally, Baker et al. (2020) concluded that no previous outbreak of infectious diseases, including the Spanish flu, had affected the stock market as strongly as the COVID-19 pandemic. The study suggests that government restrictions on business activity and social distancing are the main reasons why the US stock market has reacted more strongly to COVID-19 compared to previous pandemics of 1918–1919, 1957–1958, and 1968.

3. Data and Methodology

To achieve the objective of the study, daily data will be used from the index of the stock market in KSA. The Tadawul All Share Index (TASI) is a major stock market index, which tracks the performance of all companies listed on the Saudi Stock Exchange market. The other variable is the change in the number of daily cases infected with COVID-19.

The stock market returns calculated by the following formula:

$$R_t = P_t - P_{t-1}$$

Where, R_t stock market returns, P_t, and P_{t-1} represent the closing price in the stock market at time t, and the previous day's closing price at time $t-1$, respectively.

The relation between variables will be analyzed empirically by the regression of Vector Auto-Regressive (VAR) model where the stock market index is determined endogenously. Since COVID-19 affects the expectations of risk and uncertainty across the markets, it is included as an exogenous variable in VAR model. Within this, it is possible to measure the impact in the performance of the stock market returns. The estimation of this model should satisfy the test of stationary, and it should test for heteroscedasticity and serial correlation by using the econometrical procedure.

The period of the analysis is established in a daily periodicity obtained from March 15, 2020, to August 10, 2020 in KSA using VAR model, which allows the Impulse Response Function. The model can be written as follows:

$$X_t = AX_{t-i} + \varepsilon_t$$

The vector represents the variables used in the estimation. Autoregressive Conditional Heteroscedasticity (ARCH) models are commonly used in the financial studies to model and forecast the volatility of stock markets around the world. (ARCH) models are specifically designed to model and forecast conditional variances. The variance of the dependent variable is modeled as a function of past values of the dependent variable and independent or exogenous variables. The GARCH (p, q) model, proposed by Engle (1982) and Bollerslev (1986), can be spelt out as follows:

$$\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\sigma_{t-1}^2$$

Where σ_t^2 refers to the conditional variance. The variance equation is based on the constant terms ω and information on fluctuations in the previous period ε_{t-1}^2, which is measured by the lag of the error square and its coefficient α. The expected variance in the previous period σ_{t-1}^2, and its coefficient β. This requires knowledge of previous expectations of variance σ^2 and the error, $\sqrt{\omega/(1-\alpha-\beta)}$ the average variance in the long run. This can be calculated if $\alpha+\beta<1$ and will have meaning if the coefficients are positive. The model is called GARCH (1, 1). (1, 1) refers to the number of lags periods of the regression, or ARCH term, while the second number indicates the lags periods for the moving averages.

4. Empirical Results

Table 1 presents information on descriptive statistics for stock market returns and the number of COVID-19 infections recorded during the study period. The results of the standard deviations in the descriptive statistics show that stock market returns and COVID-19 are volatile variables because their values are farther away from the mean. The results also show that the highest stock market returns and the number of COVID-19 infection cases recorded during the study period were 234 and 4919 respectively. Figure 1 illustrates the growth rate of COVID-19 and stock market returns and displays evidence of fluctuations in the variables over the study period.

The correlation matrix for stock market returns and COVID-19 cases in Table 2 provides information about the correlation between the stock market returns and the COVID-19 infection cases. The results indicate a negative and weak relationship between the stock market returns and the number of COVID-19 infection cases recorded during the study period, with the estimated coefficient (–0.007).

Precursory to the application of the VAR models, the unit root properties of the variables checked and established that

Table 1: Descriptive Statistics

	R	COVID
Mean	11.18577	1967.031
Median	8.560000	1905.000
Maximum	233.7700	4919.000
Minimum	–527.3200	15.00000
Std. Dev.	98.15891	1362.029
Skewness	–1.961722	0.200468
Kurtosis	12.28006	2.058027
Jarque-Bera	410.2812	4.235924
Probability	0.000000	0.120277
Sum	1085.020	190802.0
Sum Sq. Dev.	924976.5	1.78E+08
Observations	97	97

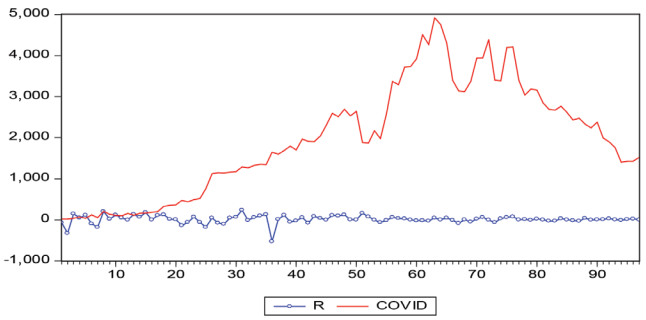

Figure 1: The Growth Rate of COVID-19 and Stock Market Returns Over the Study Period

Table 2: Correlation Matrix for Stock Market Returns and (COVID-19)

	R	COVID
R	1	–0.006816
COVID	–0.006816	1

Table 3: Vector Autoregression Estimates

	R	COVID
R(–1)	–0.022077	–0.170729
	(0.10329)	(0.30366)
	[–0.21374]	[–0.56225]
COVID(–1)	–0.001455	0.966739
	(0.00745)	(0.02189)
	[–0.19540]	[44.1541]
C	15.14720	83.19855
	(17.8886)	(52.5905)
	[0.84675]	[1.58201]
R-squared	0.000895	0.954487
Akaike AIC	12.06549	14.22223
Schwarz SC	12.14562	14.30237
Mean dependent	12.02833	1987.365
S.D. dependent	98.32095	1354.298
Log likelihood		–1255.810
Akaike information criterion		26.28772
Schwarz criterion		26.44799

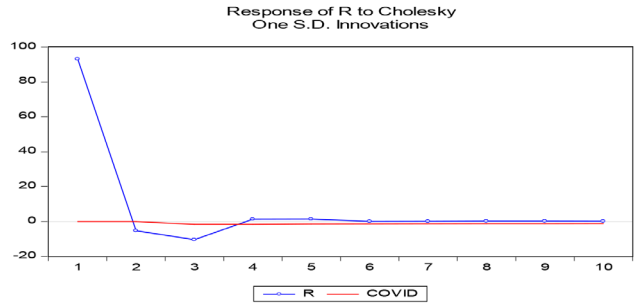

Figure 2: The Responses of the Stock Market Returns to COVID-19

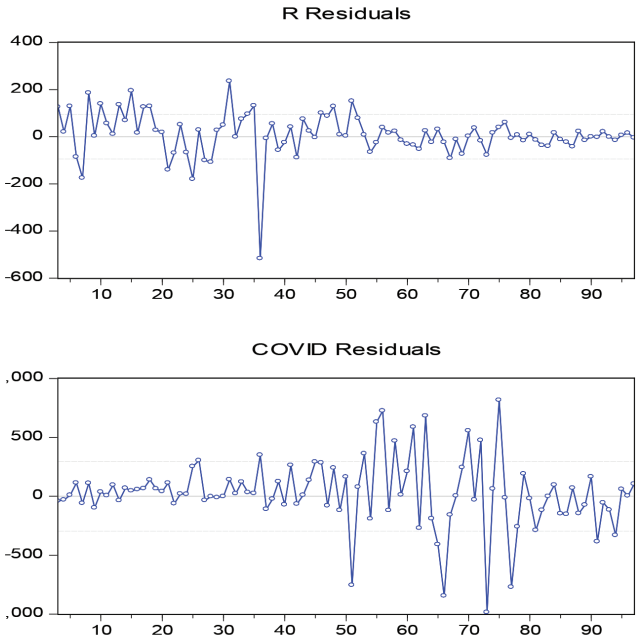

Figure 3: Stock Market Returns and COVID-19 Residuals

all the variables of the stock market returns and COVID-19 infection cases are stationary at *I*(1).

Table 3 shows the estimates of the VAR model. It is useful to mention here that interpretations of the VAR estimates may not be meaningful in this study due to the theoretical nature of this model, because the lack of a theoretical justification. However, the study depends on the Impulse Response Functions (IRF) for interpretation. Based on the estimated results, the study finds negative effects among the variables with statistically non-significance. The results of the impulse response functions display in Figure 2 reveal the responses of the shock market returns to COVID-19 pandemic. The results show that stock market returns respond strongly and negatively to the number of COVID-19 infection cases up to the second period; after that, the effect decreases in the third and fourth periods, but after the fourth period, the effect becomes weak. That mean the response at the beginning of the pandemic was strong and then the response began to decline. Therefore, based on the results of the impulse response functions, it can be said that shock market returns respond to COVID-19 negatively over the study period. This response is effective in the early periods then it becomes ineffective. The results of the residuals in Figure 3 confirm the impulse response functions results.

The study tests for the presence or otherwise of heteroskedasticity in the stock market returns series using the autoregressive conditional heteroskedasticity (ARCH). The result of the ARCH test indicates that the stock market returns series is volatile, therefore permits the application of the ARCH models. The results in Table 4 indicate that the stock market returns negatively and

Table 4: ARCH Estimates

GARCH = *C*(1) + *C*(2) * RESID(–1)² + *C*(3) * GARCH(–1) + *C*(4) * COVID				
Variable	**Coefficient**	**Std. Error**	***z*-Statistic**	**Prob.**
C	6988.679	569.5386	12.27077	0.0000
RESID(–1)²	–0.037652	0.021688	–1.736095	0.0825
GARCH(–1)	0.582664	0.033593	17.34478	0.0000
COVID	–1.515828	0.139300	–10.88178	0.0000
R-squared	0.013121	Mean dependent var		11.18577
Adjusted *R*-squared	0.002677	S.D. dependent var		98.15891
S.E. of regression	98.29019	Akaike info criterion		11.73792
Sum squared resid	937113.3	Schwarz criterion		11.84409
Log likelihood	–565.2890	Hannan–Quinn criter.		11.78085
Durbin–Watson stat	2.010238			

significantly relate to the COVID-19 infection cases recorded during the study period.

5. Conclusion

The descriptive statistics show that stock market returns and the number of COVID-19 infection cases recorded during the study period are volatile, and displays evidence of fluctuations in the variables over the study period. The correlation matrix for stock market returns and the COVID-19 infection cases provides information about a negative and weak relationship between the stock market returns and the number of COVID-19 infection cases; the estimated coefficient is (–0.007).

The estimates of the VAR model find negative effects among the variables with evidence of statistical insignificance. The results of the impulse response functions show that the shock market returns respond strongly and negatively to the number of COVID-19 infection cases up to the second period, then the effect decreases in the third and fourth period, after the fourth period, the effect becomes moderate. That mean the response at the beginning of the pandemic was strong and then the response began to decline. Based on the results of the impulse response functions that shock market returns respond to COVID-19 negatively over the study period. This response is effective during the early periods; after the fourth period, it becomes ineffective. As well as the results of the residuals confirm the impulse response functions results. This results are in line with the study by Ashraf (2020). In addition, the results of the GARCH models indicate that the shock market returns negatively and significantly relate to the COVID-19 infection cases recorded during the study period.

The study concluded that the stock market in KSA responded negatively and strong during early periods of COVID-19 pandemic, then the response began to decline. The stock markets are responding quickly to the COVID-19 pandemic, but this response varies over time according to the stage of the pandemic. However, the Saudi government's response time and size of the stimulus package have played an important role in alleviating the impacts of the COVID-19 pandemic on the stock market.

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