

Chaudhry, Naveed Iqbal; Asad, Humaira; Abdulghaffar, Mahwish; Amir, Muhammad

Article

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Contagion Effect of COVID-19 on Stock Market Returns: Role of Gold Prices, Real Estate Prices, and US Dollar Exchange Rate

Naveed Iqbal Chaudhry (Corresponding author)

Department of Business Administration, University of the Punjab, Gujranwala Pakistan
Email: Naveed.iqbal@pugc.edu.pk

Humaira Asad

Institute of Business Administration, University of the Punjab, Lahore, Pakistan
Email: humaira@ibapu.edu.pk

Mahwish Abdulghaffar

Department of Business Administration, University of the Punjab, Gujranwala, Pakistan
Email: mehwishabdulghaffar01@gmail.com

Muhammad Amir

Department of Commerce, University of the Punjab, Gujranwala, Pakistan
Email: ma.arain824@gmail.com

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Abstract

The purpose of this study is to empirically analyze the contagion effects of the COVID-19 pandemic on stock returns of the Pakistan Stock Exchange (PSX). In this context, the causal changes of three major macroeconomic indicators i.e. gold prices, prices of real estate, and the US exchange rate on the stock market returns were assessed. The daily indices of stock returns, house prices index, plot price index, daily prices of gold, and the daily US dollar exchange rate are analyzed. The data spanning six months, including three months of pre-COVID-19 and three months of post-COVID-19, was analyzed using E-views software. The event study methodology is used, and the GARCH model is applied to test the relations. The findings highlight the impact of the COVID-19 pandemic on stock returns and reveal a significant change in the relationship between prices of gold and the stock market returns. Similarly, the change in the relations between stock market returns and real estate prices got significant support. However, the change in the relations between the US dollar exchange rate and stock market returns was found insignificant. The study contributes by providing evidence that explains the changes in dynamics of the capital market during the pandemic. The study also helps the investors to understand how macroeconomic variables behave during periods of stress.

Keywords: COVID-19, Pakistan Stock Exchange (PSX), contagion effect, gold prices, real estate prices, US dollar exchange rate.

1. Introduction

1.1 Background of the Study

The most recent pandemic of COVID-19 has globally exemplified the nature of its impact. This dreadful health crisis started in Wuhan, China in December 2019, and in few months it enveloped the entire world. Its novelty means that scientists are not sure yet how it behaves as it has a little history to go, but it has affected 188 countries (Adekoya & Oliyide, 2021). The advent of the pandemic of the COVID-19 in Pakistan was on 26 February 2020, where the very first two cases were found in Karachi city (Ainine Devara Nugroho, 2021). The spread of coronavirus disease was surprising as the tally of Pakistan hit 4601 confirmed cases of COVID on 30 April 2020, including 727 recovered patients and 66 death cases (Al-Awadhi, Alsaifi, Al-Awadhi, & Alhammadi, 2020). The pandemic has devastated all sectors, though, and financial implications come with pre-warnings. Gold prices remain volatile by the time. The long-term relationship of gold prices with oil and equity markets is examined, and results demonstrate a long-term association among gold prices, oil prices, and stock market returns (Altig et al., 2020; Corbet et al., 2020).

Additionally, the relationship between gold prices and the stock market is also observed in recent studies. Moreover, recent studies have also identified a significant relationship between gold prices across different markets during the period of COVID-19. Real estate is a crucial and big sector. Investors invest in real estate for long-term investment. The size of investment in real estate is increasing day by day. It is considered a secure and growing asset. Many politicians and people with the highest net worth in Pakistan invest in the real estate business; that is why it constitutes a major proportion of total investment. It contributes largely to the Gross Domestic Product (Anh & Gan, 2020). This sector has shown major growth in the last decade (Ashraf, 2020). The private sector of Pakistan plays a major role in the prices of real estate, as highlighted in the study by Ataguba (2020). This sector has a significant association with the stock market that remains dynamic over the period.

1.2 Justifications of the Study

The exchange rate is an important macroeconomic indicator and has a great impact on the economy. It also contributes to price stability. The exchange rate changes can affect the imports and exports of a country. According to Atri, Kouki, and imen Gallali (2021), the exchange rate helps maintain the equilibrium in the balance of payments. Pakistani people, particularly the front-line workers were not fully aware of the worrying and disturbing circumstances caused by the pandemic (Barua, 2020). The current research provides useful insights to the investors on when and which segment is secure for investment. Moreover, the current study is fulfilling the gap present in the prior studies by explaining the concepts of the exchange rate, and gold prices in the context of Pakistan.

1.3 Research Gap

Several studies examine the stock market's performance over the Covid period. However, many questions stay unanswered. The destruction caused by the global pandemic is leaving an impression on each sector. The COVID-19 outbreak provides a suitable investigational structure to evaluate the insight. Stock prices are influenced greatly because of the uncertainty caused by the pandemic. Investors are unwilling to invest in such an unpredictable situation, and their investment patterns are greatly affected. Hence, it is important to investigate the causal effects of fluctuations in gold prices, oil prices, and US dollar exchange rate on stock market returns in the context of Pakistan. This study aims to fulfill this gap.

1.4 Implications of the Study and Usefulness

The stock market data has been analyzed in this study because it will provide insight into the changes in share prices throughout the COVID-19 period. The current research is a pioneer study aiming at examining the impact of changes in the gold price, fluctuations in real estate price, and variations in the exchange rate on the stock market. Although a few research studies have been conducted in Pakistan that explain the economic impact of COVID-19 (Cavallo & Forman, 2020); still, there is a gap in studying the contagious impact of the COVID-19 in the context of the three key macroeconomic indicators mentioned above. The present study will cover the gap thoroughly by providing a clear insight into the stock market, gold market, real estate, and foreign exchange market in Pakistan (Wang, 2021). The current study has theoretical and policy implications. The findings of this study contribute by explaining the relationships among the variables investigated in this study. The next section of this paper highlights the literature and proposes hypotheses. The rest of the paper includes methodology, discussion and result, and the conclusion of the study.

2. Literature Review

2.1 Related Theories

Three major theories explain the investment decision-making process. These include the expected utility theory, the efficient market hypothesis (EMH), and the theory of behavioral finance. According to the expected utility theory, the choice of the investor depends upon the risk and the expected utility attached with a certain investment opportunity. EMH is based on the assumption that available information plays an important role in determining the real value of a stock. On the other hand, behavioral finance emphasizes the behavioral biases of the market participants (Singh, Babshetti, & Shivaprasad, 2021; Chien et al., 2021; Cepoi, 2020). Therefore, the behavioral finance theory provides the basis for the current study as it explains that the investment patterns of investors change in the period of stress.

2.2 Covid-19 and its Financial Distress

Coronavirus is a newly invented virus that causes a contagious disease. It is an unanticipated outbreak. There is an urgent need to know the effects of the COVID-19 virus, how it spreads, and what are the precautionary measures to stop its transmission rapidly (WHO, 2020). The COVID-19 has given overwhelming distress all across the globe

(Ehsan, 2020). Many countries use different policies such as strict lockdown, quarantine, travel restrictions, and isolation to stop the rapid spread of the disease. According to Eleftheriou and Patsoulis (2020), the epidemic will unavoidably cause long-term socioeconomic influences on both the victim and resident societies. The living standard of all the people is severely affected by the pandemic. It causes a decrease in the income level of people.

Moreover, when these types of emergencies occur, they hit the emotional sentiments of the investor. That is why the investment patterns of investors get disturbed, which ultimately shows the fluctuation in stock prices (Elgin, Basbug, & Yalaman, 2020). Different studies are conducted to assess the impact of the COVID-19 pandemic on various sectors and different industries. Like other contagious diseases, coronavirus also affects stock market outcomes (Erdem, 2020). The outbreak of the COVID-19 has a clear and notable socioeconomic short and long-term impact. According to Gharib, Mefteh-Wali, and Jabeur (2021), the long-term significance of this epidemic may result in massive unemployment and business catastrophes. The authors bring some information about the wreaked havoc of the epidemic in the mining industry, too (Gil-Alana & Claudio-Quiroga, 2020). World Trade Organization forecasted a decline in trade up to 32% in 2020 all over the globe.

The literature showed a significant effect of the various calamities that happened in the past on multiple sectors of the economies. Similar effects have been observed in the case of the most recent coronavirus epidemic. Many research studies have explored the effects of the COVID-19 pandemic, but a further addition to the literature can be made.

2.2.1 Stock Exchange and COVID-19

The emerging markets of different countries are affected by COVID-19, but the significant negative impact of the current pandemic has gradually decreased (Goker et al., 2020). In a study, the impact of COVID-19 on the UK Stock market has been estimated. The findings of this study confirm the negative impact of the pandemic on the UK Stock market prices (Gopalan & Misra, 2020). Stock markets and stock returns are sensitive to all types of disasters and epidemics. These markets instantly respond to the changes caused by a pandemic. Likewise, a study conducted in China and the USA revealed a significant positive association between the number of COVID-19 patients and the financial stock market performance of both countries (Harjoto et al., 2021). A study by Huynh et al. (2021) explored the impact of the COVID-19 pandemic on Turkish Stock prices.

In another study, the effects of COVID-19 on the various industries in Australia. The results show that most of the stock indices reacted negatively to the daily rise in COVID-19 confirmed cases (Huynh et al., 2021). Furthermore, the prices of stock and expectations of investors get changed throughout the COVID-19 period (Ilzetzki, Reinhart, & Rogoff, 2020). Therefore, this study has proposed the following hypothesis:

- **H₁:** COVID-19 pandemic is positively related to stock market returns.

2.3 Gold Prices Volatility and COVID-19

Gold price movement must be considered closely to indicate the stock market movements and necessary actions (Jelilov et al., 2020). Literature also shows that the fluctuation in the price of gold was of no use to predict future inflation. Gold is used for hedging purposes

because of its low-slung fluctuation and its capacity to reservation of capital during the era of a rapid increase in inflation, and it provides a safeguard in investment during financial and economic crises (Kabir et al., 2020; Khan et al., 2020).

According to Konstantakis, Melissaropoulos, Daglis, and Michaelides (2021), initially gold showed a strong hedging role during the COVID-19 pandemic when other potential securities classes were less efficient. Another study investigated the bubble contagion effect of the COVID-19 outbreak and examined the correlation between crude oil and gold spot prices (Kumar and Robiyanto, 2021). Hence the literature shows many pieces of evidence of gold price fluctuation during COVID-19.

2.3.1 Gold Price and Stock Market Returns

Gold has a strong association with markets as well, including stock markets. Many studies show that this relationship changes during the global crisis. According to Kumar, Kumar, and Singh (2020), the gold price volatility has a causal effect on the stock market returns. According to Arfaoui, Ben Rejeb (2017), gold prices and stock markets usually depend on each other. Likewise, a study conducted in India highlights the impact of gold prices and oil prices on stock exchange returns (Liu, Manzoor, Wang, Zhang, & Manzoor, 2020). Similarly, the German stock exchange is also analyzed to check its relationship with gold prices, and results demonstrate the significant impact on the stock exchange (Liu, Wang, & Lee, 2020). However, there is still a gap in the literature on the contagious impact of gold prices on stock prices during the coronavirus pandemic. This study will cover this gap by using data from the PSX during the COVID-19. Hence, the following hypothesis is proposed:

- **H₂:** There is a significant change in the association between stock market returns and gold prices during COVID-19.

2.4 Real Estate Price Volatility and COVID-19

The investigation of the effects of changes in the real estate prices on the stock market during COVID-19 is one of the primary objectives of this research. In the second wave of COVID-19, an increase in domestic sales was anticipated. A varied pattern of movement in general real estate, and housing prices was observed during the COVID-19 period (Liu, Wang, & Lee, 2020). Another study based on the analysis of data of the real estate market in Turkey post first wave of COVID-19 indicated a strong relationship between COVID-19 and real-estate prices (Mishra, Rath, & Dash, 2020). According to Narayan, Devpura, and Wang (2020), COVID-19 has a drastic impact on housing prices. Furthermore, there is a significant fall in prices followed by a major decline in the income of all the workers.

2.4.1 Real Estate Price and Stock Market Returns

Chinese stock market responds to fluctuations in the prices of real estate (Onali, 2020). Furthermore, the evidence of a global crisis is driven from the literature, where the impact of the disaster on real estate and the stock returns have been estimated. The results highlight that the stock returns volatility was increased during the time of crisis by observing the crisis and pre-crisis period (Ozili, 2020). As far as its independent relationship is considered, no study is evidenced in the context of the Pakistan Stock Exchange (PSX).

Therefore, this research area needs to be addressed in future researches. In this regard, the following hypotheses have been proposed:

- **H3:** There is a significant change in the association between the house price index and the stock exchange returns during COVID-19.
- **H4:** There is a significant change in the relationship between the plot price index and the stock exchange returns during COVID-19.

2.5 Exchange Rate Volatility and COVID-19

The exchange rate has an essential role in foreign trade, including the balance of payment and balance of trade. The exchange rate changes over the period and responds to the prevailing circumstances. The empirical evidence that evaluated and supported a new channel of exchange rate predictability, namely the disease outbreak channel, highlighted that the exchange rate responds negatively to COVID-19 (Ozturk & Cavdar, 2021). Conversely, the COVID-19 pandemic can predict, two exchange rate returns, USD–CLP and USD–SEK. In addition, it can also predict six exchange rate return volatility. These include USD–CHF, USD–CNY, USD–ILS, USD–JPY, USD–PEN, and USD–KRW (Njindan Iyke, 2020). Moreover, the exchange rate is related to the stock prices, and this relationship is changed in nature during the pandemic period. Polemis and Soursou (2020) highlighted that the exchange rates have transitory effects on stock, and the pandemic of COVID-19 has changed the confrontation of the rate of exchange to the stocks. The studies mentioned above signify that the exchange rate remains volatile at the outbreak of COVID-19 and the influence of this volatility of the exchange rate affects the stock market. Furthermore, this impact is needed to be studied to generate new knowledge.

2.5.1 Exchange Rate Relationship with the Stock Exchange

The dynamic effect of the rate of exchange on the stock exchange market is studied in past researches. Several studies have examined the association of stock return and foreign exchange rate empirically. For instance, a recent study demonstrated that the change in the rate of exchange has a significant impact on stock market returns (Jayashankar, & Rath, 2017). Similarly, the effect of COVID-19 is studied on the stock exchange of many countries. Exchange rate and stock price interaction in the emerging markets remain unexplored as very few studies have explored this nexus during COVID-19. A study based on the data from BRICS countries indicates the presence of a significant negative relationship between stock and foreign exchange returns in most of the BRICS economies during the recent pandemic (Rai, & Garg, 2021). A study by Sumer & Ozorhon (2020) highlighted the influence of COVID-19 on exchange rate instability concerning stock returns, and the result demonstrated that a real-estate return performed much better than the return on gold prices.

Based on a careful review of the literature, it can be stated that there are a few studies that explain the impact of exchange rate fluctuations on the stock market returns in emerging markets, particularly in the context of Pakistan. The present study aims to test whether the pandemic influences the relationship of the rate of exchange with the stock market return and volatility in the relationship. For this purpose following hypothesis is proposed:

- **H₅:** There is a substantial change in the association between exchange rate and stock market returns during COVID-19.

3. Methodology

3.1 Data and Sample

The present research estimates whether the novel coronavirus has caused abnormality in returns of stock prices, gold prices, and real estate prices. In Pakistan, the first two cases of COVID-19 were confirmed on 26 February 2020; however, the virus spread across the country in March 2020. Therefore, to account for the pre-COVID-19 data from 01 December 2019 to 29 February 2020 was taken (Sumer & Ozorhon, 2020). Furthermore, the period after the virus spread is taken from 01 March 2020 to 31 May 2020. The data of both periods have been used to evaluate the impression of COVID-19 on the stock market returns, and other assets' price volatility. Similarly, event-based research also supports selecting the present study sample (Tanin, Sarker, & Brooks, 2021).

3.2 Measurement of Variables and Sources of Data

To account for the variation in stock market returns, the closing prices of the daily values of the KSE-100 index spanning 01 Dec 2019 to 31 May 2020. KSE-100 index is considered as the best indicator to represent variations in Pakistan Stock Exchange (PSX). The data is collected from the official website of PSX (i.e. <https://www.psx.com.pk/>). Stock market returns were calculated by using the closing prices of the daily values of the KSE-100 index. For the measurement of real estate prices, two proxies have been used. These include the house price index and plot price index. These indices represent the prices of houses and plots in the major cities of Pakistan. Daily data for house price index and plot price index have been collected from <https://www.zameen.com/>. It is considered one of the most credible sources of house price data in Pakistan. Gold prices have been taken from <https://www.gold.pk/>. Gold prices are measured as daily per tola price. Gold rate is retrieved from the website on daily basis. For the foreign exchange rate, the US dollar exchange rate has been taken. The data for the US dollar exchange rate for the sampled period has been taken from <https://www.forex.pk/currency-open.php?base=PKR&curr=USD>.

3.3 Econometric Models

To assess the effect of COVID-19 on the stock market returns the technique of event study was applied. The following two econometric models were developed to check the volatility caused by the event in the stock market returns and average abnormal returns respectively. Equation 1 presents the model developed to estimate the abnormal returns. The stock market returns are regressed on four factors explained below.

$$R_t = \alpha + \beta_1 GP_t + \beta_2 EXR_t + \beta_3 HPI_t + \varepsilon_t \quad [\text{Equation 1}]$$

The average abnormal return is estimated using Equation 2 presented below:

$$AR_t = R_t - (\alpha + \beta_1 GP_t + \beta_2 EXR_t + \beta_3 HPI_t + \varepsilon_t) \quad [\text{Equation 2}]$$

In the equations presented above, R_t is the return estimated using daily values of the KSE-100 index daily for the specified period. GP_t represents gold prices for time t , EXR_t represents the exchange rate of the US dollar for time t , HPI_t specifies the house price index

for the time t , and ε is an error term. To estimate the impact of changes in the real-estate prices, two proxies have been used, namely the house price index and plot price index. The House price index is represented as HPI_t and Plot Price Index is represented as PPI_t . This model assumes that α and β remain constant in the period observed to calculate the normal return of the KSE-100 index. Further, AR_t represents average abnormal return. It is estimated by taking the difference between normal return and expected return. The Cumulative Abnormal Returns (CAR) values were computed by taking the summation of computed abnormal returns.

4. Analysis and Results

4.1 Descriptive Statistics

Descriptive statistics demonstrate the summary of the whole data analyzed. The descriptive statistics of all the variables, including gold prices, the exchange rate of the US dollar, house price index, plot price index, and return on the KSE-100 index are presented in Table 1. This table shows the values of mean, median, maxima, minima, standard deviation, coefficients of skewness and kurtosis, and the number of observations for each of the five variables of this study for pre and post COVID-19 periods.

The mean value of the US Dollar Exchange Rate (EXR), gold prices (GP), and real estate price indices represented by HPI and PPI show an increasing trend over pre and post COVID-19, whereas the mean value of the stock market return (R) indicates a decrease in its value as it dropped from -0.05 to -0.06 during the period of analysis. The timeframe for the analysis was set as 1 December 2019 to 31 May 2020. Moreover, the values of the standard deviation of all the variables also indicate an increase in the spread around the respective mean values. The coefficients of skewness and kurtosis also indicate disturbance in the distribution of the data for all variables over the pre and post COVID-19 period.

Table 1: Descriptive Statistics

Indicators	US Dollar Exchange Rate (EXR)	Gold Price (GP)	House Price Index (HPI)	Plot Price Index (PPI)	Stock Market Returns (R)
Pre Covid-19					
Mean	155.04	89217.33	11330.40	3396.84	-0.05
Median	155.05	90200.00	11335.00	3395.00	0.00
Maximum	156.30	96350.00	11356.00	3405.00	2.82
Minimum	154.40	84350.00	11297.00	3394.00	-2.94
Std. Dev.	0.36	3099.12	17.74	3.60	1.01
Skewness	0.42	0.01	-0.36	1.15	-0.03
Kurtosis	3.47	2.33	1.89	2.88	4.57
Observations	88	88	88	88	87
Post Covid-19					
Mean	162.39	101696.80	11399.15	3415.30	-0.06
Median	162.00	103000.00	11404.00	3418.00	0.00
Maximum	168.55	111300.00	11463.00	3437.00	4.79
Minimum	154.40	87500.00	11356.00	3209.00	-6.85
Std. Dev.	3.88	5806.94	31.24	21.61	1.79
Skewness	-0.45	-0.73	0.25	-7.01	-1.12
Kurtosis	2.48	2.84	1.89	67.69	7.36
Observations	125	125	125	125	125

4.2 t-test for Equality of Means

To assess whether there is a significant difference in the means of the four variables presented below in the pre- and post COVID-19 period, the t-test for equality of means proposed by Snedecor and Cochran (1989) was applied. The results are given in Table 2. The values of t-statistics are significant with p-values < 0.001. This indicates that the mean of variables in pre and post COVID-19 periods are significantly different. The mean difference between the US dollar exchange rate before and after COVID-19 is -7.352. The mean difference between gold prices before and after COVID-19 is -12479.470. The difference in mean of house price index before and after COVID-19 was -68.754. The difference in mean plot price indices before and after COVID-19 was -18.455. All values of differences in mean are negative. This indicates that the values of the four macroeconomic indicators rose significantly after the spread of the pandemic.

Table 2: t-test for Equality of Means

Variables		Mean	t	df	Sig.	Mean Difference	Std. Error Difference	95% CI	
								Lower	Upper
EXR	Pre-COVID	155.039	⁻ 17.729	211.000	0.000	-7.352	0.415	-8.169	-6.534
	Post-COVID	162.391	⁻ 21.081	126.970	0.000	-7.352	0.349	-8.042	-6.662
GP	Pre-COVID	89217.330	⁻ 18.392	211.000	0.000	⁻ 12479.470	678.535	⁻ 13817.046	⁻ 11141.895
	Post-COVID	101696.800	⁻ 20.274	198.357	0.000	⁻ 12479.470	615.555	⁻ 13693.341	⁻ 11265.599
HPI	Pre-COVID	11330.400	⁻ 18.630	211.000	0.000	-68.754	3.690	-76.029	-61.479
	Post-COVID	11399.150	⁻ 20.377	202.941	0.000	-68.754	3.374	-75.407	-62.101
PPI	Pre-COVID	3396.840	-7.930	211.000	0.000	-18.455	2.327	-23.043	-13.867
	Post-COVID	3415.300	-9.367	133.660	0.000	-18.455	1.970	-22.352	-14.558

4.3 Correlation Test

To estimate the strength of association among the variables of study the Pearson correlation coefficients were calculated (Benesty, Chen, Huang, & Cohen, 2009). The calculations are done for pre and post COVID-19 periods separately. The values of correlation coefficients and their respective p-values are presented in Table 3. The table shows a significant change in the association between the prices of gold and the US dollar exchange rate before and after COVID-19. It was -0.3325, and after COVID-19, it was 0.7574. Changes in the values of correlation coefficients for other variables are relatively small.

Table 3: Correlation Matrix

	EXR	GP	HPI	PPI	R
Pre Covid-19					
EXR	1				
	-				
GP	-0.3326	1			
	0.0016	-			
HPI	-0.5229	0.8917	1		
	0	0	-		
PPI	0.2560	-0.7925	-0.8929	1	
	0.0167	0	0	-	
R	0.2434	-0.2245	-0.1772	0.0946	1
	0.0231	0.0366	0.1007	0.3833	-
Post Covid19					
EXR	1				

GP	0.7575	1			
	0.0000	-----			
HPI	0.6053	0.8386	1		
	0.0000	0.0000	-----		
PPI	0.2309	0.2477	0.1125	1	
	0.0096	0.0053	0.2116	-----	
R	0.2855	0.4322	0.5727	0.0623	1
	0.0012	0.0000	0.0000	0.4901	-----

4.4 Event Study Results

Event studies are one of the most commonly used methodologies in financial analysis. These studies help to analyze the impact of any event on the performance of a financial market/organization(s). Many studies that explain the changed behavior of the stock market due to the occurrence of any unexpected event have used the technique of event study. Hartley and Rebucci (2020), investigated the variations in Treasury yields by using the methodology of event study. Likewise, this study also employs event study methodology to evaluate the effect of COVID-19 on the volatility of the stock market returns. Table 4 shows the results of event windows. It shows the Average Cumulative Abnormal Returns (CAR) values for the first ten days along with the corresponding t-values. It can be seen that in the first ten days, the window is not reflecting any impact of the pandemic.

Table 4: Average CAR Values for the First 10 Days of COVID-19

Event window	Average CAR	t-value
1	-0.06992	-0.1875
2	-0.06532	-0.0175
3	-0.06909	-0.1575
4	-0.0696	-0.1775
5	-0.07069	-0.2175
6	-0.06988	-0.1875
7	-0.07527	-0.3875
8	-0.07435	-0.3475
9	-0.06966	-0.1775
10	-0.06818	-0.1275

Next, another window was created to check the effect of COVID on the Karachi stock exchange returns comprising the Average CAR values for the first twenty days. These values of Average CAR along with their t-values are given in Table 5. The average values of cumulative abnormal returns (CAR) and their respective t-statistics show that the impact of COVID-19 becomes significant from Day 17 and stays significant in the next three days. For both windows, the first day is 26 February 2020. This is the day on which the first two cases of COVID-19 were reported in Pakistan. Hence, it can be stated that the impact of the pandemic was realized on the stock market return from Day 17 of the event of the first Corona positive case in Pakistan. This validates H_1 . Hence, we can state that occurrence of COVID-19 influenced stock market returns in Pakistan substantially.

Table 5: Average CAR values for the first 20 days of COVID-19

Event window	Average CAR	t-value
1	-0.06992	-0.1875
2	-0.06532	-0.0175
3	-0.06909	-0.1575
4	-0.0696	-0.1775
5	-0.07069	-0.2175
6	-0.06988	-0.1875
7	-0.07527	-0.3875
8	-0.07435	-0.3475
9	-0.06966	-0.1775
10	-0.06818	-0.1275
11	-0.0721	-0.2695
12	-0.07245	-0.28241
13	-0.0728	-0.29532
14	-0.07314	-0.30823
15	-0.07349	-0.32114
16	-0.07384	-0.33405
17	-0.07418	-1.96955
18	-0.07453	-1.98636
19	-0.07488	-2.00318
20	-0.07522	-2.02011

4.5 GARCH Model Results

To investigate the contagion effect of the COVID-19 outbreak on stock prices and its relationship with gold prices, real estate prices, and the US dollar exchange rate, Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model was estimated in the present study (Bollerslev, 1986). GARCH is used to analyze financial data when volatility can vary due to a financial crisis or any similar event. Many studies have analyzed financial data using GARCH, including Bouazizi et al. (2021), Ghouse et al. (2019), and Wang and Kutan (2013). The estimates of the multivariate GARCH model are given in Table 6. The indicators of goodness of fit are provided at the bottom of this table. All indicators of goodness of fit confirm that the estimated model is a good fit.

The estimated results show that volatility spillovers of gold prices and the house price index significantly influence current conditional volatility in the stock market returns. The impact of gold prices is positive (and significant at $p\text{-value} < 0.000$) but the impact of house price index volatility is negative and significant ($p\text{-value} < 0.05$). However, the impact of volatility exchange is very weak, positive, and insignificant ($p\text{-value} = 0.9273$). Next, we estimated the GARCH model using the plot price index as the indicator of real estate prices. The impact of plot price index volatility on the volatility of stock market returns is positive and significant ($\beta = 0.0181$; $p\text{-value} < 0.005$). These results provide sufficient evidence in favor of H_2 , H_3 , and H_4 . Hence it can be stated that the effects of volatility of gold prices and house price index are on stock market returns are significant. These results also validate

that because of the pandemic there are variations in the impact of gold prices and house prices on the stock market returns in Pakistan.

The results also show that the impact of volatility of US dollar exchange rate on the volatility of stock market returns in Pakistan during the specified period is weak, positive, and insignificant with $\beta=0.004853$ and p-value <0.0001 . This result refutes H_5 . Thus, it is concluded that the US dollar exchange rate has no significant impact on the volatility of stock market returns in Pakistan during the specified period.

**Table 6. Estimates of Multivariate GARCH Model -
Dependent Variable: Stock Market Returns (R)**

Variable	Coefficient	Std. Error	z-Statistic	Prob.
Gold prices	0.000494	2.93E-05	16.83626	0.0000
House price index	-0.013970	0.006921	-2.018510	0.0435
Exchange rate	0.004853	0.053202	0.091227	0.9273
C	207.6916	54.17027	3.834051	0.0001
Variance Equation				
C(6)	57.39293	67.15812	0.854594	0.3928
C(7)	0.996863	0.003848	259.0305	0.0000
C(8)	0.661584	0.070892	9.332242	0.0000
C(9)	0.062419	0.021642	2.884240	0.0039
C(10)	-0.890766	0.025369	-35.11199	0.0000
R-squared	0.694658	Mean dependent var		159.3535
Adjusted R-squared	0.688786	SD dependent var		4.690836
SE of regression	2.616857	Akaike info criterion		3.884396
Sum squared resid	1424.372	Schwarz criterion		4.042203
Log-likelihood	-403.6882	Hannan-Quinn criteria.		3.948171
Durbin-Watson stat	2.137239			

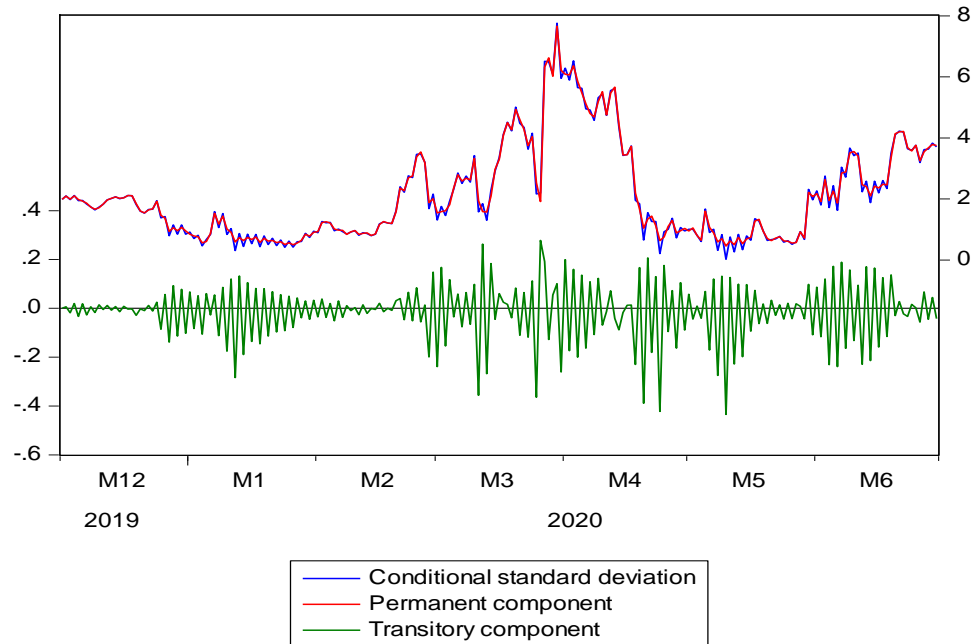


Figure 1: Conditional Volatility, Permanent and Transitory Components

Figure 1 plots the estimated (overall) conditional standard deviation and its two components, the permanent and transitory components over the pre and post COVID-19 period spanning 01 December 2019 to 30 June 2020. The permanent component is relatively smooth until February 2020. The permanent component shows three jumps throughout the period analyzed in this figure. The first jump is witnessed in March 2020, the second in April 2020, and the third in June 2020. Over the period of analysis, an increase in values showing permanent component is observed. At the bottom of Figure 1, the transitory component is graphed. The plot indicates the presence of temporary and short-lived shocks in the transitory component. These shocks were observed in January 2020, the end of February 2020, the beginning and end of March 2020, the end of April 2020, before the middle of May 2020, and the first twenty days of June 2020.

It is important to note that the transitory component is simply the difference between the total volatility and the permanent component.

5 .Discussion

The purpose of this research was to analyze the contagion effect of the COVID pandemic outbreak on stock market returns along with its dynamic correlation with other variables, including gold prices, real estate prices, and the USD exchange rate. For this purpose, daily returns of the KSE100 index were analyzed. The daily prices of gold, house price index, plot price index, and the US dollar exchange rate were used to evaluate their impact on stock market returns three months before the spread of the global pandemic and three months after the global pandemic. Pre and post COVID-19 correlations were tested to check the significant change that occurred due to the pandemic in the relationship between

stock returns and variables mentioned above. The pandemic affected the market returns negatively as calculated in the event window, indicating that hypothesis 1 is accepted. A similar study by Ashraf (2020) was conducted to check the effect of the COVID-19 pandemic on the economy. It is concluded that there are significant adverse impacts of the pandemic on economic activities. Moreover, the study also proposes that during the pandemic, the fluctuations in the real-estate prices and gold prices have significantly impacted the Pakistan Stock Exchange returns. The results confirm H_2 , H_3 , and H_4 .

Conversely, the study of Ahmed (2020) highlights that the performance of PSX returns remains insignificantly related to fatality and positive coronavirus cases. Moreover, an event-based study shows a similar adverse effect of the COVID-19 on various sectors, including transportation, mining, electricity, health, and the environment. However, some variables were resilient to the pandemic (Thorbecke, 2020; 2021). Similarly, the impact of the COVID-19 outbreak on major cryptocurrencies and high-frequency information was evaluated by using the model similar to the model used in this study, i.e., the GARCH model (Yousaf & Ali, 2020). The volatility in returns of stock markets is the major component of some of the recent studies. Another study that investigates the stock market reactions to COVID-19 derived results similar to the findings of the present study (Baker et al., 2020). However, contrary to the findings of this study, Baur and Trench (2020) concluded that the gold firms are unaffected by the COVID-19 and identified that investors' behavior remains the same for considering different gold firms differently in the normal period and the Covid-19 period.

The current study evaluates the change in the relationship between prices of gold and returns of the stock market, and the results reveal a significant change in the relationship between the variables mentioned above, i.e., gold prices and stock returns. A similar study found the contagion impact of the COVID-19 pandemic on gold and oil prices (Gharib, Mefteh-Wali, & Jabeur, 2020). Further, the study by Syahri and Robiyanto (2020) indicates that the changes in the prices of gold have significantly and positively affected the stock returns during the COVID-19 pandemic. The relationship of real estate and the KSE-100 index is also changed in the COVID-19, so hypotheses 3 and 4 are also accepted. The relationship change in the real estate market to the stock market is not studied widely; therefore, this hypothesis has limited support. However, the results of the study by Topcu and Gulal (2020) support the findings of the current study and demonstrates that real estate prices are significantly impacted during the COVID-19 pandemic. This study also shows that the impact of real estate prices on stock returns is significant during the pandemic. The findings could not provide evidence supporting hypothesis 5 because the association between the US dollar exchange rate and the KSE-100 index remained insignificant during the period analyzed in this study. This evaluation also pioneers in nature.

6. Conclusion

The underlying study was conducted to assess the contagion effect of COVID-19 on the stock market returns. It was aimed to highlight the relationship of gold prices, real estate prices, and exchange rate with the Karachi stock exchange's returns. It was conducted by using the quantitative method and assumptions proposed by the positivistic approach of the

research philosophy. The event study methodology is used in this study. GARCH model was estimated to evaluate the impact of the volatility of gold prices, real estate prices, exchange rate, on the volatility of the stock market returns in Pakistan during COVID-19. Results of event windows and the GARCH model led to the following findings: 10 days event window shows the daily returns of Karachi stock exchange were performing normally. The t statistics of abnormal returns show no significant impact of the COVID-19 outbreak on the daily returns of the KSE 100 index. For the window of twenty days after the event, the findings reflect that the impact of COVID-19 starts affecting the cumulative abnormal return from Day 17 of the event window. GARCH model results highlight the significant change in the impact of gold prices, house price index, and stock price index on the KSE-100 index returns. This test negates the impact of the change in the US dollar exchange rate on the Karachi stock exchange returns in the period of COVID-19.

6.1 Contribution and Practical Implications of the Study

The study has significant implications for investors and financial advisors. This research focuses on the investment sector only, and the findings of the current study cannot be generalized to all sectors. The pandemic has impacted almost all of the sectors, so studies must be conducted on other sectors as well. Hence, it is recommended that future studies must be conducted to identify the impacts of the pandemic on the performance of other sectors of an economy. This study is based on a relatively short time frame to analyze the impact of COVID-19 on the investment behaviour in an emerging market, Pakistan. The impact of COVID-19 on the variables of interest taken in this study might vary during the subsequent waves. Therefore, it is suggested that future researchers explore the consequences of the COVID-19 pandemic by considering a larger dataset. The present study has used the quantitative research methodology. Qualitative and mix-method research techniques can be performed to assess the impact of the COVID-19 on the risk tolerance behavior of the investors.

The current study has its implication from the theoretical point of view as it contributes by explaining the performance of the stock market, gold prices, real-estate prices, and US dollar exchange rate during a pandemic. The present study has implications for financial advisors, analysts, and policymakers. They can make decisions and give recommendations about the stock market, foreign exchange market, and real-estate and gold prices in light of the findings of this study.

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