A Comparison of Pre-pandemic & Post-pandemic Stock Market Indices in Wuhan-adjacent countries

Abstract

Our world undertook a radical turn in mid-March 2020, when CDC and the WHO recommended lockdowns, shutdowns, and other ways of preventing the spread of COVID-19 virus. Stock exchanges and stock market indices respond to pandemic infections, for example, Ebola and Severe Acute Respiratory Syndrome (SARS) outbreak (Chen, Jang et al. 2007, Ichev and Marinč 2018). Normally, stock exchange indices have been influenced profoundly during these circumstances (Engelhardt, Krause et al. 2020). The pandemic has influenced mostof the economic and financial indicators and these indicators have disintegrated due to the expanding vulnerability in most countries and this disintegration has caused remarkable damage (Goodell 2020). It very well may be normal that South-Asian countries that were physically closer to China have been affected considerably more truly by the pandemic.

Recent studies on covid and stock market returns include Ji et al (2022) and Prempeh et. al. (2022). These investigations, however, center around developed and growing markets like the USA, China, France, Germany, Italy, Spain, and South Korea. There is a theoretical gap in portfolio investment literature regarding the impact of COVID-19 on profitability and stock market performances of countries neighboring China since China is supposed to be the origin of the covid virus. This study empirically examines if there has been any significant impact of Covid-19 on stock exchange indices in South-Asian countries with the aid of regression models in pre and post pandemic periods. The dates of pandemic are determined by CDC timeline, and stock indexes data (DSE 30, BSE-Sensex 30, Karachi 100, CSE and SP500 index is collected from investing.com for the period 1/1/2019 to 1/9/2003. Before application of any statistical technique, the data for each index will be inspected for missing values, national holidays, market shutdowns or weekends. For each index, a daily return is computed. Country-specific regression equations with dummy variables are estimated in pre, pandemic, and post pandemic periods (Chauhan et. al (2022)). Results of this analysis are useful to global investors, and health officials of emerging countries, as the heavy cost of shutdowns are extremely detrimental to growth, employment, and economic development.

Literature Review

Developing countries, particularly in South Asia, with extremely high populations were hit extremely hard by COVID19 virus. Our world is still reeling from the effects of this virus, though it is getting more difficult to separate out the effects of other variables such as Russia-Ukraine conflict, persistent inflation in economies and opening of Chinese economy to worldwide travel by its citizens. Investors are rethinking whether it is time to start investing in emerging markets and are re-calibrating the risk-return tradeoffs of such investments.

Portfolio diversification has always been considered an effective risk management strategy by investors and investing in emerging markets has always been an important part of diversification. Since the pandemic hit emerging markets extremely hard, the risk-return tradeoffs may have been altered in a significant way, and it is beneficial to investigate whether investments in emerging markets can lead to low or negative correlation with domestic markets, an important feature of diversification strategy.

Stock exchanges and stock market indices respond to pandemic infections, for example, Ebola and Severe Acute Respiratory Syndrome (SARS) outbreak (Chen, Jang et al. 2007, Ichev and Marinč 2018). Normally, stock exchange indices have been influenced profoundly during these circumstances (Engelhardt, Krause et al. 2020). The pandemic has influenced most of the economic and financial indicators and these indicators have disintegrated due to the expanding vulnerability in most countries and this disintegration has caused remarkable damage (Goodell 2020).

The Covid-19 pandemic is the most significant worldwide phenomenon that the world has ever faced. Normally, the countries which are close to China faced the Covid-19 pandemic sooner than different countries that prevented it by taking significant precautions. Along these lines, it very well may be normal that South-Asian countries that were physically closer to China have been affected considerably more truly by the pandemic. Investors have been fearful of investing in such markets and are always searching for ways of protecting their reserve funds (Akhtaruzzaman, Boubaker et al. 2020).

Few empirical studies have explored the effect of Covid-19 and its lockdown on stock markets (Al-Awadhi, Alsaifi et al. 2020, Alfaro, Chari et al. 2020, Eleftheriou and Patsoulis 2020, He, Liu et al. 2020, Zhang, Hu et al. 2020). Recent studies on covid and stock market returns include Ji et al (2022) and Prempeh et. al. (2022). These investigations, however, center around developed and growing markets like the USA, China, France, Germany, Italy, Spain, and South Korea. Only 4 emerging countries (Brazil, India, Kenya & South Africa) were studied in one of the more recent papers investigating COVID and its impact on stock market performance (Insaidoo et al. (2023)).

A study looked at 23 emerging markets and found that reducing (growing) course of coronavirus cases is related with enhancing (worsening) liquidity in financial markets (Haroon & Rizvi (2020)). Erdem (2020) covered 75 international stock market indices and discovered that markets are negatively influenced by the pandemic. There is a theoretical gap in portfolio investment literature regarding the impact of COVID-19 on profitability and stock market performances of countries neighboring Wuhan, China since China is supposed to be the origin of the covid virus. This study empirically examines if there has been any significant impact of Covid-19 on stock returns in selected South Asian countries that are geographically close to the origin of the virus. Specifically ,we study how fundamental stock exchange indices in South-Asian countries react to the Covid-19 pandemic with the aid of regression models in pre and post pandemic periods. The study focuses on mainly selected South-Asian countries such as India, Pakistan, Sri Lanka, Vietnam and Thailand because they have growing stock markets, total value (% of GDP) 64.8%

according to the 2020 year-end stock traded figures (Bank 2020). Finally, we propose recommendations for governments and investors in emerging countries.

Data

Daily data has been collected from January 1, 2019, through January 9, 2023, for the following international stock indices: Bombay Stock Exchange-Sensex 30, Karachi 100, Colombo Stock Exchange, Thailand's SET, Vietnam's VN 30, and our SP500 index from invesing.com. The data period 1/1/2019 to 1/9/2003 was selected primarily due to data availability reasons. To determine the starting of the covid pandemic, we relied on World Health Organization's declaration of the pandemic on March 11, 2020. Table 1 summarizes the duration of pre and post pandemic periods. There is no official declaration date for the end of COVID19 pandemic. However, Karavias, Narayan, and Westerlund (2022) use a panel of 61 countries' stock index returns with weekly market and COVID-19-related variables to show that a structural break took place in their specification in the first week of April. In this paper, we use a different approach in identifying the "end date" for purposes of our study.

Table 1: Classification of Pandemic Periods

Stock Index	Pre-pandemic Period	Pandemic Period	Post-pandemic Period	Source
SP500	1/1/19-3/11/20	3/12/20-3/26/22	3/27/22-1/9/23	(1)
Colombo Stock Exchange	1/1/19-3/11/20	3/12/20-12/6/22	12/7/22-1/9/23	(2)
Thailand SET	1/1/19-3/11/20	3/12/20-10/1/22	10/2/22-1/9/23	(3)
Bombay Stock Exchange	1/1/19-3/11/20	3/12/20-11/22/22	11/23/22-1/9/23	(4)
Vietnam Stock Exchange	1/1/19-3/11/20	3/12/20-5/16/22	5/17/22-1/9/23	(5)
Karachi Stock Exchange	1/1/19-3/11/20	3/11/20-1/9/23		(6)

Notes:

(1) The dates of US pandemic were obtained from the CDC timeline located at https://www.cdc.gov/museum/timeline/covid19.html.The end date of the pandemic was the date when the last remaining state, Hawaii, removed the mask mandate.

(2), (3), (4), (5) For these countries, we relied on traveloffpath.com's resource on restriction-less travel to countries. (see https://www.traveloffpath.com/countries-without-any-travel-restrictions-or-entry-requirements/) as a proxy for end dates. Those dates were the dates when those countries relaxed travel restrictions for tourists entering their countries.

(6) The country of Pakistan has yet to remove restrictions that were placed during the pandemic, hence its return series does not have a post-pandemic component.

Methodology:

First, we checked if the stock index values for all 6 countries were stationary by performing unit root tests. The Augmented Dickey-Fuller test was performed on all 6 series on both the raw series as well as the logged values of the series. (See Shezad et al (2020); Adenomon et

al. (2020); and Cardonas-Arenas et al. (2020) for application of ADF tests in COVID-19 studies). In both cases, the series were non-stationary, and the null hypothesis that the series has a unit root failed to be rejected at 5 % levels. Results of unit root tests are summarized in Table 2:

Table 2: Results of Unit Root Tests

Index	t-stat	Prob	Conclusion
Thailand SET	-1.603130	0.4801	Series is Non-stationary
Bombay BSE	-0.508372	0.887	Series is Non-stationary
Sri Lanka CSE	-0.811962	0.8148	Series is Non-stationary
Vietnam 30	-1.030443	0.7441	Series is Non-stationary
SP 500	-0.416724	0.9037	Series is Non-stationary
Karachi Stock Exchange	-2.228814	0.1962	Series is Non-stationary

Since all our series were non-stationary, regressions could not be performed, as the results will be meaningless. To correct this issue, we computed returns on the indices as follows:

$R_{it} = (P_{it} - P_{it-1})/P_{it-1}$
Where R_{it} refers to return for index i in time period t, and P_{it} refers to the value of index in time period t.

We subsequently performed unit root tests on the returns series for all indices, and found that all returns series were stationary, that is, they had no trend. Consequently, we employed the return series for all subsequent analysis. Results of unit root tests on the returns series are provided in Table 3:

Table 3: Results of ADF test on Daily returns of Indices

Index	t-stat	Prob	Conclusion
Thailand SET	-11.05	0.000	Series is stationary
Bombay BSE	-12.7	0.000	Series is stationary
Sri Lanka CSE	-20.26	0.000	Series is stationary
Vietnam 30	-30.26	0.000	Series is stationary
SP 500	-9.48	0.000	Series is stationary
Karachi	-27.99	0.000	Series is stationary

We can visually see the trendless nature of our data series by plotting the returns against time for each of the countries in our sample. Please see the appendix at the end for those graphs.

To identify if the pandemic distorted the return profile of each index, we employed dummy variables in our regressions. The dummy variable took the value of 1 during the pandemic time periods, and 0 during the pre and post pandemic time periods. This method allows us to clearly see if the pandemic caused a significant shift in the returns and has been employed in several studies. (see Chen et al. (2020), to name one).

The regression that we estimated for each index was as follows:

$R_i = \alpha + \beta D_i$ Where R_i is the return of Index i, and D_i is the dummy variable for index i. The dummy variable takes the value 1 during the pandemic period for that particular index, and takes the value 0 during that particular index's pre and post-pandemic periods.

Results of our dummy variable regressions are provided in Table 4 below.

Table 4: Results of Dummy Variable Regressions

Index	Coefficient of Dummy	Standard error	T-Test	Prob	Conclusion
Thailand SET	0.000539	0.000486	1.111	0.2684	Not significant
Bombay BSE	0.000916	0.000511	1.79	0.0735	Significant @ 10%
Sri Lanka CSE	0.001	0.000577	1.75	0.0805	Significant @ 10 %
Vietnam 30	0.000976	0.000596	1.64	0.1017	Not Significant
SP 500	0.0011	0.000635	1.74	0.0828	Significant @ 10%
Karachi Stock Exchange	0.000171	0.000443	0.385	0.7006	Not Significant

The results of the dummy variable regressions are mixed. The pandemic does not seem to affect the returns of Thailand, Vietnam and Karachi's stock exchanges. Returns of Bombay, Sri Lanka and of S&P 500 indices are significant at 10 %. An explanation of this behavior could be that investors in those countries may have become accustomed to the pandemic life and adopted behaviors to the "new normal" life of the pandemic. It is very likely that some industries, namely, tourism, hospitality and restaurants may be more negatively impacted by the pandemic in those countries, but the overall impact on stock market returns of those countries seem to be minimal.

Granger-Causality

It is strongly believed that the COVID-19 virus originated in Wuhan, China. Countries that are geographically close to China may have had very quick exposure to the virus, compared to countries that are distant. In other words, it is likely that the virus spread rapidly among the neighboring countries first, followed by exposure in distant lands. To test this hypothesis, we conducted a range of Granger causality tests to see if returns in one country are affected by or affecting returns in neighboring countries. Granger-causality tests have been performed extensively in studies pertaining to transmission of some mechanisms between markets. Examples of such studies include Insaidoo et al (2023), and Ghergina et al. (2022).

In this study, we are interested in seeing if there is some transmission mechanism between stock markets of countries neighboring China. Since COVID-19 did transmit across international borders, it would be interesting to see if such transmission affected stock market returns of those countries. We first tested for Granger causality in the full period (1/1/2019-1/9/2023) between pairs of countries in our sample, and then we followed with pair-wise Granger Causality tests in

the pandemic period. This period starts with the WHO declaration on March 11, 2020, and it ends with the date when each country either removed its mask mandates or relaxed or eliminated travel restrictions for tourists. Consequently, the duration of the pandemic period varies across countries. One of the countries in our sample, Pakistan, still has not removed travel restrictions or its mask mandate, despite its neighboring countries doing so.

To employ tests of Granger Causality, all data must be stationary. Since we already tested for unit roots in stock market returns data, our data is stationary and we can safely proceed with testing for Granger causality. We follow the procedure performed by Insaidoo et al (2023) and Ghergina et al. (2020) who studied the impact of COVID19 on stock market reactions.

Results of our Granger-causality tests for full period and for pandemic periods are given in Tables 5 and 6.

Granger Causality results indicate that flow of causality goes from KSE to BSE, from SET to BSE, from BSE to SP500, from BSE to Vietnam, from Vietnam to KSE, from Vietnam to SET, from SET to CSE and from CSE to SP500 during the full period (1/1/2019-1/9/2023).

When we look at the flow of causality during the pandemic period, it follows a similar pattern: It goes from KSE to BSE, from SET to BSE, from SP500 to BSE, from BSE to Vietnam, from Vietnam to KSE, from SP500 to SET, from SET to SP500, from SP500 to CSE and from SP500 to Vietnam.

The presence of pandemic does not seem to change the nature of causality between our sample countries due to the fact that full period results and the pandemic results are almost identical.

[Insert Tables 5 & 6 here]

Conclusions

When we started studying the impact of the pandemic on stock market returns of countries bordering China, we assumed that the neighboring countries would display more violent reactions in stock market returns to the COVID-19 virus. However, our results indicate that the markets may have become accustomed to the seemingly long-lasting presence of the virus, and they seemed to have taken the virus and its variations in stride. Our results are very broad-based as they do not touch upon the effects of the pandemic on key sectors in each of the economies being studied. If some countries draw a significant amount of revenue from hospitality and tourism industries, then they are more likely to suffer from the COVID pandemic. However, their problems may have been masked by above average stock market performance in other sectors who have much less exposure to the COVID-19 virus. What we may be witnessing in our results is that the pandemic did not distort the standard relationships between stock markets of countries, and that these countries endured the pandemic jointly.

This paper may have some policy implications. As long as stock markets all over the world do not move in unison, there are significant opportunities for achieving benefits of diversification. Global investors can reduce risk by investing in markets that are not geographically close and/or exposed to common pandemics. This line of thinking of inefficient global markets is supported by Beck et al. (2022) and Mensi et al. (2022).

More research needs to be conducted on stock market interactions between countries in the presence of other destabilization forces and see whether similar causalities are observed even in those cases.

Table 5: Pairwise Granger Causality results for the full period [1/1/2019-1/9/2023] (only statistically significant results are reported)

Null Ho:	Obs	F-stat	Prob	Conclusion
KSE does not Granger cause BSE	997.00	6.0709	0.0139	Returns of Karachi Stock Exchange "Granger cause" returns of Bombay Stock Exchange
SET does not Granger cause BSE	973.00	86.6	9.00E-20	Returns of Thailand Stock Exchange (SET) "Granger cause" returns of Bombay Stock Exchange
BSE does not Granger cause SP500	997.00	4.322	0.0379	Returns of Bombay Stock Exchange "Granger cause" returns of SP 500
BSE does not Granger cause Vietnam St Exc	997.00	19.067	1.00E-05	Returns of Bombay Stock Exchange "Granger cause" returns of Vietnam Stock Exchange
Vietnam SE does not Granger cause KSE	997.00	6.67	0.0099	Returns of Vietnam Stock Exchange "Granger cause" returns of Karachi Stock Exchange
SET does not Granger cause CSE	925.00	6.593	0.0104	Returns of Thailand Stock Exchange "Granger cause" returns of Colombo Stock Exchange
Vietnam SE does not Granger cause SET	973.00	6.205	1.29E-02	Returns of Vietnam Stock Exchange "Granger cause" returns of Thailand Stock Exchange (SET)
CSE does not Granger cause SP500	925.00	12.917	0.0003	Returns of Colombo Stock Exchange "Granger cause" returns of SP500

Table 6: Pairwise Granger Causality results for the Pandemic period [3/11/2020-]**
(only statistically significant results are reported)

Null Ho:	Obs	F-stat	Prob	Conclusion
KSE does not Granger cause BSE	597	10.2	0.0015	Returns of Karachi Stock Exchange "Granger cause" returns of Bombay Stock Exchange
SET does not Granger cause BSE	441	8.51	0.0037	Returns of Thailand Stock Exchange (SET) "Granger cause" returns of Bombay Stock Exchange
SP500 does not Granger cause BSE	453	29.812	8.E.-08	Returns of SP500 "Granger cause" returns of BSE
CSE does not Granger cause BSE	531	5.08749	0.0245	Returns of Colombo Stock Exchange "Granger cause" returns of Bombay Stock Exchange
KSE does not Granger cause SP500	462	6.539	0.0109	Returns of Vietnam Stock Exchange "Granger cause" returns of Karachi Stock Exchange
SP500 does not Granger cause SET	434	25.39	7E-07	Returns of SP500 "Granger cause" returns of Thailand Stock Exchange
SET does not Granger cause SP500	434	20.978	6E-06	Returns of Thailand St Exchange "Granger cause" returns of SP500
SP500 does not Granger cause CSE	402	14.3178	0.0002	Returns of SP500 "Granger cause" returns of CSE
SP500 does not Granger Cause Vietnam Stock Exc	471	21.392	5E06	Returns of SP500 "Granger Cause" returns of Vietnam Stock Exchange

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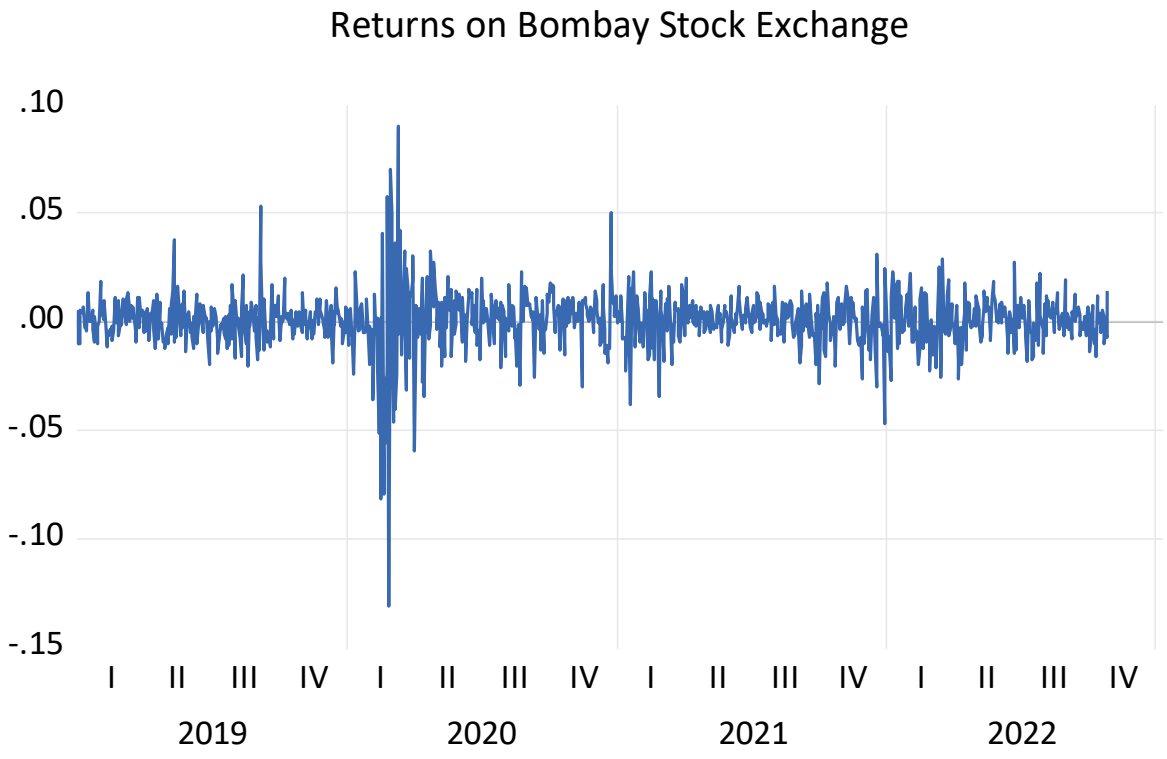
APPENDIX


Returns on Bombay Stock Exchange
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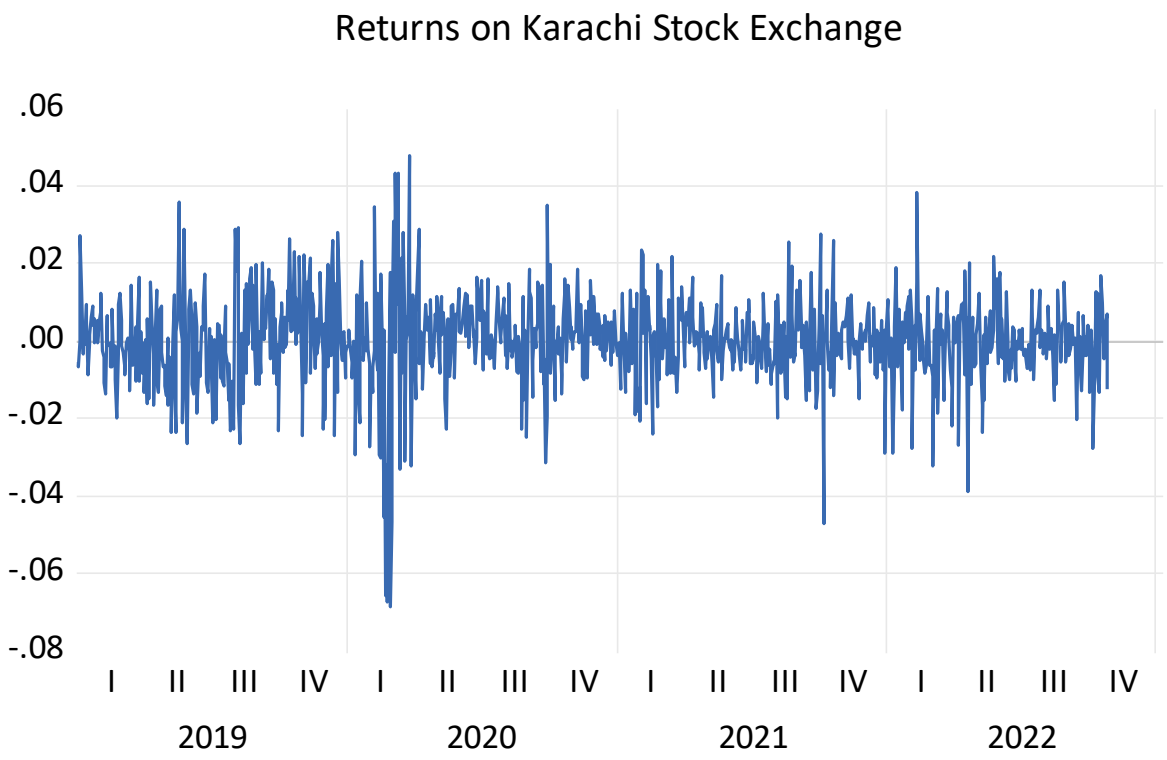
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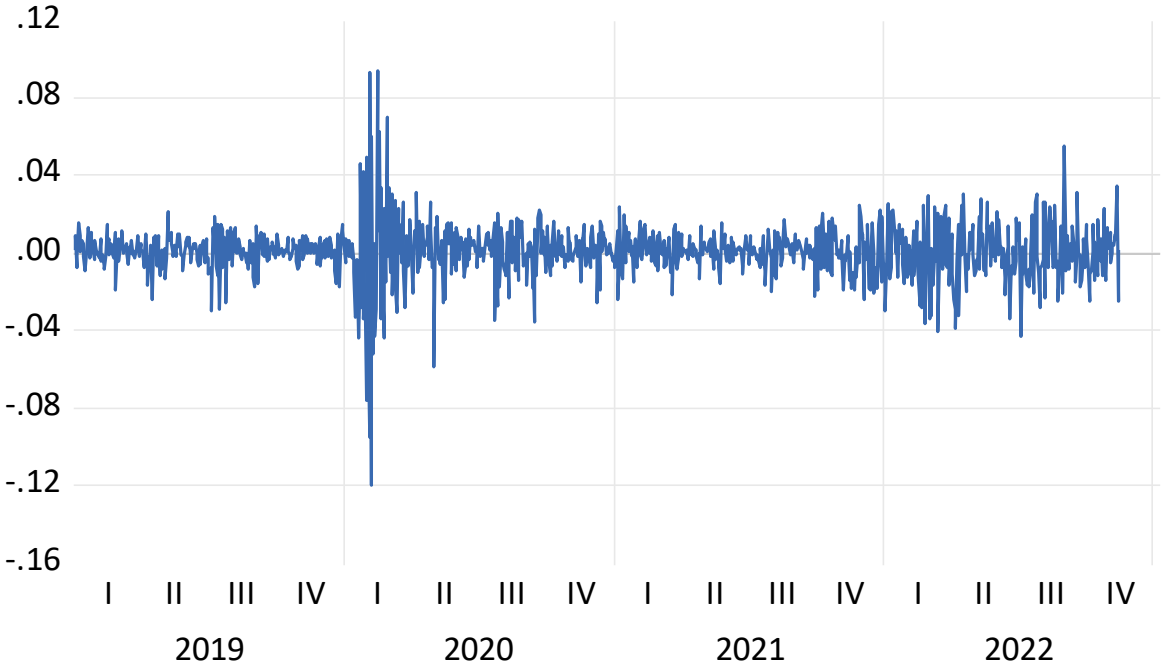
Returns on SP500



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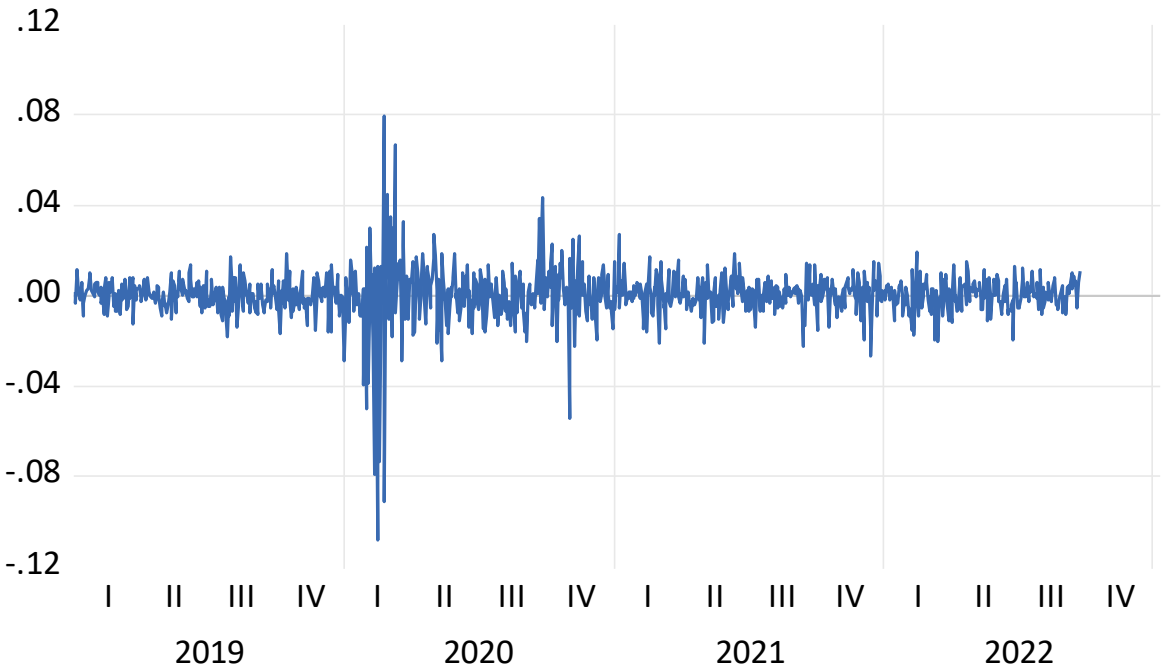
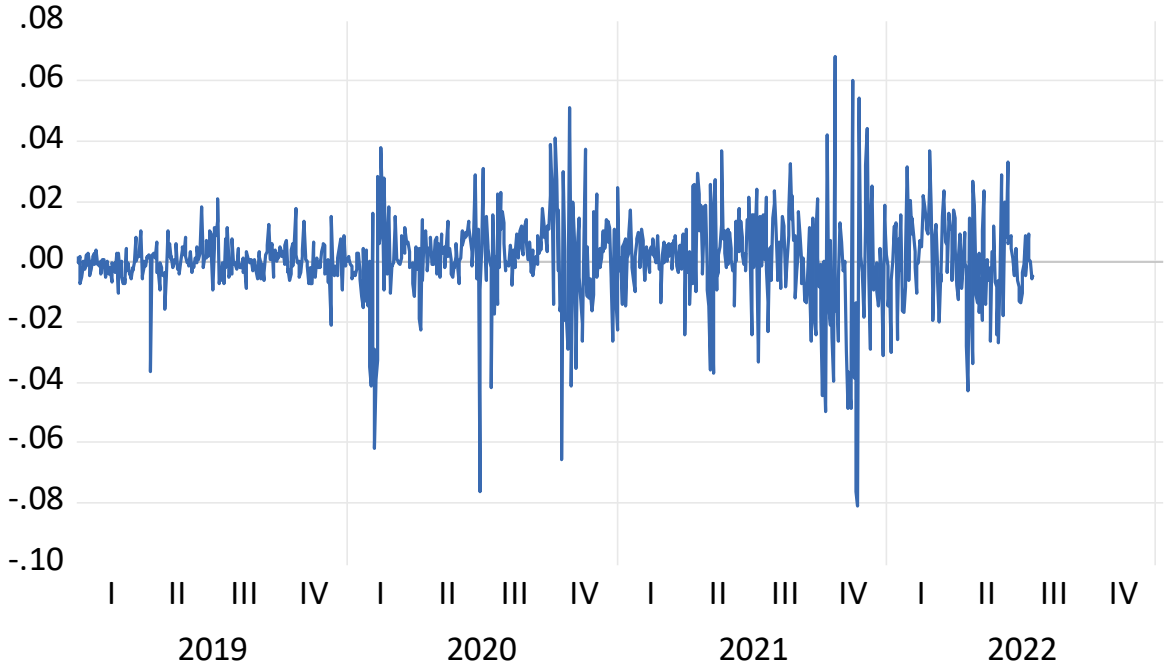


Returns on Colombo Stock Exchange



Returns on Vietnam Stock Exchange