The Effect of Cases and Fatalities from COVID-19 Pandemic on Thai Stock Market

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Abstract

In this study, the author aimed to determine whether COVID-19 had an impact on the stock market and the extent of its impact in each wave. The author proposed the following hypotheses: COVID-19 worsened stock market liquidity and volatility, and the effect of COVID-19 was the largest in the first wave compared with the subsequent waves. The author used panel regression with fixed effects to estimate the results. The author obtained the data, with daily frequency, from January 13, 2020 to September 13, 2021, and separated them into three waves. Results showed that most of the COVID-19 pandemic indices, except for mobility trends, worsened stock market liquidity and volatility. Moreover, the impact of COVID-19 was the largest in the first wave and decreased continuously in the subsequent waves. However, the stringency index did not follow this pattern, which had the highest negative impact on stock market liquidity and volatility in the second wave and was considered as the index that exerted the highest overall impact.

Keywords: COVID-19, stock market, volatility, liquidity, sentiment index

Introduction

In December 2019, China was the first country that detected the new disease, which was a respiratory illness that would subsequently be called the coronavirus disease or COVID-19. In January 2020, the World Health Organization (WHO) reported a cluster of pneumonia cases in Wuhan and declared the disease a Public Health Emergency of International Concern.

In March 2020, the WHO voiced its serious concern and characterized the disease as a pandemic.

The pandemic had a severe impact on social and economic activities. Stock markets around the world were also affected by the pandemic. Since the WHO pandemic announcement on March 11, 2020, global stock markets have dropped significantly, including the Stock Exchange of Thailand (SET).

In January and February 2020, the first cases outside and in Thailand were reported. However, the stock market had yet to realize the effect of COVID-19. Thus, its impact on the stock market was minimal. The increase in the number of cases indicated the seriousness of the situation. During the first wave after the WHO pandemic announcement, the SET100 index dropped sharply according to the increase in the number of cases. That is, the higher the number of cases, the larger the drop in the SET100 index. However, in the second wave, the number of cases skyrocketed, but the SET100 index did not fall as sharply as during the first wave and fluctuated only slightly. This finding shows that investors tended to overreact to the situation because of uncertainty. The trend was similar to the daily trading volume. However, in the third wave, the number of cases skyrocketed, but the trading volume increased continuously.

The reason behind the large drop in the trading volume in the first wave, people were highly concerned and anxious owing to the novelty of COVID-19 and lack of knowledge on how to deal or cope with the disease. The liquidity and volatility of the stock market were affected by the pandemic, because investors were concerned about the uncertainty in the stock market, causing liquidity to drop and the volatility of stock prices to worsen. Such changes created large price fluctuations because demand for stocks was low, and matching the trade became difficult.

In this study, the author aims to determine the impact of COVID-19 on the Thai stock market by measuring its impact on stock-level liquidity and volatility in each wave. The scope of this study is from January 13, 2020 to September 13, 2021. The data used in this study have a daily frequency.

Studies have yet to examine the impact of COVID-19 on the liquidity of the Thai stock market. Thus, this study contributes to the extensive literature by analyzing the impact of COVID-19 on stock-level liquidity and volatility in the Thai stock market and the extent of its impact in three different periods.

Literature review

Conceptual framework

At the beginning of the COVID-19 pandemic, its effect was unknown, so investors were concerned about the uncertainty and afraid to lose in the stock market. Kahneman and Tversky (1979) established prospect theory, which emphasizes that investors set and decide the portfolios to be placed under risk. The theory assumes that losses and gains are weighed differently, and individuals with gains are likely to be risk averse, whereas individuals with losses are likely to be risk lovers. In this case, it can be seen as receiving good news or bad news. Bad news leads to a large negative impact, whereas good news leads to a small positive impact.

Markets tended to overreact to the escalated uncertainty during the early stages, so asset prices collapsed at the beginning of the pandemic (Sun et al., 2021). In the succeeding waves, governments implemented policies to cope with the pandemic, which can be considered good news. Cheong et al. (2020) found evidence that markets overreacted to various COVID-19 events, and Permata et al. (2021) showed a correlation between the overreaction and trading volume in stock markets.

Stock market liquidity

According to prospect theory, good news and bad news have an asymmetric effect. In the first wave, COVID-19 was an unknown shock to investors, who were unaware of the extent of its effect and thus slowed their investment and sold their stocks to avoid losses. Owing to the lack of information on the disease, people tended to overreact, which caused the stock market to rapidly become less liquid. Baig et al. (2021) indicated that the increase in market illiquidity and instability is related to the number of confirmed COVID-19 cases and deaths. Ahmed et al. (2021) stated that the effect of the first wave on stock markets in Southeast Asian countries is more severe than that of the second wave.

Liquidity can be defined and measured in various ways. Marozva et al. (2021) estimated stock market liquidity during the COVID-19 pandemic by adopting the model developed by Chiu et al. (2012) and Stoll (2000), who also used a bid-ask spread as a liquidity measure. Baig et al. (2021) determined the impact of the COVID-19 pandemic in terms of liquidity in US equity markets by adopting the equation based on Blau (2018) and the Amihud illiquidity measure and a bid-ask spread as liquidity measures. In the model, the authors used stock

market and macroeconomic control variables to control for stock market liquidity, namely, the stock market index, volume, market capitalization, and volatility. The authors also added pandemic indices to estimate the impact of COVID-19 and find relationships.

In this study, the author uses the Amihud illiquidity measure and a bid-ask spread, because such measures are commonly used and accepted by many researchers. However, Lesmond (2005) found that the Amihud volume-based model is downward biased for low-liquidity markets. For this study, the author uses the SET100 index, which demonstrates the highest liquidity in the Thai market, thereby addressing the aforementioned concern.

Stock market volatility

The COVID-19 pandemic was a negative signal to investors. Moreover, the stock trading volume decreased substantially in the first wave as investors overreacted, thereby demonstrating the decrease in trading demand. Prices dropped and volatility worsened, generating large stock price fluctuations. Hong et al. (2021), Syed and Fatima (2021), and Chundakkadan and Nedumparambil (2021) found that COVID-19 induced excess price volatility in stock markets. In the Thai stock market, Panyagometh (2020) determined that the majority of the stocks in the SET were adversely affected by the pandemic and demonstrated high volatility during the early stages of the COVID-19 pandemic

Baig et al. (2021) reported the impact of the COVID-19 pandemic in terms of liquidity and volatility in US equity markets by adopting the equation based on Blau (2018). The authors used the range volatility measure and GARCH (1,1) volatility measure as volatility measures. As mentioned previously, the authors utilized a model similar to the liquidity model but added a bid-ask spread as a control variable, because when volatility is high and uncertainty and risk are maximal, the bid–ask spread will widen. Meanwhile, Bouchaud et al. (2007) showed a strong relationship between volatility and the bid-ask spread.

Pandemic indices

To determine the effect of the COVID-19 pandemic, researchers commonly used variables such as the number of cases and deaths, stringency index, mobility trends, and global sentiment index.

The number of COVID-19 cases and deaths raised people’s awareness of the disease, which caused a panic and was reflected in stock markets, as it is related to investing. Sapkota

(2020) found that the rise in the number of deaths affects stock markets negatively. In addition, Grima et al. (2021) observed that the number of cases has more impact on stock markets than the number of deaths. When a country encounters a problem as well as a COVID-19 situation, the government is generally responsible for taking action. Ibrahim (2020) determined that government action reduces the volatility of stock prices. However, Yang and Deng (2021) reported opposite results and argued that government policies exert a large negative effect on stock market returns.

Research methodology

Model specification

In this study, the author tests the relationship between liquidity and volatility and pandemic indices in each wave. The author separates the study period into three parts, that is, the first wave (January 13, 2020 to November 30, 2020), the second wave (December 1, 2020 to March 31, 2021), and the third wave (April 1, 2021 to September 13, 2021).

To estimate the results, the author adopts the models from Baig et al. (2021) and uses panel regression with fixed effects. The author presents four equations in this study: two for stock market illiquidity and two for stock market volatility, as follows:

$$\begin{aligned} SPREAD_{i,t} &= \beta_0 + \beta_1(PANDEMIC\ INDEX)_{i,t} + \beta_2 PRICE_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 VOLUME_{i,t} + \beta_5 SET_{i,t} + \beta_6 INF_{i,t} \\ &\quad + \beta_7 VOLT_{i,t} + \varepsilon_{i,t} \\ ILLIQ_{i,t} &= \beta_0 + \beta_1(PANDEMIC\ INDEX)_{i,t} + \beta_2 PRICE_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 VOLUME_{i,t} + \beta_5 SET_{i,t} + \beta_6 INF_{i,t} \\ &\quad + \beta_7 GVOLT_{i,t} + \varepsilon_{i,t} \\ VOLT_{i,t} &= \beta_0 + \beta_1(PANDEMIC\ INDEX)_{i,t} + \beta_2 PRICE_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 VT_{i,t} + \beta_5 SET_t + \beta_6 SPREAD_{i,t} \\ &\quad + \varepsilon_{i,t} \\ GVOLT_{i,t} &= \beta_0 + \beta_1(PANDEMIC\ INDEX)_{i,t} + \beta_2 PRICE_{i,t} + \beta_3 SIZE_{i,t} + \beta_4 VT_{i,t} + \beta_5 SET_t + \beta_6 ILLIQ_{i,t} \\ &\quad + \varepsilon_{i,t} \end{aligned} \tag{1}$$

Dependent variable

The author employs four dependent variables, two volatility measures, and two illiquidity measures.

The bid-ask spread, denoted as SPREAD can be computed by the difference between the bid and ask price. The author obtains the bid and ask price data from SETSMART.

The Amihud illiquidity measure (ILLIQ), which can be computed as follows:

$$ILLIQ = \frac{1}{n}\sum_{i=1}^{n}\frac{|r_i|}{P_i \times V_i} \tag{2}$$

where n is the number of days, r_i is the return of the stock, and V_i is the volume of the stock, and the higher the trading volume.

The author computes volatility by using the difference between the natural log of the maximum price and the natural log of the minimum price, denoted as VOLT. The author also obtains the maximum and minimum price data from SETSMART.

GVOLT is the volatility estimated by the GARCH technique using the first difference of the daily return. The author used the following equation:

$$\sigma_{i,t}^2 = w_0 + \alpha_1 \varepsilon_{i,t-1}^2 + \beta_1 \sigma_{i,t-1}^2 \quad (3)$$

where σ is the volatility of an individual stock from the SET100 index, and ε is the stock return.

Independent variables

The author collects information on the number of COVID-19 cases in Thailand (CASES) from the Open Government Data of Thailand and information on the number of deaths (DEATHS) from Our World in Data. Thai mobility trend (THDWT) reports show daily changes in requests for directions by transportation type in Thailand, consisting of driving and walking. The author collects this information from the Apple website. The Thai stringency index (STG) developed by the Oxford COVID-19 Government Response Tracker team demonstrates the strictness of Thai government policies to address the COVID-19 situation. Lastly, the global coronavirus sentiment index (GSENT) measures sentiment across all entities mentioned in the news regarding COVID-19, which is available on coronavirus.ravenpack.com.

Control variables

The author obtains information on the stocks in the top 100 stocks on the SET (SET100) from SETSMART. From the 100 companies, the author drops five (i.e., CRC, NRF, OR, SCGP, and STGT) because of the imbalanced panel data.

PRICE is the closing price of the SET100 traded in the SET; SIZE represents market capitalization, which shows a company's value and can be computed by multiplying the total number of shares by the share price; VOLUME is the number of shares that changes hands over a day; SET is the daily return of the SET100 index; INF is the inflation rate, and VT is the volume turnover.

Result

Impact of COVID-19 on stock market illiquidity

The empirical findings in Table 1 showed that the stock market volatility had an impact on the stock market illiquidity, and a positive relationship existed between the bid-ask spread and volatility of the stock market. That is, the more volatile the stock market, the wider the bid-ask spread.

For the pandemic indices, the author noticed that in the first wave, the higher the CASES, the more illiquid the stock market, and a 1% increase in CASES caused a 0.0158% increase in illiquidity. In the early stage of the COVID-19 pandemic, information on the disease was limited, thereby causing panic in the stock market, as investors were not absolutely confident about how to invest. During this period, “wait and see” tended to be a reasonable attitude. However, in the second and third waves, CASES did not have a negative effect, but rather a positive impact, on the stock market liquidity. Surprisingly, but understandably, the more the understanding of the disease, and the more the concern of the government for the residents, the higher the confidence and ability of the residents to address and cope with their fears. In addition, the stock market was in a recovery stage. However, in the third wave, the impact of COVID-19 became insignificant, specifically, CASES had no effect on the stock market.

For DEATHS, the results showed that it was insignificant throughout the three waves. In the third wave, DEATHS was higher compared with the other waves, but the results remained insignificant.

In terms of THDWT, it demonstrated a negative relationship with the stock market illiquidity throughout the three waves. THDWT consisted of walking and driving. Thus, in this case, the author implied that people avoided public transportation to prevent COVID-19 infection.

For STG, in the first wave, it had a positive relationship with the stock market illiquidity. During the first wave, the more and the stricter the policies implemented by the government, the more afraid and anxious the people were about the situation. Thus, STG exerted a negative impact on the stock market illiquidity, and a 1% increase in STG caused an increase of 0.0119% in the stock market illiquidity. Meanwhile, the results showed that STG did not have an impact on the stock market illiquidity in the second wave. In the third wave, the results demonstrated a positive relationship, but the effect was higher than in the first wave, because in the third

wave, CASES skyrocketed to more than 10,000, thereby raising people's awareness of the government's ability to deal with the issue.

For GSENT, in the first wave, the results revealed that the index had a positive relationship with the illiquidity of the stock market. In the first wave, the WHO announced the disease as a pandemic, thereby causing panic around the world. However, in the second wave, many countries intervened and helped reduce the number of infections. GSENT had a positive impact on the stock market illiquidity, but the impact was reduced. In the third wave, the impact of the index was negative. The stock market had recovered, information on the disease was available, and various institutions, such as government and financial institutions, took the situation seriously, thereby boosting people's confidence to invest in the stock market.

Table 1 Spread regression

	Wave 1				
	lnSpread	**lnSpread**	**lnSpread**	**lnSpread**	**lnSpread**
lnVOLT	0.1210***	0.1288***	0.1238***	0.1306***	0.1351***
	(0.0055)	(0.0055)	(0.0056)	(0.0054)	(0.0055)
lnCases	0.0158***				
	(0.0017)				
Deaths		0.0003			
		(0.0037)			
lnTHWDT			-0.0334***		
			(0.0084)		
lnSTG				0.0192***	
				(0.0018)	
lngsent					0.0119***
					(0.0029)
Price	-0.0031***	-0.0031***	-0.0032***	-0.0029***	-0.0029***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
lnsize	0.9628***	0.9340***	0.9476***	0.9297***	0.9158***
	(0.0129)	(0.0127)	(0.0131)	(0.0125)	(0.0128)
lnvolume	-0.0618***	-0.0619***	-0.0610***	-0.0646***	-0.0640***
	(0.0037)	(0.0037)	(0.0037)	(0.0037)	(0.0037)
SET	-1.1375***	-1.0248***	-1.0692***	-1.0642***	-1.0478***
	(0.0968)	(0.0964)	(0.0972)	(0.0960)	(0.0961)
Inf	0.0053***	0.0015	0.0077***	0.0174***	0.0001
	(0.0018)	(0.0018)	(0.0024)	(0.0023)	(0.0017)
cons	-24.4726***	-23.7167***	-23.9354***	-23.6166***	-23.1873***
	(0.2973)	(0.2926)	(0.2934)	(0.2853)	(0.2953)
Observations	20502	20502	20502	20502	20502
Number of groups	95	95	95	95	95
F-statistic	1003.44***	987.53***	975.24***	1008.79***	996.91***
With-in R-squared	0.2561	0.2531	0.2525	0.2571	0.2549
Overall R-squared	0.2579	0.2580	0.2557	0.2665	0.2638

Note: Standard errors are in the parentheses below the coefficient estimates. *, **, *** denote statistical significance at the 0.1, 0.05, 0.01 respectively.

Table 1 Spread regression (cont.)

	Wave 2				
	lnSpread	**lnSpread**	**lnSpread**	**lnSpread**	**lnSpread**
lnVOLT	0.0729***	0.0705***	0.0717***	0.0718***	0.0703***
	(0.0061)	(0.0057)	(0.0057)	(0.0059)	(0.0057)
lnCases	-0.0049***				
	(0.0018)				
Deaths		0.0015			
		(0.0035)			
lnTHWDT			0.0269***		
			(0.0084)		
lnSTG				-0.0138	
				(0.0152)	
lngsent					0.0031*
					(0.0017)
Price	0.0009***	0.0011***	0.0012***	0.0012***	0.0011***
	(0.0002)	(0.0002)	(0.002)	(0.0002)	(0.0002)
lnsize	0.6783***	0.6727***	0.6703***	0.6652***	0.6731***
	(0.0228)	(0.0217)	(0.0022)	(0.0234)	(0.0216)
lnvolume	-0.0509***	-0.0501***	-0.0496***	-0.0503***	-0.0501***
	(0.0043)	(0.0040)	(0.0040)	(0.0040)	(0.0040)
SET	-0.4436***	-0.3836**	-0.3883***	-0.3741**	-0.3947***
	(0.1604)	(0.1510)	(0.1516)	(0.1514)	(0.1510)
Inf	-0.0258***	-0.0207***	-0.0228***	-0.0184***	-0.0179***
	(0.0055)	(0.0045)	(0.0046)	(0.0051)	(0.0048)
cons	-18.1293***	-18.0361***	-18.0900***	-17.7889***	-18.0389***
	(0.5690)	(0.5409)	(0.5449)	(0.6121)	(0.5398)
Observations	7587	7587	7587	7587	7587
Number of groups	95	95	95	95	95
F-statistic	257.22	297.92***	294.44***	298.04***	298.46***
With-in R-squared	0.2160	0.2179	0.2181	0.2180	0.2182
Overall R-squared	0.4325	0.4372	0.4398	0.4414	0.4371

Note: Standard errors are in the parentheses below the coefficient estimates. *, **, *** denote statistical significance at the 0.1, 0.05, 0.01 respectively.

Table 1 Spread regression (cont.)

	Wave 3				
	lnSpread	**lnSpread**	**lnSpread**	**lnSpread**	**lnSpread**
lnVOLT	0.0581***	0.0576***	0.0576***	0.0568***	0.0598***
	(0.0047)	(0.0047)	(0.0048)	(0.0048)	(0.0048)
lnCases	0.0008				
	(0.0019)				
Deaths		-0.0001***			
		(0.0000)			
lnTHWDT			-0.0096		
			(0.0081)		
lnSTG				0.0349**	
				(0.0151)	
lngsent					-0.0022*
					(0.0013)
Price	0.0012***	0.0012***	0.0012***	0.0012***	0.0010***
	(0.0002)	(0.0002)	(0.0002)	(0.0002)	(0.0002)
lnsize	0.4824***	0.4788***	0.4848***	0.4888***	0.4930***
	(0.0229)	(0.0228)	(0.0229)	(0.0230)	(0.0229)
lnvolume	-0.0380***	-0.0373***	-0.0379***	-0.0376***	-0.0396***
	(0.0032)	(0.0032)	(0.0032)	(0.0032)	(0.0033)
SET	0.1023	0.1640	0.0845	0.0564	0.0590
	(0.1777)	(0.1789)	(0.1784)	(0.1788)	(0.1797)
Inf	0.0001	-0.0033**	0.0004	0.0006	-0.0011
	(0.0020)	(0.0016)	(0.0015)	(0.0013)	(0.0013)
cons	-13.4904***	-13.3963***	-13.5117***	-13.7941***	-13.7018***
	(0.5665)	(0.5626)	(0.5639)	(0.5804)	(0.5666)
Observations	10137	10137	10137	10137	10137
Number of groups	95	95	95	95	95
F-statistic	162.08***	163.24***	163.24***	162.9***	160.83***
With-in R-squared	0.0160	0.1022	0.1017	0.1020	0.1007
Overall R-squared	0.4752	0.4757	0.4732	0.4699	0.4751

Note: Standard errors are in the parentheses below the coefficient estimates. *, **, *** denote statistical significance at the 0.1, 0.05, 0.01 respectively.

Impact of COVID-19 on stock market volatility

The empirical findings in Table 2 revealed that the stock market illiquidity had an impact on the volatility of the stock market. A positive relationship exists between the volatility and bid-ask spread of a stock market. Volatility jeopardizes an asset's market value, buyers and sellers become anxious, and stocks may not be traded at a fair price. In such a situation, investors are prone to panic and feel compelled to sell, thereby resulting in increased volatility and asset value loss owing to premature liquidation. High illiquidity typically results in a highly volatile market and causes prices to change drastically.

In terms of the pandemic indices, the author noticed that in the three waves, the impact of CASES on the stock market volatility decreased gradually, and a 1% change in CASES caused an increase of 0.0338%, 0.0248%, and 0.0260% in the first, second, and third waves, respectively.

However, DEATHS had a significant and larger positive impact than CASES in the first wave. The impact of DEATHS was 0.0514% in the first wave, which was the second largest compared with that of the other pandemic indices. In the second wave, DEATHS had a negative relationship with the stock market volatility. Although DEATHS was higher in the second wave than in the first wave, people believed that it was under control. Thus, its impact dropped to 0.0255%, and in the third wave, its effect was insignificant.

For THWDT, the results revealed that it had a negative relationship with the stock market volatility. Possible explanations for this result are the use of private transportation, which can help reduce the spread of the virus, and the increase in infection prevention measures, such as mask wearing in public and while driving.

Concerning STG, it demonstrated the same relationship with the stock market illiquidity (Table 3 and Table 4). The implementation of government policies on the pandemic can affect the market positively or negatively. For its positive effect, government policies can help ease the impact of the pandemic. For its negative effect, the number of policies implemented may indicate the out-of-control status of the situation and the seriousness of the pandemic. The results showed that in the first wave, the stock market reacted positively to the strict government policies on COVID-19, so a 1% increase in the index caused a 0.0217% increase in volatility. However, in the second and third waves, CASES and DEATHS skyrocketed and were out of control. The number of infected individuals in Thailand reached 10,000,

thereby causing volatility in the stock market. The impact of the index in the second and third waves was 0.4908% and 0.4214%, respectively, which was relatively high.

Finally, GSENT had a positive relationship with the stock market volatility in the first and second waves. The impact of the index was the largest in the first wave but decreased in the succeeding waves. As the world panicked, the impact of GSENT on the stock market volatility was 0.0548% in the first wave and 0.0077% in the second wave. However, in the third wave, the relationship between GSENT and the volatility of the stock market was insignificant.

Table 2 Range-based volatility regression

	Wave 1				
	lnVOLT	**lnVOLT**	**lnVOLT**	**lnVOLT**	**lnVOLT**
lnSpread	0.2050***	0.2148***	0.2112***	0.2202***	0.2203***
	(0.0088)	(0.0088)	(0.0088)	(0.0088)	(0.0087)
lnCases	0.0338***				
	(0.0021)				
Deaths		0.0514***			
		(0.0044)			
lnTHWDT			-0.1042***		
			(0.0078)		
lnSTG				-0.0217***	
				(0.0017)	
lngsent					0.0548***
					(0.0021)
Close	0.0023***	0.0022***	0.0023***	0.0020***	0.0015***
	(0.0002)	(0.0002)	(0.0002)	(0.0003)	(0.0002)
lnsize	-0.7937***	-0.8357***	-0.8054***	-0.9090***	-0.7745***
	(0.0173)	(0.0169)	(0.0175)	(0.0163)	(0.0166)
lnvt	0.4098***	0.4152***	0.4099***	0.4255***	0.4120***
	(0.0036)	(0.0036)	(0.0036)	(0.0036)	(0.0035)
SET	-2.4898***	-2.3432***	-2.4209***	-2.0260***	-2.0616***
	(0.1218)	(0.1214)	(0.1225)	(0.1217)	(0.1194)
cons	16.8824***	17.9891***	17.6774***	19.9093***	16.3831***
	(0.4333)	(0.4219)	(0.4269)	(0.4103)	(0.4170)
Observations	20501	20501	20501	20501	20501
Number of groups	95	95	95	95	95
F-statistic	2673.03***	2639.33***	2635.58***	2645.96***	2800.19***
With-in R-squared	0.4401	0.4370	0.4389	0.4376	0.4516
Overall R-squared	0.1997	0.1931	0.1972	0.1849	0.2091

Note: Standard errors are in the parentheses below the coefficient estimates. *, **, *** denote statistical significance at the 0.1, 0.05, 0.01 respectively.

Table 2 Range-based volatility regression (cont.)

	Wave 2				
	lnVOLT	**lnVOLT**	**lnVOLT**	**lnVOLT**	**lnVOLT**
lnSpread	0.2881***	0.2889***	0.2926***	0.2902***	0.2870***
	(0.0244)	(0.0230)	(0.0231)	(0.0224)	(0.0230)
lnCases	0.0248***				
	(0.0033)				
Deaths		-0.0255***			
		(0.0070)			
lnTHWDT			-0.0878***		
			(0.0167)		
lnSTG				0.4908***	
				(0.0257)	
lngsent					0.0077**
					(0.0033)
Close	0.0031***	0.0028***	0.0027***	0.0020***	0.0028***
	(0.0004)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
lnsize	0.3541***	0.4046***	0.4043***	0.6303***	0.3980***
	(0.0482)	(0.0459)	(0.0463)	(0.0465)	(0.0459)
lnvt	0.4844***	0.4789***	0.4789***	0.4606***	0.4797***
	(0.0063)	(0.0059)	(0.0059)	(0.0058)	(0.0059)
SET	-0.0804	-1.077298***	-1.0771***	-1.4115***	-1.0675***
	(0.3186)	(0.3033)	(0.3042)	(0.2969)	(0.3034)
cons	-8.6445***	-9.7625***	-9.3908***	-17.2996***	-9.5913***
	(1.2132)	(1.1563)	(1.1652)	(1.1998)	(1.1554)
Observations	7587	7587	7587	7578	7578
Number of groups	95	95	95	95	95
F-statistic	1182.56***	1324.67***	1315.54***	1444.78***	1322.03***
With-in R-squared	0.5205	0.5150	0.5164	0.5366	0.5145
Overall R-squared	0.7213	0.7089	0.7097	0.6181	0.7099

Note: Standard errors are in the parentheses below the coefficient estimates. *, **, *** denote statistical significance at the 0.1, 0.05, 0.01 respectively.

Table 2 Range-based volatility regression (cont.)

	Wave 3				
	lnVOLT	**lnVOLT**	**lnVOLT**	**lnVOLT**	**lnVOLT**
lnSpread	0.2560***	0.2604***	0.2520***	0.2478***	0.2596***
	(0.0205)	(0.0206)	(0.0204)	(0.0204)	(0.0206)
lnCases	0.0260***				
	(0.0024)				
Deaths		0.0001			
		(0.0000)			
lnTHWDT			-0.1901***		
			(0.0140)		
lnSTG				0.4214***	
				(0.0289)	
lngsent					-0.0015
					(0.0025)
Close	0.0025***	0.0026***	0.0025***	0.0025***	0.0027***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
lnsize	0.2978***	0.2549***	0.3319***	0.3498***	0.2496***
	(0.0485)	(0.0487)	(0.0485)	(0.0485)	(0.0486)
lnvt	0.4597***	0.4577***	0.4583***	0.4579***	0.4577***
	(0.0050)	(0.0050)	(0.0049)	(0.0049)	(0.0050)
SET	-4.1028***	-3.8654***	-4.3727***	-4.4793***	-3.7822***
	(0.3690)	(0.3743)	(0.3691)	(0.3691)	(0.3700)
cons	-7.4045***	-6.1154***	-7.3245***	-10.2074***	-5.9801***
	(1.2185)	(1.2207)	(1.1211)	(1.2393)	(1.1219)
Observations	10160	10160	10160	10160	10160
Number of groups	95	95	95	95	95
F-statistic	1653.92***	1617.66***	1677.17***	1686.74***	1617.19***
With-in R-squared	0.4966	0.4911	0.5001	0.5015	0.4910
Overall R-squared	0.6894	0.7026	0.6796	0.6723	0.7032

Note: Standard errors are in the parentheses below the coefficient estimates. *, **, *** denote statistical significance at the 0.1, 0.05, 0.01 respectively.

Conclusion, Discussion, and Recommendation

Conclusion

In this study, the author aimed to determine whether COVID-19 had an impact on the stock market and the extent of its impact in each wave. The author proposed the following hypotheses: COVID-19 worsened the stock market liquidity and volatility, and the effect of COVID-19 was the largest in the first wave, followed by that in the succeeding waves.

In summary, the results showed that the COVID-19 pandemic had a significant impact on the stock market. However, some of its impacts disappeared gradually by the third wave. The results revealed that most of the pandemic indices had the largest effect in the first wave, except for STG. The results of this study are consistent with prospect theory. The COVID-19 pandemic, which was considered bad news, had an immense effect during the first wave. Stock markets tended to overreact to the escalated uncertainty during the early stages, so the effect of COVID-19 was significantly high during the first wave. In the succeeding waves, the good news was reported, such as action by the government and the recovery of the economy and stock market; thus, the effect of COVID-19 on the stock market decreased continuously.

GSENT had the highest negative impact on the stock market illiquidity and volatility. However, THWDT was the only index that lightened the stock market illiquidity and volatility situation. The results are consistent between SPREAD and ILLIQ and between VOLT and GVOLT. In addition, STG exhibited the largest impact on the volatility of the stock market in the second wave. In the ILLIQ regression, the impact of GSENT was slightly higher in the second wave than in the first wave, but the negative relationship was similar.

Discussion

The author expected stock market illiquidity to have a positive impact on stock market volatility and stock market volatility to have a positive impact on stock market illiquidity. The obtained results are consistent with the expectation. Many prior studies, such as French et al. (1987) and Haugen et al. (1991), determined that market volatility decreases aggregate stock returns. Volatility can be considered a risk, as it can create fear and uncertainty, which can lead to bad investment decisions. Baig et al. (2021) and Haroon and Rizvi (2020) determined the positive impact of stock market volatility on stock market illiquidity. The authors used a bid-ask spread as an illiquidity measure, which obtained the same results as the present study. The results are also in line with those of Brunnermeier and Pedersen (2009), who found that

volatility affects liquidity. However, Marozva and Magwedere (2021) employed a bid-ask spread and the Amihud illiquidity measure to measure stock market illiquidity. The Amihud illiquidity measure revealed that volatility has a negative impact on stock market illiquidity in emerging markets, and an increase in stock market volatility increases stock market illiquidity.

According to prospect theory, in terms of good news and bad news, bad news can lead to a large negative impact, and good news can lead to a small positive impact. At the beginning of the pandemic, people were more sensitive than usual and thus overreacted. Initially, the author expected either the number of cases or the number of deaths to have the highest impact on the illiquidity and volatility of the stock market, as they are the most obvious indicator of the seriousness of COVID-19. However, the results revealed that the number of deaths did not have an impact on the stock market. Anh and Gan (2020), Chatjuthamard et al. (2021), and Nguyen et al. (2021) confirmed that the worsening severity of COVID-19 decreases market liquidity. Mishra et al. (2022) examined the effect of the number of cases and deaths on the US stock markets and reported that at the beginning of 2020, the number of cases and deaths had a negative impact on the Dow Jones. However, within the same year, the movement of the Dow Jones increased along with the number of cases. This finding is related to the present study, as the author also observed that in the second wave, the impact of the number of cases on the stock market liquidity was positive when the bid-ask spread was used as the illiquidity measure.

Meanwhile, STG exerted an impact on the stock market in terms of volatility mostly in the second wave and was considered the index with the highest overall impact. Ibrahim et al. (2020) and Bakry et al. (2021) showed that stringency in Thailand has a positive relationship with stock market volatility. However, in the research, the study period was only the first wave. The author obtained similar results in the first wave. By contrast, Haroon and Rizvi (2020) observed that stringency has a negative impact on stock market volatility. As mentioned previously, stringency can exert a positive or negative impact depending on how people feel during the period.

Recommendations and limitations

In this research, the author aimed to provide some perspective and benefit the government, investors, and individuals associated with stock markets. First, the government plays an important role in overcoming the pandemic and helping people cope with the

uncertainty and indicates the strictness of lockdown policies that primarily restrict people's behavior. This study showed that the government's action exerted a considerable impact on the stock market. The government-implemented lockdown sent a signal to the stock market and created uncertainty. In addition, the government should be concerned about the stability of the stock market. If the government's action increases the volatility of the stock market, then liquidity will drop. Subsequently, the low liquidity will increase the volatility of the stock market, because the market is sensitive. Second, this study can provide investors with information for making investment decisions and learning about the situation. Investors should be cautious because the stock market was very sensitive during the pandemic. When the market is illiquid and volatile because of an unexpected event, most investors will suffer losses. However, investors may adopt a contrarian strategy in investing, buy at a low price when others are afraid to invest, then wait until the price rises to gain a profit.

The limitation of this study is that some of the variables, such as THDWT and STG, were gathered by foreign institutions. The results may reflect a clearer picture if the variables were collected by official Thai institutions. Moreover, in conducting this study, researchers should be careful about the definition of the variables. Determining whether other variables that can capture liquidity and volatility will obtain similar or different estimates would be interesting. Different variable meanings can lead to different results. In future studies, exploring cross-country analyses would also be interesting. However, such analyses are beyond the scope of this study. Future studies should consider whether the variables used in this study are consistent with those used in other countries.

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