

Volatility and Liquidity Comparison of Indonesian and Singapore Stock Market in COVID-19 Mobility Restrictions Era

Irene Nathania¹; Sumani^{2*}

^{1,2}Management Study Program, Faculty of Economic and Business, Atma Jaya Catholic University of Indonesia
Jln. Jend. Sudirman No. 51, Jakarta Selatan 12930, Indonesia

¹irene.201701010037@student.atmajaya.ac.id; ²sumani@atmajaya.ac.id

Received: 11th October 2022/ **Revised:** 19th April 2023/ **Accepted:** 19th April 2023

How to Cite: Nathania, I., & Sumani. (2023). Volatility and Liquidity Comparison of Indonesian and Singapore Stock Market in COVID-19 Mobility Restrictions Era. *Binus Business Review*, 14(3), 235–245.
<https://doi.org/10.21512/bbr.v14i3.9063>

ABSTRACT

The COVID-19 case found at the end of December 2019 became a pandemic in March 2020. The research aimed to see and understand the differences in the performance of the Indonesian and Singapore stock indices represented by the Indeks Harga Saham Indonesia (IHSG) and Straits Times Index (STI) before and after the implementation of community mobility restrictions (Pembatasan Sosial Berskala Besar (PSBB) in Indonesia and Circuit Breaker in Singapore). The stock index data were stock index prices at closing and stock trading volume. The stock index performance was measured by its volatility and liquidity. Meanwhile, data volatility with heteroscedasticity symptoms were measured using the GARCH (1,1) model. Meanwhile, the standard deviation was used to measure homoscedastic data. The results show differences in return volatility and stock index liquidity before and after restrictions on community mobility. The return volatility of the IHSG and STI is higher before the community mobility restrictions compared to the period after. IHSG experiences liquidity after PSBB I and before PSBB II. The conclusion indicates that liquidity in Indonesia does not improve when PSBB I is implemented, but it improves in PSBB II. Meanwhile, STI's liquidity is higher in the period after the implementation of Circuit Breaker. These results indicate that implementing the Circuit Breaker helps to improve the stock index's performance in Singapore because volatility decreases when the policy is implemented. The policy also reduces the liquidity of the Singapore stock index.

Keywords: volatility, liquidity, Indonesian Stock Market, Singapore Stock Market, COVID-19 mobility restrictions era

INTRODUCTION

The first COVID-19 case was discovered in Wuhan, China, in late December 2019. However, the advancement of technology and ease of traveling caused the virus to spread rapidly to other parts of the world. Most countries have implemented many policies to curb the spread of COVID-19. One of the policies is mobility restrictions. Indonesia is one of the countries which implemented the policy. It is called Pembatasan Sosial Berskala Besar (PSBB) (Mashabi, 2020). The policy was enforced twice throughout 2020. The other country in Southeast Asia which also

implements a similar policy is Singapore. The policy is known as Circuit Breaker and enforced earlier than in Indonesia (Ministry of Health Singapore, 2020b).

The COVID-19 pandemic has impacted the economy (Ministry of Health Singapore, 2020a). Policies that are created and implemented by various governments also affect stock markets. One of the policies, such as mobility restrictions, has implications for companies from various industries. According to Ekananda (2018), volatility is a return movement experienced by securities during a specific time. Other than volatility, liquidity is another indicator for capital markets. During this uncertain time, liquidity becomes

an essential factor to be noticed. Liquidity is the speed and ease the investors get in converting an asset into cash.

A few months after the pandemic started, many researchers have examined the relationship between the COVID-19 pandemic and its impact on the economy. However, many of those studies focus on the effect of information, such as the number of COVID-19 cases, mortality, and recoveries on the economy. Research about liquidity during the pandemic is also quite rare to find. Other than that, most research is centered in the United States, Europe, and China (Castro et al., 2021; Thangamuthu et al., 2022; Zhang et al., 2020).

In addition, numerous researchers have analyzed the effect of the COVID-19 pandemic on the volatility or liquidity of stock markets months after the pandemic started. For example, Chaudhary et al. (2020) examined the impact of COVID-19 on the return and volatility of ten countries with the highest GDP (the United States, China, Japan, Germany, India, Great Britain, France, Italy, Brazil, and Canada). One of the findings showed that the COVID-19 pandemic had increased the volatility of those countries. Meanwhile, Baek et al. (2020) found that the volatility had been affected by specific economic indicators and was sensitive to news about COVID-19. The market sensed a more significant influence from negative news, such as mortality rate than recovery rate. Bai et al. (2020) analyzed the effect of a pandemic of infectious disease on the stock market's volatility. The analyzed stock markets were the United States, Great Britain, China, and Japan. It showed a significant and positive effect of the infectious disease pandemic from up to 24 months on the permanent volatility of the stock market. Next, Albulescu (2020) examined the impact of official announcements about infection cases and fatality rates on the financial market's volatility in the United States. The research was done by comparing the data which were reported globally and data from the United States. The result showed how new infection reported cases caused the volatility to grow stronger. Other than that, the mortality rate had a significant and positive effect on volatility. The result also indicated that global data about COVID-19 had a more significant impact than data in the United States. Insaïdoo et al. (2021) stated that in Ghana's stock market revealed a negative and insignificant relationship between the stock return and the COVID-19 pandemic. Meanwhile, Liu et al. (2020) studied the effect of the COVID-19 pandemic on 21 leading stock markets. They stated a significant and negative effect on all stock markets from the COVID-19 outbreak. However, Asian stock markets responded more quickly to the COVID-19 pandemic than other stock markets. They also had more significant abnormal returns.

Some studies identify the effect of the COVID-19 pandemic on the stock market's liquidity. For example, Alaoui Mdaghri et al. (2021) stated that overall, the COVID-19 pandemic negatively and significantly affected stock market liquidity in Middle East and North Africa (MENA) countries. Stock return

volatility also escalated because of the pandemic.

Several studies also investigate the impact of government policies during the pandemic on the volatility or liquidity of the stock market. For example, Anh and Gan (2021) studied the Vietnam stock market before and during the lockdown period. The period before the lockdown negatively and significantly affected stock returns. In the meantime, the stock market and various business sectors generally experienced positive and significant effects due to the lockdown period. Said that Nguyen et al. (2022) that the government's announcement of ending the lockdown of Ho Chi Minh City in October 2021 positively affected the stock market performance in Vietnam. Phan and Narayan (2020) pointed out that the stock markets in the United States, Germany, Russia, Swiss, Israel, Peru, and Chile faced a positive impact due to the lockdown enforcement. Announcements regarding the lockdown were positively perceived by those stock markets (except the Swiss stock market) rather than announcements about the pandemic and traveling restrictions. Zaremba et al. (2020) identified a significant impact and volatility increase in international stock markets in 67 countries listed in Datastream Global Equity Indices because of the government's policies, such as information campaigns and public events cancellation. On the other hand, Baig et al. (2021) observed the effect of the COVID-19 pandemic on the microstructure of the United States' capital market. The observation showed that the implementation of restrictions and lockdowns caused a decline in the liquidity and stability of the market. Haroon and Rizvi (2020) researched the impact of flattening the curve on the liquidity of capital markets in 23 developed countries in America, Asia, and Europe. The research proved that liquidity growth occurred in financial markets when there was a reduction in COVID-19 cases. It could happen because of the critical uncertainty that investors face. The liquidity improvement happened due to the implementation of the government's social restrictions policy.

From the literature study mentioned, the studies about the impact of COVID-19 to stock market performance in Southeast Asia, specifically in Indonesia, are limited. That is why the researchers are interested in studying stock indexes' volatility and liquidity patterns before and during the implementation of mobility restrictions. It is the novelty of the research. In particular, the research analyzes stock indexes in two countries in Southeast Asia: Indonesia and Singapore.

METHODS

The researchers apply the event study methods to research the pattern of volatility and liquidity of stock indexes before and during policies related to limiting people's mobility. In particular, research is conducted to examine the performance of the stock indices of the two countries located in Southeast Asia, namely Indonesia and Singapore. This model is used

to test whether there are differences in the volatility and liquidity of the Indonesian and Singapore stock markets before and after implementing the policy of limiting community mobility. Figures 1 and 2 show the research model.

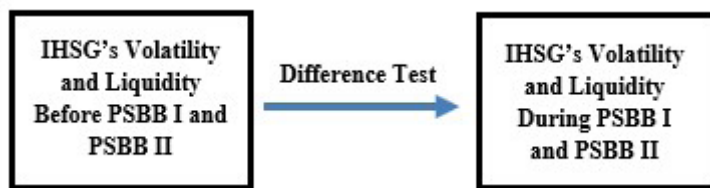


Figure 1 Research Model 1 - Indonesia

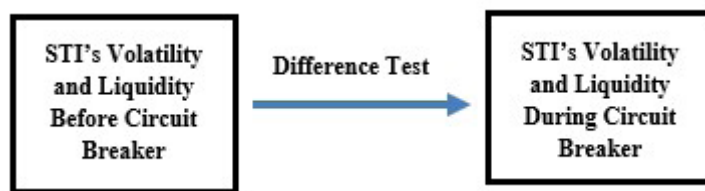


Figure 2 Research Model 2 - Singapore

All data collected can be classified as secondary data because they are collected from available sources, such as Yahoo Finance (www.yahoofinance.com). The data are the closing price and volume of Indeks Harga Saham Indonesia (IHSG) and Straits Times Index (STI). The researchers use data regarding the PSBB in Jakarta because every area in Indonesia has implemented the policy on different dates. Therefore, the researchers choose data from Jakarta as a reference because Jakarta is Indonesia's capital city and economic center.

There are six different periods in the research. First, it is the period before PSBB I since the first COVID-19 case in Indonesia until a day before PSBB I in Jakarta. The first COVID-19 case was found on March 2, 2020, and the first day of PSBB I implementation was April 10, 2020. So, this time starts from March 2, 2020, to April 9, 2020. Second, the period during PSBB I includes PSBB I implementation in Jakarta from April 10, 2020, to June 4, 2020. Third, it is the period before PSBB II begins (the first day after PSBB ends and a day before PSBB II in Jakarta). PSBB I ended on June 4, 2020, and PSBB II started on September 14, 2020. So, this period starts from June 5, 2020, to September 13, 2020. Fourth, it consists of the period during PSBB II. It covers the PSBB II enforcement in Jakarta, which began on September 14, 2020, until October 11, 2020. Fifth, the period is before Circuit Breaker starts (the first discovered COVID-19 in Singapore until a day before the enforced Circuit Breaker). The first COVID-19 case in Singapore was found on January 23, 2020, and the Circuit Breaker started on April 7, 2020. Hence, the period includes January 23, 2020, to April 6, 2020. Last, it is the period during Circuit Breaker (April 7,

2020, until June 1, 2020).

Some STI data for specific dates on the website still need to be completed. For example, there are no data for the closing prices on March 11 and March 13, 2020, even though trading happens on both dates. The data regarding the volumes on March 9, 10, and 11, 2020, are also needed. Consequently, those dates are omitted from the observation for both IHSG and STI. Therefore, in total, there are 226 days of observations for both stock indexes from six different periods.

Next, two different variables are used in the research. The first one is volatility. As the research aims to understand stock indexes' performances before and during the implementation of mobility restrictions, volatility is one of the indicators to measure that performance. The stock return volatility is the one that will be calculated to be more specific. Therefore, stock return is calculated using Equation (1) from Ekananda (2018). It has CP as the closing price.

$$\text{Return} = \text{Log} \frac{\text{CP}}{\text{CP}_{t-1}} \quad (1)$$

The simplest method that can be used to determine the stock return's volatility is using its standard deviation (Sekaran & Bougie, 2017; Sutrisno, 2020). The most commonly used volatility measurement is standard deviation. It is able to indicate the difference by the amount that the average stock price differs from the average over some time.

Another variable is liquidity. Liquidity is measured by the equation in a research by Alaoui Mdaghri et al. (2021). Liquidity can be found by the ratio. This ratio is calculated by dividing absolute daily return with its dollar trading volume. The result can be interpreted as a higher ratio that can cause a higher illiquidity. It is shown in Equation (2). It has $R_{i,t}$ as daily stock return, which is calculated as its natural logarithm from the closing price on a day (t) divided by the closing price from the day before ($t-1$) and $\text{volume}_{i,t}$ as Dollar volume i on a day t .

$$\text{Amihud}_{i,t} = \frac{|R_{i,t}|}{\ln(\text{volume}_{i,t})} \quad (2)$$

Descriptive statistics consists of collecting, processing, presenting, and interpreting data to find a conclusion (Silvia, 2020). It aims to provide explanations and information about the results that can lead to conclusions. It also has data accumulation, processing, presentation, and interpretation to find a conclusion. Descriptive statistics used are mean, median, standard deviation, maximum, and minimum.

All data are analyzed and processed using Eviews 10 because the data are time series, which are more precisely processed using Eviews (Ma et al., 2018). The first step in data analysis is the normality test. The test can be used as a reference to choose the correct statistic (Riyanto & Hatmawan, 2020). The normality test utilized is the Jarque-Bera Test. The

decision from the Jarque-Bera test is that H0 will be denied if the p-value is low. Conversely, H0 will not be denied if the p-value is high.

The second step is the stationarity test. According to Bawdekar and Prusty (2022), one of the underlying assumptions of time-series data is that the data are stationer. It means the data have constant mean, variance, and autocovariance. The stationarity test is the unit root test, specifically the Augmented Dickey-Fuller test. Data can be identified as stationary if the ADF value is more significant than the critical values. On the other hand, the data are not stationer if the ADF value is lower than the critical values (Ekananda, 2018).

The next step is the heteroscedasticity test. The Autoregressive Conditional Heteroscedasticity (ARCH) test is used to determine whether there is heteroscedasticity in the data. According to Laily et al. (2018), the interpretation of the ARCH test is the same as other heteroscedasticity tests. It means a lower p-value than the significance level indicates the ARCH effect or heteroscedasticity effect in data.

However, the measurement for volatility is determined by the type of data. Here are the different measurements which are used for each type of data. If the test shows homoscedastic data, the standard deviation can be used to calculate volatility (Fadilah et al., 2018; Wulandari et al., 2018). The standard deviation is shown in Equation (3).

$$\sigma = \sqrt{\frac{\sum_{i=1}^n (R - \bar{R})^2}{n-1}} \quad (3)$$

However, if the test shows heteroscedastic data, data containing the ARCH effect can be estimated using the ARCH or Generalized Autoregressive Conditional Heteroscedasticity (GARCH) model. Various time-series variances in a period of time can be measured using a model named ARCH (Bawdekar & Prusty, 2022). ARCH model was proposed and developed by Engle. Later, the model is expanded by Bollerslev into Generalized Autoregressive Conditional Heteroscedasticity (GARCH). Equation (4) is the general model of ARCH, which is shown by AL-Najjar (2016). It has α_0 as mean, α_1 as conditional volatility, and ε_{t-i}^2 as white noise, which represents residual from time series. Meanwhile, the general model of the GARCH model is shown in Equation (5) (AL-Najjar, 2016). It consists of I as 0, 1, 2, 3, ..., p , conditional volatility, and ω , α_j , and β_i are constants that are not negative, and if the sum between α_j and β_i is higher than 1, the condition of the best model is already fulfilled. It also has ε_{t-j}^2 as residual with

lagged conditional volatility. α_j and ε_{t-j}^2 as ARCH component, and β_i and σ_{t-j}^2 as GARCH component. After the ARCH/GARCH model estimation, the ARCH Lagrange Multiplier (LM) test can be applied to the model to determine whether the data still have

heteroscedasticity (Yolanda et al., 2017).

$$\sigma_t^2 = \alpha_0 + \sum_{i=1}^q \alpha_i \varepsilon_{t-i}^2 \quad (4)$$

$$\sigma_t^2 = \omega + \sum_{j=1}^q \alpha_j \varepsilon_{t-j}^2 + \sum_{i=1}^p \beta_i \sigma_{t-i}^2 \quad (5)$$

GARCH is the proper method to identify volatility in financial data (Hartati & Saluza, 2017). The GARCH model is also the correct method to examine data that contains heteroscedasticity, such as stock index price. The usage of GARCH is more supported than ARCH because of its efficiency in getting the estimation owing to the less parameter that are used and its ability to identify the effect of the previous variance error on the variance error now (Karnadi, 2017).

RESULTS AND DISCUSSIONS

Table 1 shows the descriptive statistics of both stock indexes from different periods. All data have a positive average. The average from IHSG and STI before the implementation of mobility restrictions is higher than the implementation time. Conversely, the average volume is lower during the implementation of the policy.

Volatility can be conveyed through its standard deviation. IHSG's standard deviation before PSBB I is high, showing how high the volatility is. It can happen because of the spread of COVID-19 in Indonesia and the world during that period. Other than standard deviation, volatility can also be seen through the difference between its maximum and minimum values (Raneo & Muthia, 2018). The difference between the closing's price maximum value and minimum value is relatively high, which is 1.712,504. This result solidifies that the volatility in this period is higher than in other periods. Based on all the observed periods, STI's volatility during the implementation of Circuit Breaker is the lowest. There is a significant decrease from the period before to the period during the implementation. It shows that the policy helps to decrease the volatility.

Table 2 shows the result of the normality test using the Jarque-Bera test. All stock returns of IHSG and STI before the implementation of mobility restrictions are abnormal because p-values are less than 0,05. Meanwhile, stock returns during the implementation of mobility restrictions are normal because they have p-values bigger than 0,05. According to Nurdina et al. (2021), leptokurtic is why the stock return often experiences abnormality. Leptokurtic can be described as a condition in which the distribution tail is bigger than 3.

Table 3 shows the result of the stationarity test using the Augmented Dickey-Fuller test. The stock returns from various periods are proven to be stationer due to the fact that their p-values are lower than the significant level, which is 0,05. The results also show that all data are free from the unit root.

Table 1 Descriptive Statistics Result

		Mean	Median	Maximum	Minimum	Std. Dev
IHSG Before PSBB I	Closing Price	4.682,503	4.545,571	5.650,136	3.937,632	512,9419
	Volume	4.7879.970	43.426.600	86.224.800	26.383.700	17.236.936
IHSG During PSBB I	Closing Price	4.619,020	4.597,430	4.941,006	4.480,607	114,1422
	Volume	53.474.155	47.798.700	110.933.800	0	20.539.969
IHSG Before PSBB II	Closing Price	5.088,272	5.079,122	5.371,472	4.816,336	144,6115
	Volume	83.497.813	80.885.000	146.510.200	0	27.322.965
IHSG During PSBB II	Closing Price	4.983,319	4.984,658	5.161,828	4.842,756	82,89918
	Volume	88.605.445	87.625.400	113.645.500	65.673.400	14.554.631
STI Before Circuit Breaker	Closing Price	2.904,086	3.116,310	3.240,020	2.233,480	353,4794
	Volume	349.036.749	315.229.200	628.761.400	111.850.600	132.832.202
STI During Circuit Breaker	Closing Price	2.563,594	2.563,320	2.634,570	2.499,830	34,55713
	Volume	379.262.522	329.637.800	1.472.751.700	163.623.700	218.412.950

Note: Community Mobility Restrictions (Pembatasan Sosial Berskala Besar (PSBB)), Indeks Harga Saham Indonesia (IHSG), and Straits Times Index (STI).

(Source: Data Processed Using Eviews)

Table 2 Normality Test Result

	Before PSBB I		During PSBB I	
	Jarque-Bera	P-Value	Jarque-Bera	P-Value
Return of IHSG	8,563334	0,013820	0,100526	0,950979
	Before PSBB II		During PSBB II	
	Jarque-Bera	P-Value	Jarque-Bera	P-Value
	44,38966	0,000000	1,633064	0,441962
Return of STI	Before Circuit Breaker		During Circuit Breaker	
	Jarque-Bera	P-Value	Jarque-Bera	P-Value
	260,7684	0,000000	2,920699	0,232155

Note: Community Mobility Restrictions (Pembatasan Sosial Berskala Besar (PSBB)), Indeks Harga Saham Indonesia (IHSG), and Straits Times Index (STI).

(Source: Data Processed Using Eviews)

The ARCH test result in Table 4 shows that most data are not heteroscedastic. Most of them have a higher prob. F and prob. Chi-Square than level significance. The result indicates that most stock return volatility will be measured using the standard deviation. Meanwhile, the only heteroscedastic data set in the research is IHSG's stock return during the implementation of PSBB I. The data have both lower prob. F and prob. Chi-Square than 0,05. The result also implies that the ARCH/GARCH model can only be applied to this data set.

Based on the ARCH test applied to all IHSG and STI return data before and after restrictions on community mobility, five data sets are free from ARCH effects. They have F probability and Chi-Square probability bigger than the significance level of

0,05. Therefore, the volatility of the data is measured using the standard deviation formula. Table 5 lists the homoscedastic return data's standard deviation from different periods.

Meanwhile, volatility for the heteroscedastic data can be obtained using the ARCH/GARCH model. Regression is done using the variable return to its constant. The first step is estimating the ARCH model. Based on the ARCH model from lag 1 to lag 9 that is applied to the data, each p-value is bigger than the level of significance. Therefore, the ARCH model is not a suitable model to be applied to the data. The second step is estimating the GARCH model. The GARCH model is the right option to be used to calculate volatility in the research. The GARCH (1,1) model has a p-value lower than the significance level.

Table 3 Stationarity Test Result

	Before PSBB I		During PSBB I	
	ADF Test Statistic	Prob.	ADF Test Statistic	Prob.
Return IHSG	-3,337465	0,0260	-6,642034	0,0000
	Before PSBB II		During PSBB II	
	ADF Test Statistic	Prob.	ADF Test Statistic	Prob.
	-9,124188	0,0000	-4,844437	0,0014
Return STI	Before Circuit Breaker		During Circuit Breaker	
	ADF Test Statistic	Prob.	ADF Test Statistic	Prob.
	-7,194700	0,0000	-8,556980	0,0000

Note: Community Mobility Restrictions (Pembatasan Sosial Berskala Besar (PSBB)), Indeks Harga Saham Indonesia (IHSG), Straits Times Index (STI), and Augmented Dickey-Fuller (ADF).
(Source: Data Processed Using Eviews)

Table 4 ARCH Test Result

	Before PSBB I		During PSBB I	
	Prob. F	Prob. Chi-Square	Prob. F	Prob. Chi-Square
Return IHSG	0,8007	0,7882	0,0259*	0,0260*
	Before PSBB II		During PSBB II	
	Prob. F	Prob. Chi-Square	Prob. Prob. F	Prob. Chi-Square
	0,1191	0,1156	0,8825	0,8736
Return STI	Before Circuit Breaker		During Circuit Breaker	
	Prob. F	Prob. Chi-Square	Prob. F	Prob. Chi-Square
	0,9817	0,9812	0,9723	0,9713

Note: * shows that the data contains the ARCH effect. Community Mobility Restrictions (Pembatasan Sosial Berskala Besar (PSBB)), Indeks Harga Saham Indonesia (IHSG), and Straits Times Index (STI).
(Source: Data Processed Using Eviews)

Its p-value is 0,0018. This result indicates that its variance error is affected by the variance error from the previous period. Hence, the GARCH (1,1) model is shown in Equation (6).

$$\sigma_t^2 = 125E-05-0,455604\varepsilon_{t-1}^2+1,429517 \sigma_{t-1}^2 \quad (6)$$

After choosing the GARCH (1,1) model, the ARCH-LM test can be applied to examine whether the data are still heteroscedastic. The ARCH-LM test in Table 6 shows that the data are no longer heteroscedastic. Based on the ARCH-LM test carried out, the IHSG return data after PSBB I are free from symptoms of heteroscedasticity because they have an F probability and a Chi-Square probability with values of 0,8418 and 0,8351, respectively, which are greater than the significance level of 0,05. Moreover, the liquidity of stock indexes is calculated using an equation from Alaoui Mdaghri et al. (2021). The higher the ratio is, the higher the illiquidity will be. The liquidity of both stock indexes from different periods is calculated daily. Therefore, the means of liquidity are used to understand the liquidity performance of both stock indexes. Table 6 shows the average liquidity. It contains data relating to the average liquidity of the

IHSG and STI according to the period before and after restrictions on community mobility.

Volatility in the research can be classified as historical volatility because they are calculated based on past prices. IHSG's return volatility before the implementation of PSBB I is high because its standard deviation is 0,050049. The result shows that volatility is higher than during the implementation of policy. Then, the GARCH (1,1) model is used to calculate the volatility of IHSG during the implementation of PSBB I. According to Burhani et al. (2013), high or low volatility is measured by its ARCH coefficient. Meanwhile, shock and persistence in data can be seen from its GARCH coefficient. IHSG's return volatility during the implementation of PSBB I is low because its ARCH coefficient is negative, which is -0,455604. On the other hand, the GARCH coefficient value of 1,429517 with a p-value of 0,00018 shows that its current variance error is significantly affected by its previous variance error. The sum of ARCH ($\alpha 1$) and GARCH ($\beta 1$) coefficients, which is almost 1, proves that the volatility may stay for a long time (Kanal et al., 2018), The sum of both coefficients is 0,973913, which is close to 1. The result shows that the volatility in data is quite persistent.

Table 5 Standard Deviation of Stock Indexes Based on Time Periods

Period	Standard Deviation
Return IHSG before PSBB I	0,050049
Return IHSG before PSBB II	0,012651
Return IHSG during PSBB II	0,010488
Return STI before Circuit Breaker	0,034027
Return STI during Circuit Breaker	0,013282

Note: Community Mobility Restrictions (Pembatasan Sosial Berskala Besar (PSBB)), Indeks Harga Saham Indonesia (IHSG), and Straits Times Index (STI).
(Source: Data Processed Using Eviews)

Table 6 Average Liquidity of Stock Indexes Based on Time Periods

	Before PSBB I	During PSBB I
Average IHSG Liquidity	-0,000406	0,000165
	Before PSBB II	During PSBB II
	0,0000137	-0,0000616
	Before Circuit Breaker	During Circuit Breaker
Average STI Liquidity	-0,000301	0,0000441

Note: Community Mobility Restrictions (Pembatasan Sosial Berskala Besar (PSBB)), Indeks Harga Saham Indonesia (IHSG), and Straits Times Index (STI).
(Source: Data Processed Using Eviews)

PSBB has been implemented again since September 2020 because of the increasing number of COVID-19 cases. During the implementation of the policy, IHSG's value is much better compared to the beginning of the pandemic. Volatility is also higher before the implementation of PSBB II compared to the period in which the policy was implemented. However, the difference between them is slightly different. Before the implementation, the standard deviation of IHSG is 0,012651. Meanwhile, the standard deviation during the implementation of PSBB II is 0,010488.

In the meantime, Singapore's stock market is represented by STI in the research. STI's volatility is higher before the implementation of Circuit Breaker because its standard deviation is 0,034027. On the other hand, the standard deviation during the implementation of Circuit Breaker is 0,013282.

Both stock indexes' volatility is higher before the implementation of mobility restrictions. It can occur because of the emergence of the virus, which is included in that period. At that time, COVID-19 is foreign, and its emergence in each country is shocking. The rapid spread of COVID-19 and the rise of cases daily have caused a decrease in stock index prices. It decreases even more after the World Health Organization (WHO) has declared the situation as a pandemic. The uncertainty caused by this virus plays a role in the declining performance of stock indexes.

Various business sectors are hit because of the pandemic. The tourism sector is a hard hit because of the travel restrictions. Moreover, investors' concern and fear over the uncertainty caused by the increased pandemic, so they prefer investing in other types of investment with better performance and hedges. One of the investments that investors favor during the COVID-19 pandemic is cryptocurrency. Unlike other investments with decreased value, cryptocurrency, such as Bitcoin, has increased. Increasing value is also perceived by gold. This statement is supported by the JP Morgan financial analyst team that both investments have had increased prices during the pandemic (P., 2020). Based on that statement, the researchers assess that the increasing values of both investments cause the investors to invest in them.

Other than that, the announcement regarding the implementation of mobility restrictions has occurred during this period. Therefore, the volatility in this period is higher. This statement is supported by the finding from Zaremba et al. (2020), in which the government's policy to curb the cases of COVID-19, such as information campaigns and public events cancellations, plays a significant role in increasing volatility.

Meanwhile, IHSG and STI volatility have declined during the implementation of mobility restrictions. It shows that the enforcement of the policy assists in the recovery of the economy during the pandemic. The policy has been created and implemented to suppress the number of COVID-19 cases. Thus, the lower the infection rates are, the more significant the possibility will be for the economy to

recover. Furthermore, the government can choose and implement the appropriate policies owing to the experience in handling the pandemic from the previous months. In addition, the private sector can also take the proper steps in operating their business during such a turbulent time. Accordingly, the declining volatility can reflect abilities and skills in handling the pandemic. As the volatility goes lower than the period before, positive sentiment can be perceived by investors, so they want to invest in stocks again.

Based on the volatility measurement that has been done, the researchers conclude that the return volatility of IHSG and STI experiences a decline during the implementation of mobility restrictions. The finding is supported by the research conducted in Vietnam's stock market by Anh and Gan (2021), showing a positive effect of the lockdown on the stock return. On the contrary, the finding clashes with the finding from Zaremba et al. (2020) that volatility increases due to the government's policies, such as information campaigns and public events cancellation.

The finding also shows that the policy regarding mobility restrictions, which the government implements, helps to decrease the volatility of stock returns. This case shows that the policy is a solution to indirectly fix the stock market performance, which is shocked by the COVID-19 pandemic. This finding also aligns with the study conducted by Phan and Narayan (2020) that the government's reaction towards a crisis is reflected in stock price. Early on, the government has an exaggerated reaction, but then the reaction is fixed once the government finds the right way to face a crisis. Therefore, the stock price will also be fixed.

Based on the average liquidity, there is a difference between the liquidity of stock indexes before and during the implementation. IHSG's illiquidity is higher during the implementation of PSBB I. Meanwhile, STI's illiquidity is higher during the implementation of Circuit Breaker. These stock indexes have better performance before the implementation of PSBB I and STI, respectively. The result is supported by research examining the stock market's liquidity during the COVID-19 pandemic. According to Baig et al. (2021), mobility restrictions cause the declining liquidity of the United States stock market.

High illiquidity experienced by both stock indexes during the implementation of mobility restrictions can be caused by many factors. First, the COVID-19 pandemic has caused an uncertain fluctuation in stock prices. It has caused many investors to switch to other investments with minimal risk. Stock can be categorized as an investment with high risk. The risk can be felt during times of crisis like the pandemic. Second, investment diversification is favored by investors. Investments like gold are seen as a haven because of their rising prices when the other investments' prices drop. According to Yousaf et al. (2021), gold is seen as a solid haven in Indonesia and Singapore during the COVID-19 pandemic. Other than gold, interest in cryptocurrencies like Bitcoin

rises significantly, specifically among the younger generation. Based on JP Morgan financial analyst team, millennials tend to invest in cryptocurrency like Bitcoin during the COVID-19 pandemic. Meanwhile, the older generation prefers gold (P., 2020). Third, the COVID-19 pandemic, which may have no end, causes many companies to suffer financially because of declining sales. In the end, many companies lay off workers or even stop their operations. When many people lose their jobs, their consumption rate also declines.

On the other hand, IHSG's liquidity made a recovery during the implementation of PSBB II. This result indicates that policy regarding the second mobility restrictions helps to recover the liquidity of the stock index, which has been severely hit before. The result is supported by the finding of the research conducted in 23 developed countries in America, Europe, and Asia by Haroon and Rizvi (2020) that liquidity recovers because of the implementation of mobility restrictions.

Other than the previous research mentioned, researchers such as Anh and Gan (2021) and Phan and Narayan (2020) also have similar sentiments in which mobility restrictions such as lockdowns positively affect the stock market performance. Therefore, the researchers see the positive reaction from the stock market towards the policy regarding mobility restrictions as an incentive to boost the recovery of the stock market's liquidity. Indonesia's economy has slowly recovered after the government loosened the mobility restriction. The policy implemented during PSBB II is less tight than the previous one enforced during PSBB I. Many business sectors can operate, although it is at a small capacity. One of them is shopping malls, which are allowed to open. As the condition gets better than before, investors' optimism also rises. Investors are slowly investing in stocks again. The stock index's value is also slowly rising, giving investors a positive signal to invest in stocks again.

CONCLUSIONS

The volatility of both IHSG and STI is higher before mobility restrictions are implemented in Indonesia and Singapore. Meanwhile, IHSG's illiquidity is higher during the implementation of PSBB I. IHSG's illiquidity is also higher before the implementation of PSBB II. The result shows that liquidity improvement happens during the implementation of PSBB II. Liquidity does not improve when the implementation of PSBB I, but the improvement in liquidity occurs during PSBB II. It may be because investors are still in shock during PSBB I, and they have not been able to adapt to the conditions of social restrictions at that time. Meanwhile, during PSBB II, investors have adapted to social restrictions and can take investment actions more calmly.

On the other hand, STI's illiquidity is higher during the implementation of Circuit Breaker in

Singapore. These results indicate that Circuit Breaker's implementation helps to improve the stock index's performance in Singapore because volatility decreases when the policy is implemented. In contrast, the high liquidity STI experienced during Circuit Breaker's implementation indicates that the policy reduces the liquidity of the Singapore stock index.

The research findings provide insights and implications for managers, investors, creditors, and policymakers. The stock market's performance can give a clear signal to the economy concerning the overall economic conditions of the national economy. Information relating to the volatility and liquidity of stock indices can be used as a reference for investors who are used to choosing stocks as a form of investment and prospective investors who are about to start investing. This information can be used as a consideration for investors to determine the type of investment to choose and the suitable period to buy or sell the investment. Academics can also use this information for future research references regarding stock performance in the COVID-19 era.

The limitation of the research is that it is only limited to the Indonesian and Singapore market stock indices during the social restriction era of COVID-19. The results can also be used as a reference for researchers to examine the performance of volatility and liquidity in more depth. Future researchers can use other methods to analyze volatility, such as Threshold Generalized Auto-regressive Conditional Heteroscedasticity (TARCH), Exponential Generalized Autoregressive Conditional Heteroscedasticity (EGARCH), and Exponentially Weighted Moving Average (EWMA). In addition to other methods, future researchers can study other forms of investment, such as bonds, gold, or cryptocurrencies in other countries. They can also use other periods during the COVID-19 pandemic to determine investment performance in other periods apart from those used in the research.

REFERENCES

- AL-Najjar, D. M. (2016). Modelling and estimation of volatility using ARCH/GARCH models in Jordan's Stock Market. *Asian Journal of Finance & Accounting*, 8(1), 152–167. <https://doi.org/10.5296/ajfa.v8i1.9129>
- Alaoui Mdaghri, A., Raghbi, A., Thanh, C. N., & Oubdi, L. (2021). Stock market liquidity, the great lockdown and the COVID-19 global pandemic nexus in MENA countries. *Review of Behavioral Finance*, 13(1), 51–68. <https://doi.org/10.1108/RBF-06-2020-0132>
- Albulescu, C. T. (2020). COVID-19 and the United States financial markets' volatility. *Finance Research Letters*, 38(January), 1–5. <https://doi.org/10.1016/j.frl.2020.101699>
- Anh, D. L. T., & Gan, C. (2021). The impact of the COVID-19 lockdown on stock market performance: Evidence from Vietnam. *Journal of Economic Studies*, 48(4), 836–851. <https://doi.org/10.1108/JES-06-2020-0312>

- Baek, S., Mohanty, S. K., & Glambosky, M. (2020). COVID-19 and stock market volatility: An industry level analysis. *Finance Research Letters*, 37(November), 1–10. <https://doi.org/10.1016/j.frl.2020.101748>
- Bai, L., Wei, Y., Wei, G., Li, X., & Zhang, S. (2020). Infectious disease pandemic and permanent volatility of international stock markets: A long-term perspective. *Finance Research Letters*, 40(May), 1–10. <https://doi.org/10.1016/j.frl.2020.101709>
- Baig, A. S., Butt, H. A., Haroon, O., & Rizvi, S. A. R. (2021). Deaths, panic, lockdowns and US equity markets: The case of COVID-19 pandemic. *Finance Research Letters*, 38(January), 1–9. <https://doi.org/10.1016/j.frl.2020.101701>
- Bawdekar, A. A., & Prusty, B. R. (2022). Selection of stationarity tests for time series forecasting using reliability analysis. *Mathematical Problems in Engineering*, 2022, 1–8. <https://doi.org/10.1155/2022/5687518>
- Burhani, F. J., Fariyanti, A., & Jahroh, S. (2013). Analisis volatilitas harga daging sapi potong dan daging ayam broiler di Indonesia. *Forum Agribisnis : Agribusiness Forum*, 3(2), 129–146.
- Castro, M. M. S., Calisto, E. O., & Cabello-Rosales, A. (2021). US equity market volatility index components, impact on the industrial production index and post COVID-19 forecasting: Relevance to Mexico. *Contaduría y Administración*, 65(5), 1–26.
- Chaudhary, R., Bakhshi, P., & Gupta, H. (2020). Volatility in international stock markets: An empirical study during COVID-19. *Journal of Risk and Financial Management*, 13(9), 1–17. <https://doi.org/10.3390/jrfm13090208>
- Ekananda, M. (2018). *Analisis ekonometrika untuk keuangan: Untuk penelitian bisnis dan keuangan* (1st ed.). Salemba Empat.
- Fadilah, R., Askandar, N. S., & Malikhah, A. (2018). Penghitungan Value at Risk (VAR) portofolio optimum saham perusahaan berbasis syariah dengan pendekatan Exponentially Weighted Moving Average (EWMA) (Studi kasus pada perusahaan yang terdaftar di Jakarta Islamic Index periode Juni 2016–November 2017). *E-JRA*, 7, 90–103.
- Haroon, O., & Rizvi, S. A. R. (2020). Flatten the curve and stock market liquidity—An inquiry into emerging economies. *Emerging Markets Finance and Trade*, 56(10), 2151–2161. <https://doi.org/10.1080/1540496X.2020.1784716>
- Hartati, & Saluza, I. (2017). Aplikasi GARCH dalam mengatasi volatilitas pada data keuangan. *Jurnal Matematika*, 7(2), 107–118. <https://doi.org/10.24843/jmat.2017.v07.i02.p87>
- Kanal, F. A., Manurung, T., & Prang, J. D. (2018). Penerapan model GARCH (Generalized Autoregressive Conditional Heteroscedasticity) dalam menghitung nilai beta saham Indeks Pefindo25. *Jurnal Ilmiah Sains*, 18(2), 67–74. <https://doi.org/10.35799/jis.18.2.2018.19732>
- Karnadi, E. B. (2017). *Panduan Eviews sederhana untuk ekonometrika dasar*. Grasindo.
- Laily, V. O. N., Warsito, B., & Maruddani, D. A. I. (2018). Comparison of ARCH/GARCH model and Elman recurrent neural network on data return of closing price stock. *Journal of Physics: Conference Series*, 1025, 1–11. <https://doi.org/10.1088/1742-6596/1025/1/012103>
- Liu, H., Manzoor, A., Wang, C., Zhang, L., & Manzoor, Z. (2020). The COVID-19 outbreak and affected countries stock markets response. *International Journal of Environmental Research and Public Health*, 17(8), 1–19. <https://doi.org/10.3390/ijerph17082800>
- Ma, L., Hu, C., Lin, R., & Han, Y. (2018). ARIMA model forecast based on EViews software. In *IOP Conference Series: Earth and Environmental Science* (Vol. 208, No. 1). IOP Publishing. <https://doi.org/10.1088/1755-1315/208/1/012017>
- Mashabi, S. (2020). *Daftar 18 daerah yang diterapkan PSBB, dari Jakarta hingga Makassar*. Retrieved October 20th, 2020, from <https://nasional.kompas.com/read/2020/04/20/05534481/daftar-18daerah-yang-terapkan-psbb-dari-jakarta-hingga-makassar?page=all>
- Ministry of Health Singapore. (2020a). *Confirmed imported case of novel coronavirus infection in Singapore; Multi-ministry taskforce ramps up precautionary measures*. Retrieved November 10th, 2020, from <https://www.moh.gov.sg/news-highlights/details/confirmed-imported-case-of-novel-coronavirus-infection-in-singapore-multi-ministry-taskforce-ramps-up-precautionary-measures%0A>
- Ministry of Health Singapore. (2020b). *COVID-19 (temporary measures) act 2020*. Retrieved from <https://sso.agc.gov.sg/SL-Supp/S254-2020/Published>
- Nguyen, N. H., Vu, N. T., Tran, Q., Tran, T., & Vo, D. H. (2022). Market performance and volatility during the COVID-19 pandemic in Vietnam: A sector-based analysis. *Cogent Business & Management*, 9(1), 1–12. <https://doi.org/10.1080/23311975.2022.2119681>
- Nurdina, Sidharta, R. Y., & Mochklas, M. (2021). Inefficient markets, anomalies, and investor behavior: A literature review. *International Journal of Economics, Business and Accounting Research (IJEBAR)*, 5(2), 354–374.
- P., H. (2020). *JP Morgan: Bitcoin dicari milenial, emas pilihan orang tua*. Retrieved July 7th, 2021, from <https://www.cnbcindonesia.com/tech/20200807165000-37-178297/jp-morgan-bitcoin-dicari-milenial-emas-pilihan-orang-tua>
- Phan, D. H. B., & Narayan, P. K. (2020). Country responses and the reaction of the stock market to COVID-19—A preliminary exposition. *Emerging Markets Finance and Trade*, 56(10), 2138–2150. <https://doi.org/10.1080/1540496X.2020.1784719>
- Raneo, A. P., & Muthia, F. (2018). Penerapan model GARCH dalam peramalan volatilitas di Bursa Efek Indonesia. *Jurnal Manajemen dan Bisnis Sriwijaya*, 16(3), 194–202. <https://doi.org/10.29259/jmbs.v16i3.7462>

- Riyanto, S., & Hatmawan, A. A. (2020). *Metode riset penelitian kuantitatif penelitian dibidang manajemen, teknik, pendidikan dan eksperimen*. Depublish.
- Sekaran, U., & Bougie, R. (2017). *Metode penelitian untuk bisnis: Pendekatan pengembangan-keahlian* (6th ed.). Salemba Empat.
- Silvia, V. (2020). *Statistik deskriptif*. Penerbit Andi.
- Sutrisno, B. (2020). The determinants of stock price volatility in Indonesia. *EAJ (Economics and Accounting Journal)*, 3(1), 73–79. <https://doi.org/10.32493/eaj.v3i1.y2020.p73-79>
- Thangamuthu, M., Maheshwari, S., & Naik, D. R. (2022). Volatility spillover effects during pre-and-post COVID-19 outbreak on Indian market from the USA, China, Japan, Germany, and Australia. *Journal of Risk and Financial Management*, 15(19), 1–15. <https://doi.org/10.3390/jrfm15090378>
- Wulandari, H. D., Mustafid, & Yasin, H. (2018). Penerapan metode Exponentially Weighted Moving Average (EWMA) dalam pengukuran risiko investasi saham portofolio untuk volatilitas heterogen. *Jurnal Gaussian*, 7(3), 248–259. <https://doi.org/10.14710/j.gauss.v7i3.26658>
- Yolanda, N. B., Nainggolan, N., & Komalig, H. A. H. (2017). Penerapan model ARIMA-GARCH untuk memprediksi harga saham Bank BRI. *Jurnal MIPA UNSRAT Online*, 6(2), 92–96. <https://doi.org/10.35799/jm.6.2.2017.17817>
- Yousaf, I., Bouri, E., Ali, S., & Azoury, N. (2021). Gold against Asian Stock Markets during the COVID-19 outbreak. *Journal of Risk and Financial Management*, 14(4), 1–23. <https://doi.org/10.3390/jrfm14040186>
- Zaremba, A., Kizys, R., Aharon, D. Y., & Demir, E. (2020). Infected markets: Novel coronavirus, government interventions, and stock return volatility around the globe. *Finance Research Letters*, 35(July), 1–7. <https://doi.org/10.1016/j.frl.2020.101597>
- Zhang, D., Hu, M., & Ji, Q. (2020). Financial markets under the global pandemic of COVID-19. *Finance Research Letters*, 36(October), 1–6. <https://doi.org/10.1016/j.frl.2020.101528>