CHAPTER 4

RESULTS AND ANALYSIS

This chapter will describe the results of the analysis that was conducted from the data, research, and discussion of the topic, in order to achieve the goals of this research.

4.1 Descriptive Statistics

Descriptive statistics are used to describe the features of the data in quantitative terms. The purpose is to summarize the data set using statistical measures.

Table 3 : Descriptive statistic

	COMPOSITE(IDX)	S&P500	SSEC	STI
Mean	0.000256	0.000494	0.000107	-6.29E-05
Median	0.000442	0.000692	0.000551	5.23E-05
Maximum	0.101907	0.09383	0.057635	0.060718
Minimum	-0.0888	-0.11984	-0.08491	-0.07353
Std. Dev.	0.010615	0.011048	0.013371	0.008544
Skewness	-0.39375	-0.72539	-0.82048	-0.48965
Kurtosis	12.10295	20.09257	8.809273	11.06388
Jarque-Bera	8031.843	28310.33	3505.868	6348.321
Probability	0	0	0	0
Sum	0.590074	1.141369	0.247964	-0.14515
Sum Sq. Dev.	0.260072	0.281726	0.412616	0.168501
Observations	2309	2309	2309	2309

Source : Results Analysis

Table 3 is a Descriptive Statistics of the daily closing price index and return of the stock markets of the US S&P500, China SSEC, Singapore STI, and Indonesia COMPOSITE (IDX), and is the Descriptive Statistics of stock indices of each country's stock market during the entire sample period. First of all, the average over the entire sample period showed that the daily indices in four countries, Indonesia, Singapore, the United States, and China, all had positive values.

The STI share price index average is 3114.406, the S&P500 share price index average is 2054.594, the SSEC share price index average is 2799.434 and the COMPOSITE(IDX) share price index average is 4963.788.

During the entire sampling period, Indonesia and Singapore show a positive skewness distribution, while the rest of the U.S. and China show a negative skewness distribution. In all four countries, kurtosis is less than four, showing a milder sharp distribution than regular distribution.

The Jarque-Bera statistic, which shows the results of the normality test of the distribution, confirmed that all four variables do not follow the normal distribution because it rejects the null hypothesis that each country's revenue follows the normal distribution at a significant level of 1% for the entire sample period.

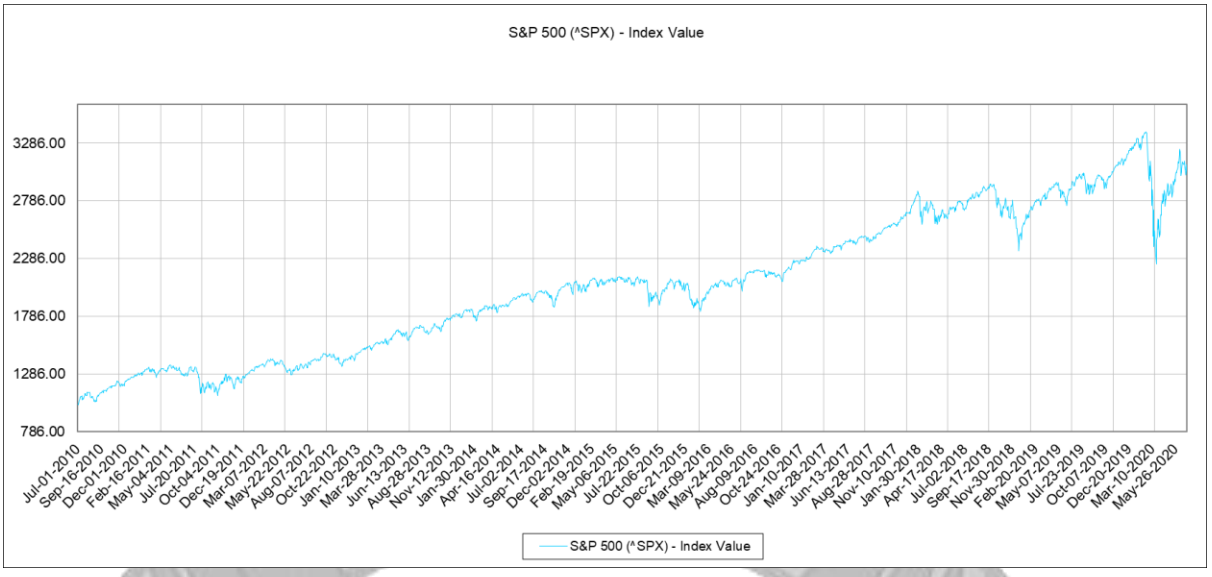


Figure 1: S&P 500 stock index of the United States

Figure2 : SSEC stock index of the China

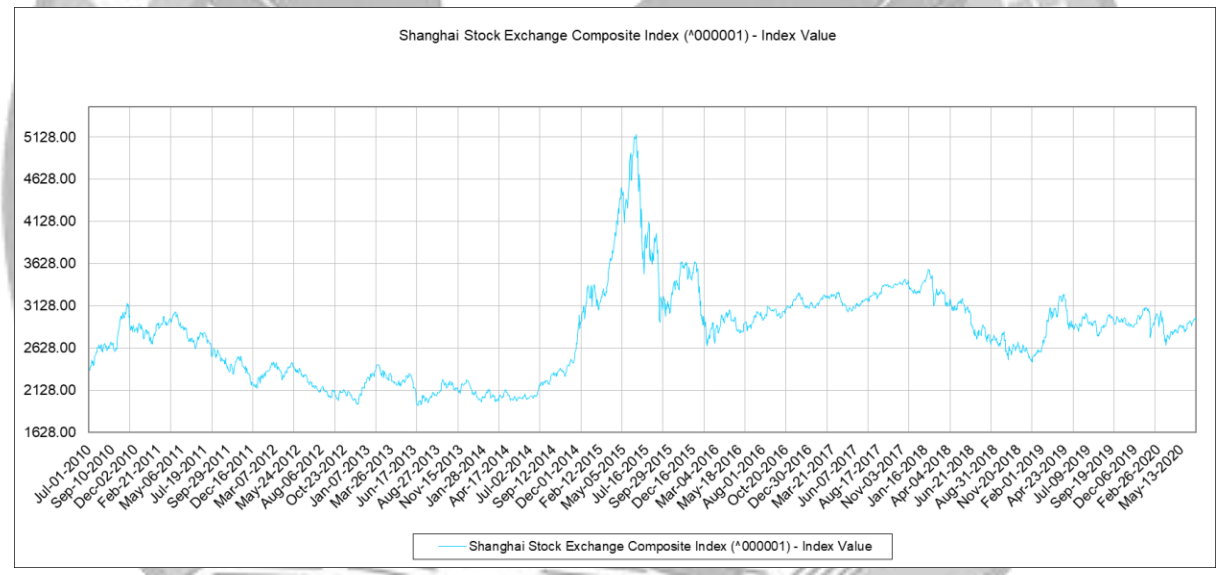


Figure 2 : SSEC stock index of the China

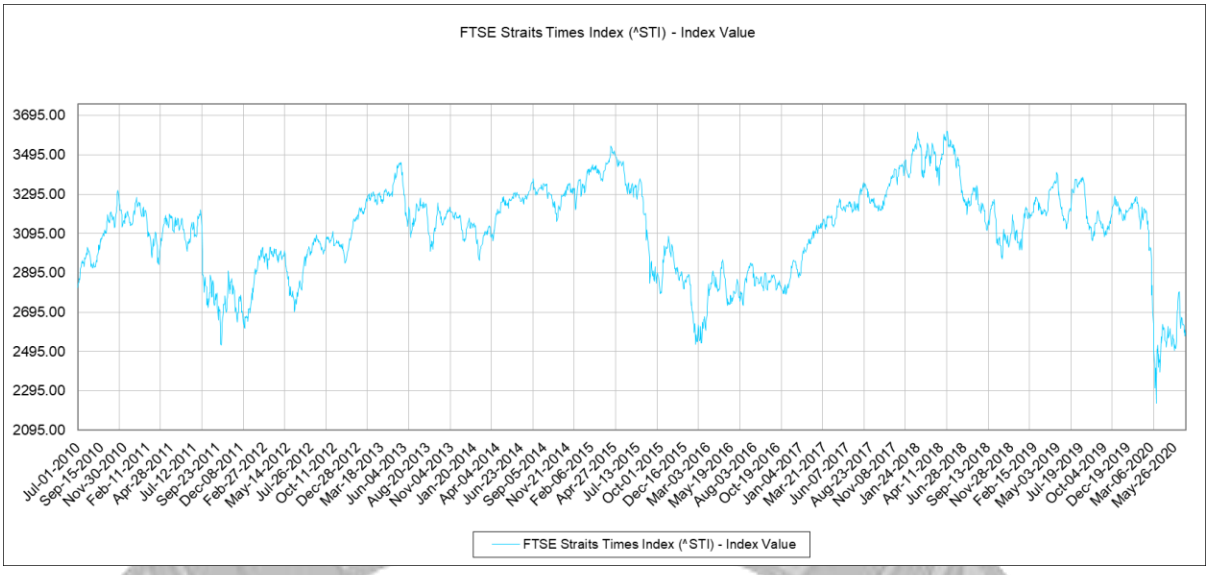


Figure 3 : STI stock index of the Singapore

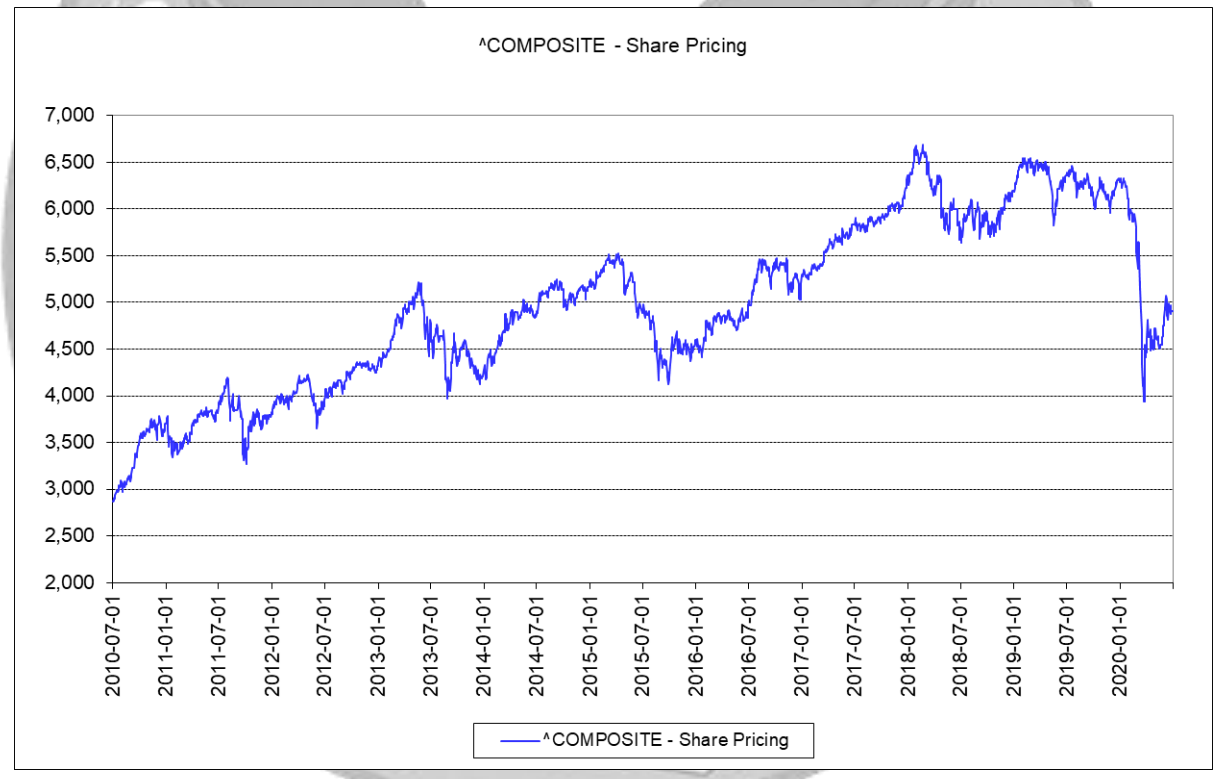


Figure 4 : COMPOSITE(IDX) stock index of the Indonesia

Figure 1 ~ 4 shows the trend of stock price indices in Indonesia, Singapore, the United States and China. As the figure shows, the Indonesia and U.S. stock market indices have been

steadily rising, but have recently plummeted due to the Corona virus, and Singapore has seen rapid sharp volatility, with the rest of China showing a sharp downturn between December 2014 and March 2016, particularly in March 2015.

Figure 5 : compare S&P 500, SSEC, STI, COMPOSITE(IDX)

Figure 5 shows S&P500, SSEC, COMPOSITE (IDX) and STI stock index trends. First of all, S&P500 and COMPOSITE (IDX) tend to increase slowly from July 2010 to March 2020. In the case of SSEC, unlike the two countries, it soared from July 2014 to August 2015 and has since fallen sharply. In the case of STI, the variability is high, but in conclusion neither increases nor decreases. And in recent years, the Corona virus has caused most stock indexes to fall sharply.

4.2 Unit Root Test

Because time series data are not always stationary, a unit root test was performed to confirm stationary. Data used in is log (level) index price. This is because if time series data are non-stationary, false results can be obtained through fictitious regression. The Augmented

Dickley-Fuller (ADF) test method was used to determine whether the time series variables were stationary. Each data goes through a unit root test and the results are as follows the Table4.

During the whole sampling period, the theory that stock prices in the four countries of the United States, China, Singapore and Indonesia "have unit roots" was rejected at a significant level of 1% in all 1st difference, indicating that time series data were stationary.

Table4 is a unit root test analyzed to confirm the stationary of the analysis data. A total of 10,074 daily stock prices were used for the entire period data from July 1, 2010 to June 30, 2020.

Table 4 : Unit root tests

Variables	Level prob.	1st prob	ADF level	ADF 1st diff
Log(S&P)	0.0635	0.0000	-1.252537	-18.87149
Log(SSEC)	0.2223	0.0000	-2.157525	-32.29564
Log(STI)	0.0858	0.0000	-2.635967	-31.90375
Log(COMPOSITE(IDX))	0.0637	0.0000	-2.763678	-27.84479

The result this test is, The unit root tests show that the data are not stationary in the level tests. Otherwise Level tests fail to reject the null hypothesis (H0) that a time series showed non-stationary because all p-value values are greater than the significance levels at 1%, 5%, and 10%. Therefore, the Log(S&P500), Log(SSEC), Log(STI), and Log(COMPOSITE (IDX)) markets are time series with unit root. Log(S&P500), Log(SSEC), Log(STI), and Log(COMPOSITE (IDX)) are non-stationary time series. Therefore, we conducted a 1st differential test. The result was that the significant probability value (p-value) was less than the 1%, 5 and 10% significance levels, thus rejecting the null hypothesis (H0) that the time series is stationary. Therefore, the Log(S&P500), Log(SSEC), Log(STI), and

Log(COMPOSITE (IDX)) series are time series with no unit root. It means, Log(S&P500), Log(SSEC), Log(STI), and Log(COMPOSITE (IDX)) are stationary time series.

4.3 Correlation

Table 5 : Correlation

	STI_LOG	SSEC_LOG	COMPOSITE_LOG	S_P500LOG
STI_LOG	1	0.178541582	0.4723492	0.268204325
SSEC_LOG	0.178541582	1	0.390214612	0.462920806
COMPOSITE_LOG	0.4723492	0.390214612	1	0.915594667
S_P500LOG	0.268204325	0.462920806	0.915594667	1

The correlation test for each variable used found no variable with a correlation coefficient of 0.7 or higher, indicating that there was no strong relationship between the variables.

4.4 Cointegration

Table 6 : Cointegration

No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.008816	34.32071	47.85613	0.4844
At most 1	0.004889	16.47789	29.79707	0.6783
At most 2	0.003021	6.602454	15.49471	0.6243
At most 3	0.000251	0.505502	3.841466	0.4771
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical Value**	**Prob.****
None	0.008816	17.84282	27.58434	0.5082
At most 1	0.004889	9.875436	21.13162	0.7563
At most 2	0.003021	6.096953	14.2646	0.6008
At most 3	0.000251	0.505502	3.841466	0.4771

Johansen test check the cointegration at this time series. It means this time series don't have cointegration. First, At the trace statistic value is less than 0.05 critical value. As the result Trace test can't indicates cointegrating equations at the 0.05 level. Second, At the Max-eigenvalue statistic is less than 0.05 critical value. As the result Max-eigenvalue test can't indicates cointegrating equations at the 0.05 level. Third, At Normalized cointegrating coefficients An estimate of the co-integral vector is presented at none until at most3. However, over here 0 cointegration relationships are reported. As the result Trace test and Max-eigenvalue test can't indicates cointegrating equations at the 0.05 level. So this test show this time series have 0 cointegration.

In summary, this cointegration test revealed that this time series has no long-term relationship. Therefore, we will find the appropriate lag in the lag length criteria and do a VAR test.

4.5 Lag Length Criteria Test

Lag Length Criteria Test was performed to find the appropriate time difference.

Table 7: Lag Length Criteria Test

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-41122.97	NA	3.70E+20	58.71087	58.72585	58.71647
1	-27522.09	27104.66	1.40E+12	39.31776	39.39264	39.34575
2	-27283.76	473.6049	1.02E+12	39.00037	**39.13515***	39.05075
3	-27241.04	84.63877	9.80E+11	38.96223	39.15691	**39.03500***
4	-27221.07	39.45679	9.74E+11	38.95657	39.21114	39.05173
5	-27199	43.48943	9.66E+11	38.94789	39.26236	39.06544
6	-27173.54	50.01781	9.53E+11	38.93438	39.30875	39.07433
7	-27156.95	32.48859	9.52E+11	38.93354	39.36781	39.09588
8	-27103.26	104.8374	9.02E+11	38.87975	39.37392	39.06447
9	-27086.7	32.2598	9.02E+11	38.87894	39.43301	39.08606
10	-27048.52	**74.11247***	**8.74e+11***	**38.84729***	39.46125	39.07679

* indicates lag order selected by the criterion

Source : Analysis Lag Length Criteria Test

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

In general, it is known that the AIC information standard tends to over-identify the number of parameters than the SC information standard, so the appropriate time difference is determined according to the SC information standard. If the parallax is determined too wide, the series correlation of the error term can be reduced, but there is a trade-off with less efficiency. Therefore, in this case, it is seen that the appropriate time difference has the minimum value when it is lag 2 according to the SC information standard.

4.6 VAR Test

In this study, the VAR test was performed at 1diff.

Table 8 : VAR test

	COMPOSITE_LOG
STI_LOG(-1)	-0.077112
	-0.03228
	[-2.38872]*
STI_LOG(-2)	0.077912
	-0.03231
	[2.41104]**
SSEC_LOG(-1)	-0.025681
	-0.01769
	[-1.45135]
SSEC_LOG(-2)	0.023818
	-0.01767
	[1.34759]
S_P500LOG(-1)	0.313781
	-0.02095
	[14.9751]*
S_P500LOG(-2)	-0.308611
	-0.021
	[-14.6944]*
COMPOSITE_LOG(-1)	1.036915
	-0.02399
	[43.2266]*
COMPOSITE_LOG(-2)	-0.046352
	-0.02398

	[-1.93307]* **
C	0.02146
	-0.01071
	[2.00318] **

*:1% null hypothesis

**: 5% null hypothesis

***:10% null hypothesis

The VAR model was applied to each country's stock market. At this time, the first order term was found to be appropriate as a result of using the information standard of Akaike (1974) for the order of X as the parallax variable. This paper uses t-statistics to differentiate significant level. When t-statistic bigger than 1.65, 1.96, 2.58(significant level 10%,5%,1%), it means null hypothesis reject.

Over here some countries have significant level. At the 1% levels are STI_LOG(-1), S_P500LOG(-1), S_P500LOG(-2), COMPOSITE_LOG(-1). These result are showed [-2.38872]*, [14.9751]*, [-14.6944]*, [43.2266]*. And at 10% significant level COMPOSITE_LOG(-2) show the [-1.93307]***.

And first check the STI (Singapore) the coefficient result showed STI_LOG(-1) is coefficient is -0.077112. Its result show negative. But the coefficient result of STI_LOG(-2) is 0.077912. So this result is positive. Second S&P (USA)'s result show S_P500LOG(-1) is 0.313781. The result is positive. But S_P500LOG(-2)'s coefficient value is -0.308611. it result meaning is negative. The last result is COMPOSITE_LOG(-1)'s coefficient value is 1.036915. it show the result is positive. But COMPOSITE_LOG(-2)'s value is -0.046352. so It is negative. So, the results meaning are contradict.

So VAR tests have found that several past variable values t-1 are related to the current variable t. A t-statistic value of 1.96 or higher indicates significant results at the 1%, 5%, and 10% levels.

4.8 Granger Causality Test

The Granger causality test is analyzed to analyze whether the stock indexes of each country help predict each other's price findings. And the result is as follows.

Table 9 : COMPOSITE Granger Causality Test

Dependent variable: COMPOSITE_LOG			
Excluded	Chi-sq	df	Prob.
STI_LOG	5.815252	2	0.0546**
SSEC_LOG	3.720236	2	0.1557***
S_P500LOG	228.0627	2	**0**
All	232.0484	6	0

*:1% null hypothesis
**: 5% null hypothesis
***:10% null hypothesis

As a result, the Granger Causality Test in the four countries of the United States, China, Singapore and Indonesia. The null hypothesis was reviewed at 1%, 5% and 10% on the null hypothesis.

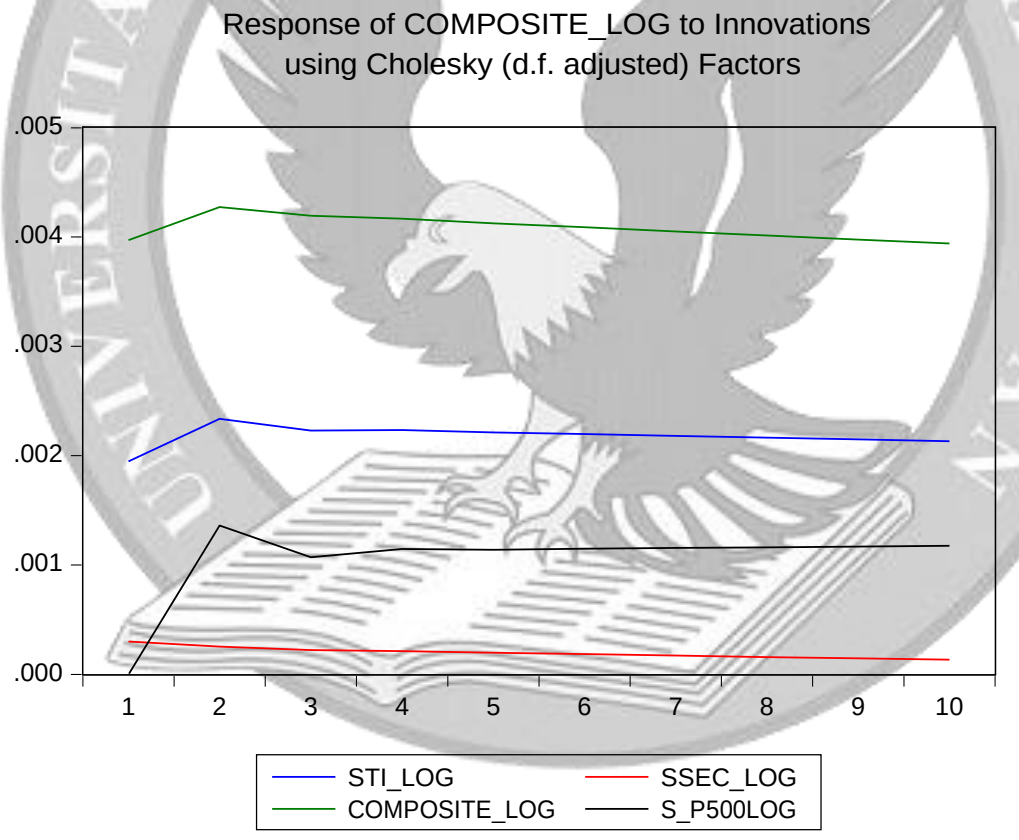
This paper take a test at COMPOSITE. COMPOSITE (Indonesia) stock market in three different countries (US, China, Singapore) and Granger has a causal relationship. As a result, at Singapore have causal relation at 5% null hypothesis. And China have causal relation at 10% null hypothesis. In other words, the Indonesian stock market has a Granger causal

relationship with Singapore and China. So to summarize, for short term association COMPOSITE can be a good candidate for a dependent variable.

4.9 Impulse Response Function

An analysis of the impulse response, which shows how different markets react in the event of an unexpected shock, was conducted using each country's stock market. The analysis results are as follows. This experiment was conducted to determine how much impact on Indonesia's stock market would affect the stock markets of other three countries (US, China, Singapore).

Figure 6 : Results of impulse response function on COMPOSITE stock index



In Figure 6, the results show that is if Indonesia has its own shock, in the case of the United States, if there is a positive response of about 0.001 from period 1 to 2, it remains almost

constant until period 10 after that. Next, looking at Singapore, if Indonesia has its own shock, in Singapore, if there is a positive response of about 0.002 from period 1 to 2, it will remain almost constant until period 10 after that. Thirdly, looking at China, if Indonesia has its own shock, in the case of China, if there is a very small positive response from period 1 to 2, it will remain almost constant until period 10 after that. Lastly, looking at Indonesia, if there is a shock in Indonesia, in the case of Indonesia, if there is a positive response of 0.004 or more from period 1 to 2, it will remain almost constant until period 10 after that.

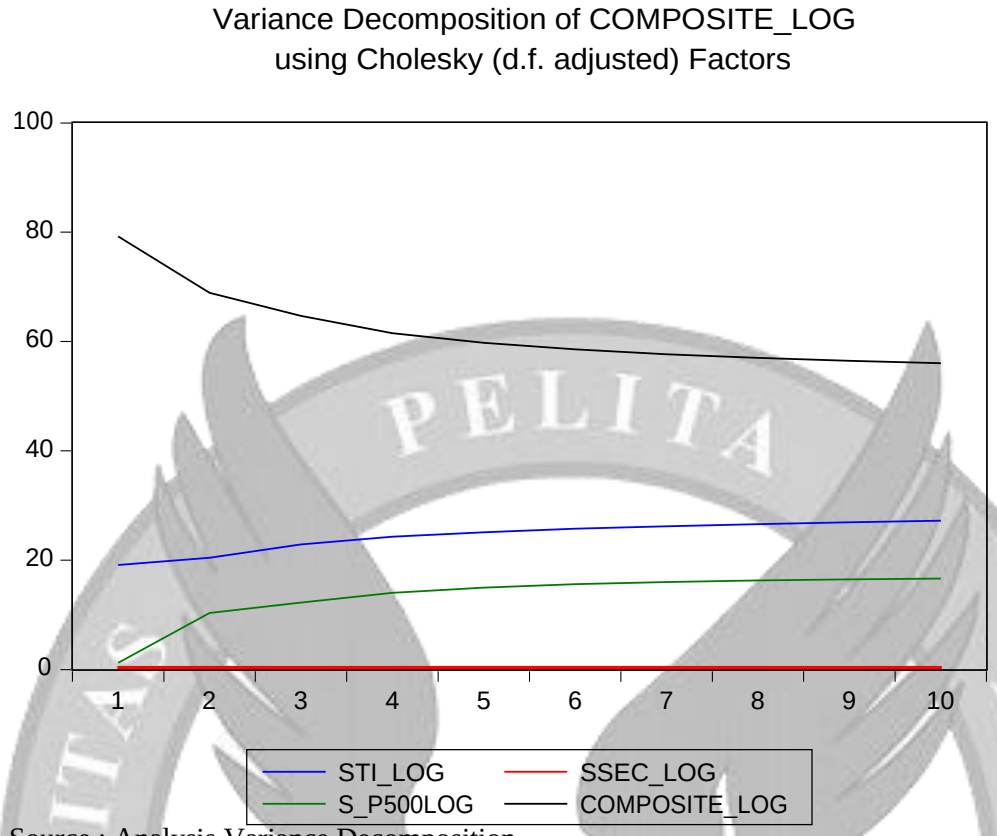
To summarize the result, the impulse response function's result is SSEC is not related to composite. and you see S&P is positively associated. And STI also has weak positively association. So this test is contradict.

4.10 Variance Decomposition

An analysis by variance decomposition was conducted to identify the direction of the necessary information flow and to analyze the relative explanatory power of each country's stock return on the prediction residuals of the stock return of the countries to be analyzed. The results of the analysis are as follows.

First, the analysis results for the entire sample period were divided into lags of 1 to 10 days and presented as the following. In terms of time lag, it can be seen that no country's stock index can explain its own shock to 100% and is affected by information from other countries' stock markets.

Figure 7 : VAR Variance Decomposition of COMPOSITE



Source : Analysis Variance Decomposition

As can be seen in Table 13, First the COMPOSITE index at other countries. first explained itself 73.4152% percent by period 10. Looking at the other countries, Singapore is affecting the highest 20.96029%. The next is U.S.A is affecting 5.442771%, and then China 0.181734 is having little impact.

Summarizing the results above, SSEC is no related with COMPOSITE, while S&P500 and STI have negative association with COMPOSITE. It show the negative associate when period go to 10. when there was an unexpected self-shock in Indonesia. The result is Singapore and USA is negative associate with Indonesia, and China is almost no response. So this test result is contradict.

4.11 Empirical Result and Interpretation

Since the results of impulse response function and variance decomposition‟s result are contradictive, there is not enough evidence to support the null hypothesis that is there is a volatility spillover among USA, China, and Singapore to Indonesia stock market. The study concludes that there are no information spillovers between the index markets of the observed countries.

Based on the results of the empirical interpretation, investors can conclude that they cannot rely on other index markets to account for COMPOSITE in the short term. Sometimes the U.S. index is related, while the other two countries, China and Singapore cannot be guessed. However, it is also impossible to predict whether the US is positive or negative. There are other proxies that can better explain COMPOSITE, such as the coronavirus, the Sino-American trade war, and the regime change in each country. There are other proxies that can explain the IHSG better like gross domestic product (GDP), import values, export values, foreign exchange rate, etc. Investors should focus more on these factors if they want to understand the IHSG better. (Oktavia & Handayani, 2018).