

# **Time Series Analysis of the FTSE Bursa Malaysia Top 100 Index Revolving the COVID-19 Pandemic**

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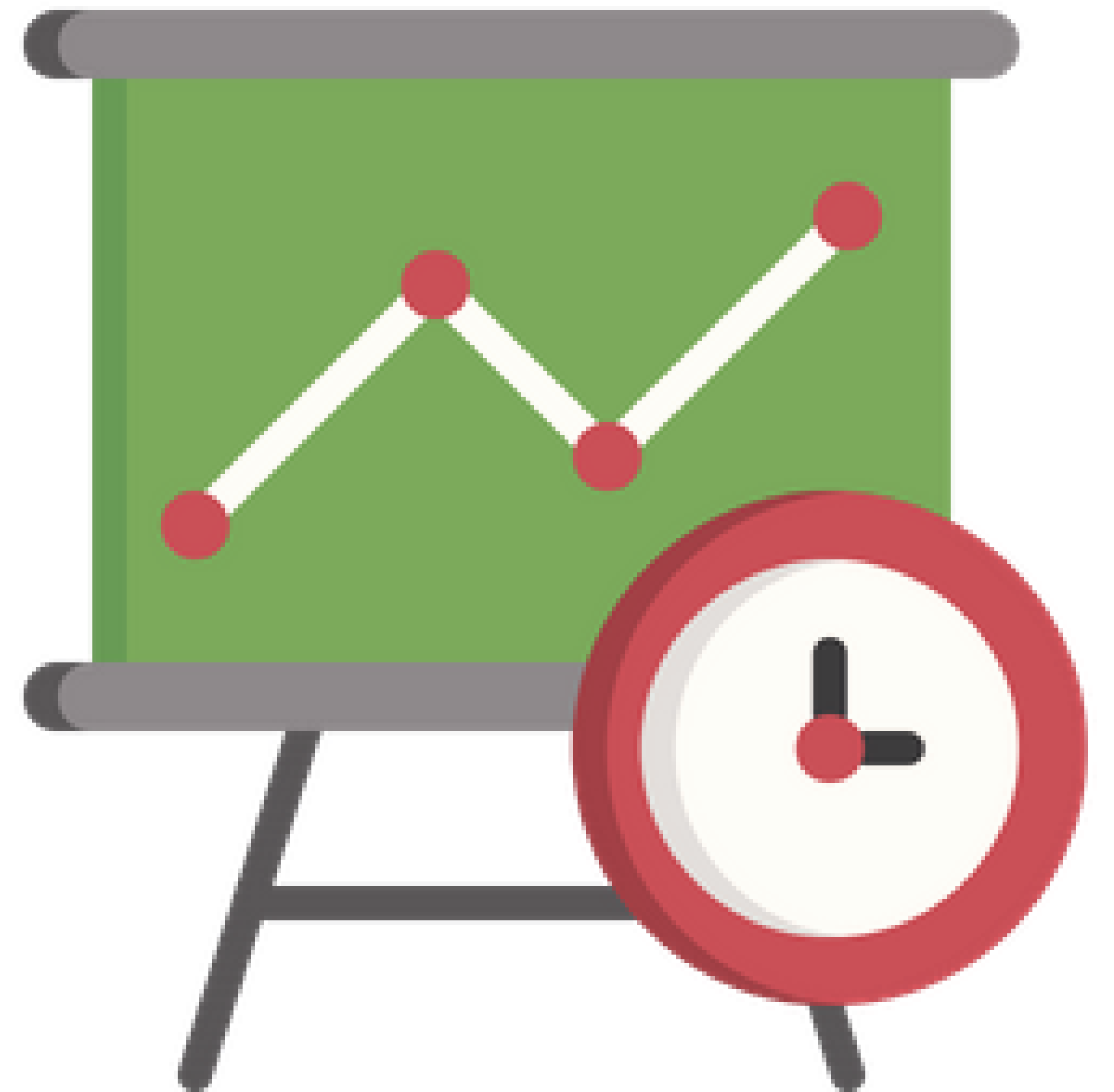
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# Introduction

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## CORONAVIRUS DISEASE 2019 (COVID-19)

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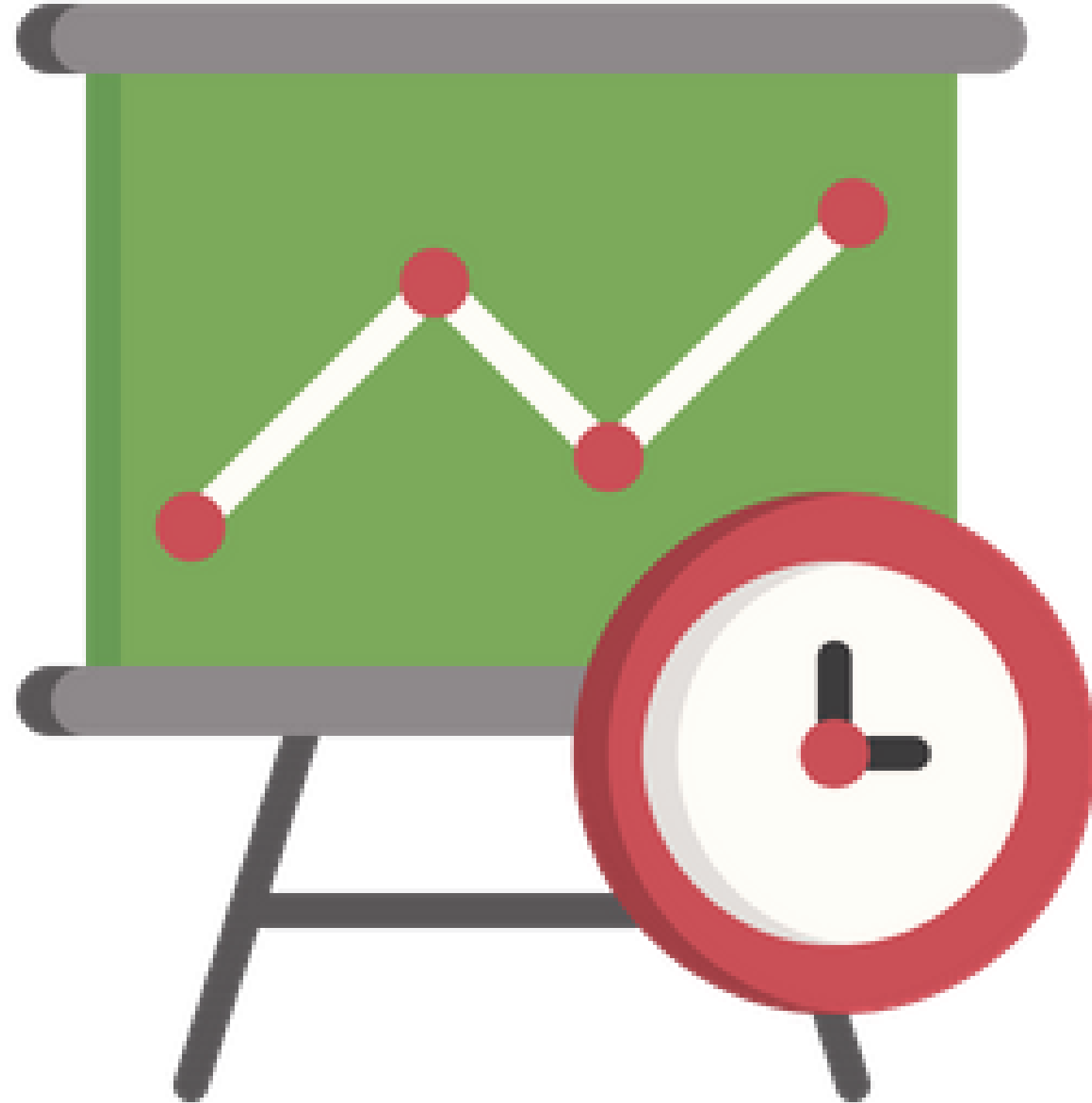
The Coronavirus Disease 2019 (**COVID-19**) has caused **sudden shocks** to stock markets globally and Malaysia is not excluded from these **negative effects**. According to the World Health Organization, there have been 5,031,826 confirmed cases of COVID-19 with 36,905 deaths in Malaysia as of 13 January 2023.

## BURSA MALAYSIA STOCK MARKET

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In the face of **black swan events** like the breakout of SARS, the 2008 Global Financial Crisis or the COVID-19 pandemic, **stock markets** can become extremely **volatile** with increased risk.





# Objectives

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1

To provide an overview of the Malaysian stock market during the pre, during and post-COVID-19 periods.

To compare and identify the better time series forecasting model between Autoregressive Integrated Moving Average (ARIMA) and Simple Moving Average (SMA).

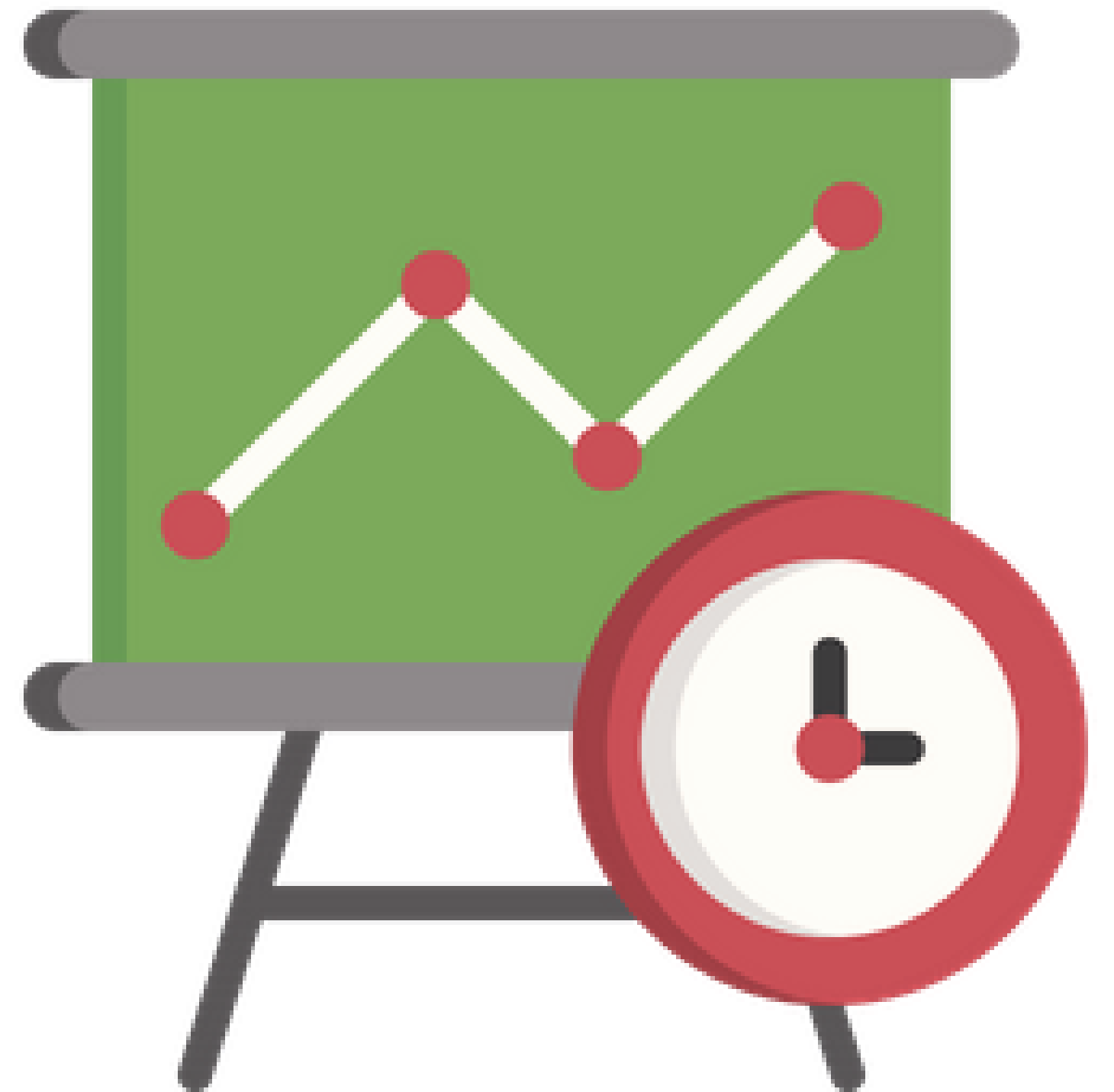
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3

To determine clusters for the stocks of the pre, during and post-COVID-19 periods.

# Data

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## Data Set

### Data Type

Daily closing prices for stocks in the FTSE Bursa Malaysia Top 100 Index

5 stocks are removed due to data inavailability

### Period of Study

1 September 2018 to 31 May 2022

Divided into three subperiods, namely the pre, during and post-COVID-19 periods

916 trading days altogether

### Data Source

Refinitiv Eikon Datastream

## 13 Sectors in the Bursa Malaysia Sectorial Index Series

| No. | Sector Name                          |
|-----|--------------------------------------|
| 1   | Construction                         |
| 2   | Consumer Products and Services       |
| 3   | Energy                               |
| 4   | Financial Services                   |
| 5   | Health Care                          |
| 6   | Industrial Products and Services     |
| 7   | Plantation                           |
| 8   | Property                             |
| 9   | Real Estate Investment Trusts (REIT) |
| 10  | Technology                           |
| 11  | Telecommunications and Media         |
| 12  | Transportation and Logistics         |
| 13  | Utilities                            |



|    | A   | B    | C                                     | D                                | E                              | F | G   |
|----|-----|------|---------------------------------------|----------------------------------|--------------------------------|---|---|
| 1  | NO. | RIC  | STOCK NAME                            | SECTOR                           | REMOVED STOCKS                 |   |   |
| 2  | 1   | AMMB | AMMB HOLDINGS BHD                     | Financial Services               |                                |   | REMOVED 5 STOCKS:<br>MRDI<br>CTOS<br>FARM<br>GREA<br>UWCB |
| 3  | 2   | AXIA | AXIATA GROUP BERHAD                   | Telecommunications & Media       |                                |   |   |
| 4  | 3   | CIMB | CIMB GROUP HOLDINGS BERHAD            | Financial Services               |                                |   |   |
| 5  | 4   | DIAL | DIALOG GROUP BHD                      | Energy                           |                                |   |   |
| 6  | 5   | DSOM | DIGI.COM BHD                          | Telecommunications & Media       |                                |   |   |
| 7  | 6   | GENT | GENTING BHD                           | Consumer Product & Services      |                                |   |   |
| 8  | 7   | GENM | GENTING MALAYSIA BERHAD               | Consumer Product & Services      |                                |   |   |
| 9  | 8   | HLBB | HONG LEONG BANK BHD                   | Financial Services               |                                |   | BALANCE 95 STOCKS   |
| 10 | 9   | HLCB | HONG LEONG FINANCIAL GROUP BHD        | Financial Services               |                                |   |   |
| 11 | 10  | IHHH | IHH HEALTHCARE BERHAD                 | Health Care                      |                                |   |   |
| 12 | 11  | INAR | INARI AMERTRON BERHAD                 | Technology                       |                                |   |   |
| 13 | 12  | IOIB | IOI CORPORATION BHD                   | Plantation                       |                                |   |   |
| 14 | 13  | KLKK | KUALA LUMPUR KEPONG BHD               | Plantation                       |                                |   |   |
| 15 | 14  | MBBM | MALAYAN BANKING BHD                   | Financial Services               |                                |   |   |
| 16 | 15  | MXSC | MAXIS BERHAD                          | Telecommunications & Media       |                                |   |   |
| 17 | 16  | MISC | MISC BHD                              | Transportation & Logistics       |                                |   |   |
| 18 | 17  | MRDI | MR D.I.Y. GROUP (M) BERHAD            | Consumer Product & Services      | Only listed on 26 October 2020 |   |   |
| 19 | 18  | NESM | NESTLE (M) BHD                        | Consumer Product & Services      |                                |   |   |
| 20 | 19  | PCGB | PETRONAS CHEMICALS GROUP BHD          | Industrial products and Services |                                |   |   |
| 21 | 20  | PETR | PETRONAS DAGANGAN BHD                 | Consumer Product & Services      |                                |   |   |
| 22 | 21  | PGAS | PETRONAS GAS BHD                      | Utilities                        |                                |   |   |
| 23 | 22  | PEPT | PPB GROUP BHD                         | Consumer Product & Services      |                                |   |   |
| 24 | 23  | PMET | PRESS METAL ALUMINIUM HOLDINGS BERHAD | Industrial products and Services |                                |   |   |
| 25 | 24  | PUBM | PUBLIC BANK BHD                       | Financial Services               |                                |   |   |
| 26 | 25  | QRES | QL RESOURCES BHD                      | Consumer Product & Services      |                                |   |   |
| 27 | 26  | RHBC | RHB BANK BERHAD                       | Financial Services               |                                |   |   |
| 28 | 27  | SIME | SIME DARBY BHD                        | Consumer Product & Services      |                                |   |   |
| 29 | 28  | SIPL | SIME DARBY PLANTATION BERHAD          | Plantation                       |                                |   |   |
| 30 | 29  | TLMM | TELEKOM MALAYSIA BHD                  | Telecommunications & Media       |                                |   |   |
| 31 | 30  | TENA | TENAGA NASIONAL BHD                   | Utilities                        |                                |   |   |
| 32 | 31  | AEOM | AEON CO. (M) BHD                      | Consumer Product & Services      |                                |   |   |
| 33 | 32  | AFIN | AFFIN BANK BERHAD                     | Financial Services               |                                |   |   |
| 34 | 33  | ALLI | ALLIANCE BANK MALAYSIA BERHAD         | Financial Services               |                                |   |   |
| 35 | 34  | ASTR | ASTRO MALAYSIA HOLDINGS BERHAD        | Telecommunications & Media       |                                |   |   |

AutoSave

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Time Series Data Set by Stock • Saved

Search (Alt+Q)

FileHomeInsertPage LayoutFormulasDataReviewViewAutomateHelpRefinitiv EikonRefinitiv Eikon Datastream

Get Data

From Text/CSV

From Web

From Table/Range

From Picture

Recent Sources

Existing Connections

Get & Transform Data

Refresh All

Queries & Connections

Properties

Edit Links

Queries & Connections

Stocks

Currencies

Data Types

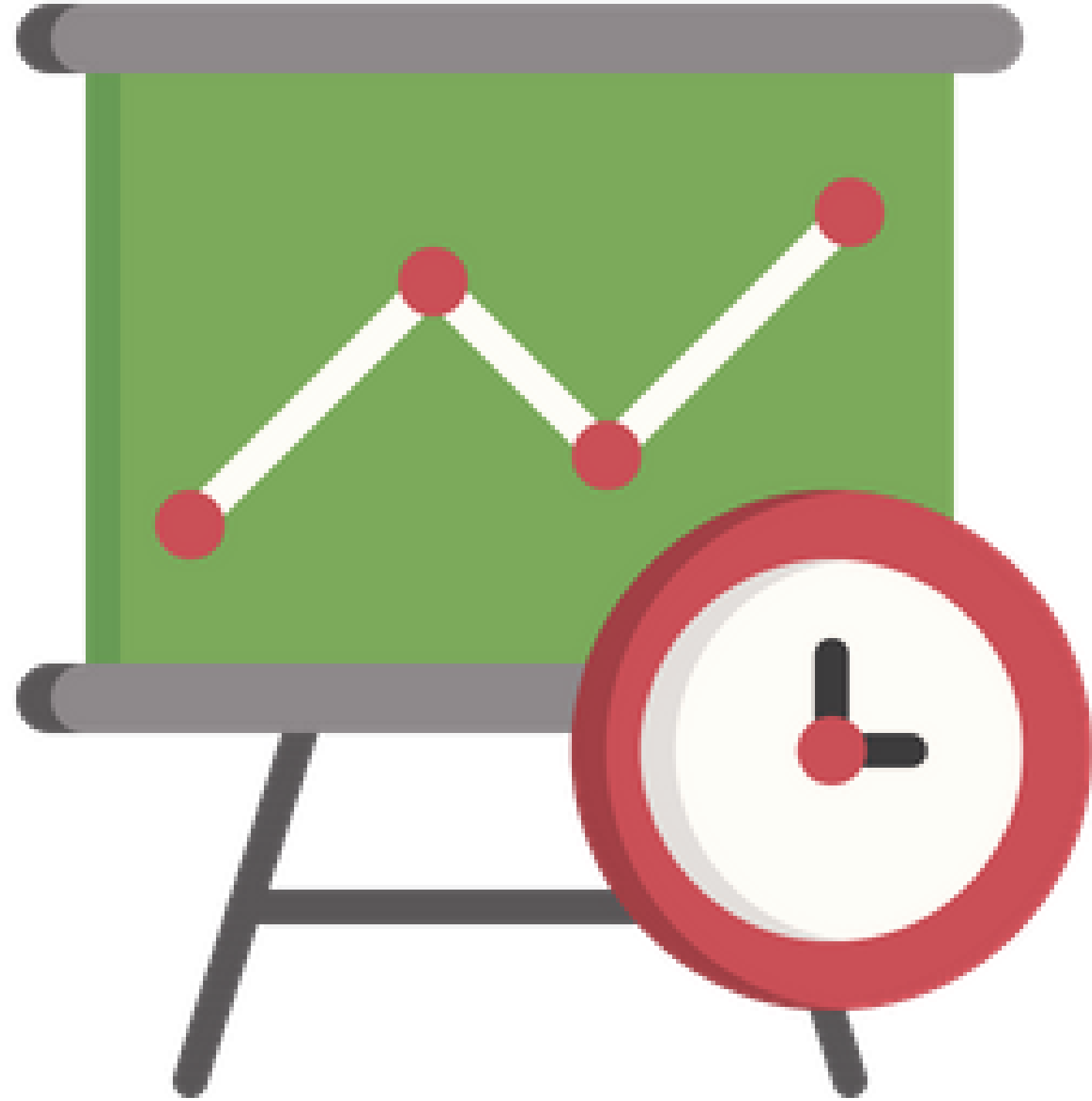
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# Results & Discussion

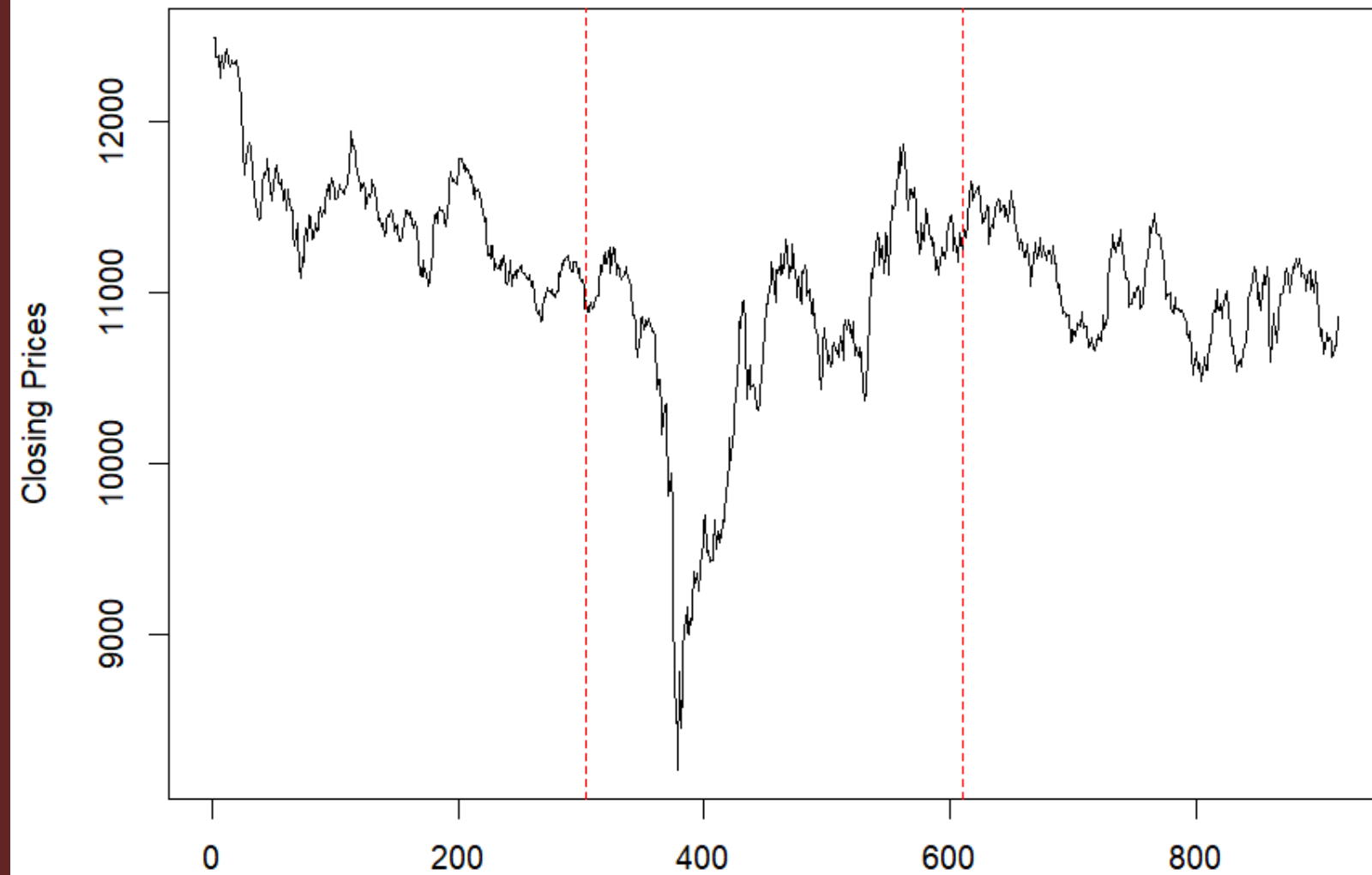
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# Objective 1

# Overview

Pre, During and Post-COVID-19  
Daily Closing Prices



- Overall decreasing trend for almost four years.
- Lowest point of RM 8214.63 on 19 March 2020.

# Descriptive Statistics

| Period          | Mean    | Median                    | Standard Deviation | Skewness | Kurtosis | Jarque-Bera p-value   |
|-----------------|---------|---------------------------|--------------------|----------|----------|---|
| Pre-COVID-19    | -0.0004 | -0.0003                   | 0.0054             | -0.2365  | 0.9903   | <p>p-value = 0.0004 &lt; 0.05</p> <p>Conclusion: Log returns do not follow normal distribution</p>  |
| During COVID-19 | 0.0001  | 0.0005                    | 0.0116             | -0.4358  | 6.9670   | <p>p-value = 2.2e-16 &lt; 0.05</p> <p>Conclusion: Log returns do not follow normal distribution</p> |
| Post-COVID-19   | -0.0001 | 7.2192 x 10 <sup>-5</sup> | 0.0064             | -0.2410  | 0.4891   | <p>p-value = 0.0421 &lt; 0.05</p> <p>Conclusion: Log returns do not follow normal distribution</p>  |

During COVID-19 period standard deviation = 0.0116 (double other periods)

Distribution is more left skewed during COVID-19

→ The probability for stock returns to be below the mean is actually higher than the probability of being above the mean.

- Pre and post periods have slightly positive excess kurtosis
- During period kurtosis = 6.967

→ Heavier tail where returns show a leptokurtic behaviour, meaning that there tends to be more outliers.

During period JB p-value = 2.2e-16 < 0.05

→ Solid rejection of the normality assumption for returns.

Stock returns during the COVID-19 period are the most volatile with extreme returns

→ Investors should definitely plan their strategies more carefully as they could encounter extreme return observations.

Cevik et. al. (Cevik et al., 2022)

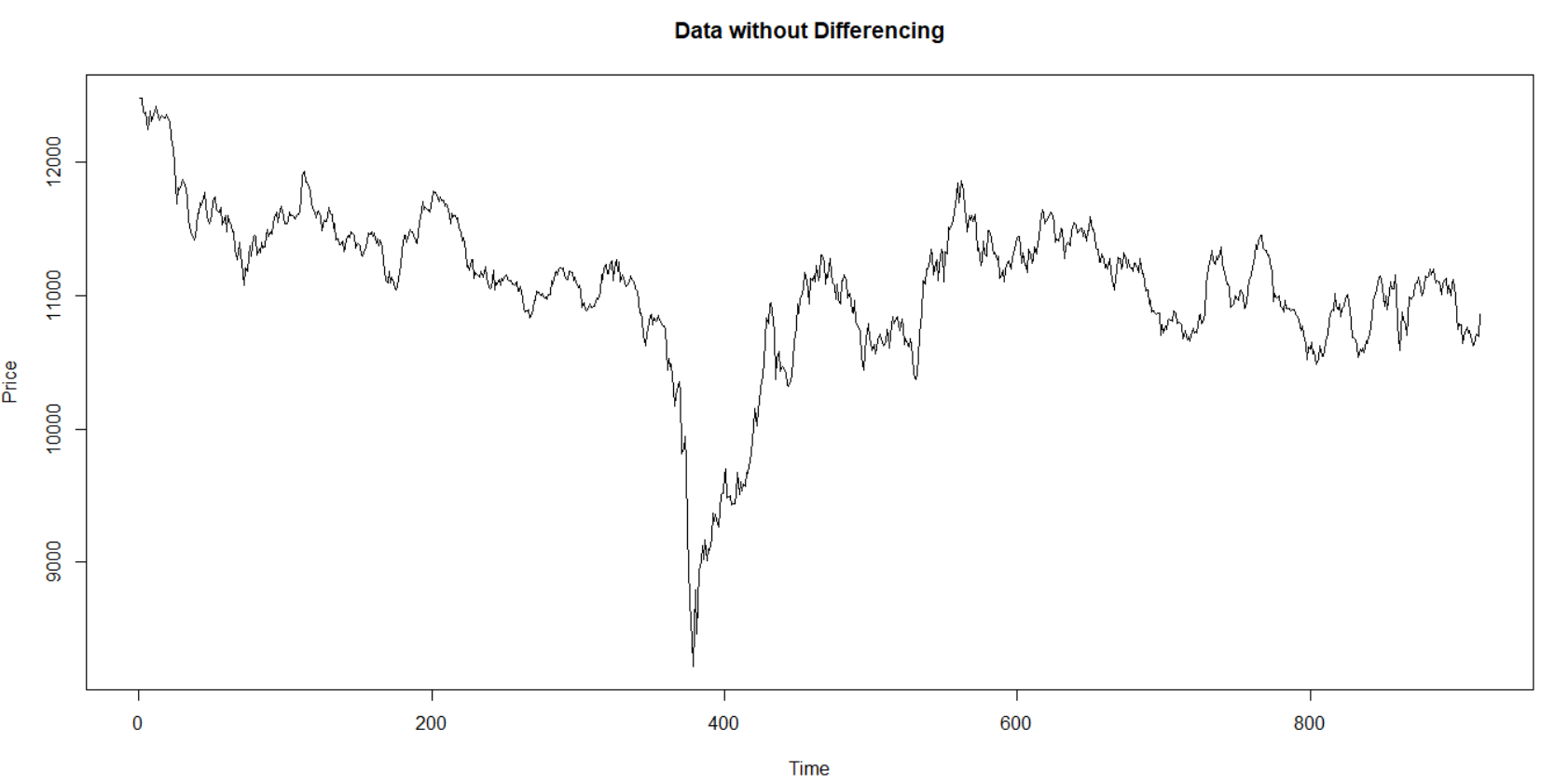
→ Negative investor sentiment decreases stock returns and increases volatility.

→ We believe that one of the factors causing high deviation from normality during COVID-19 can be caused by fear related sentiments about the uncertainty of a global disease.

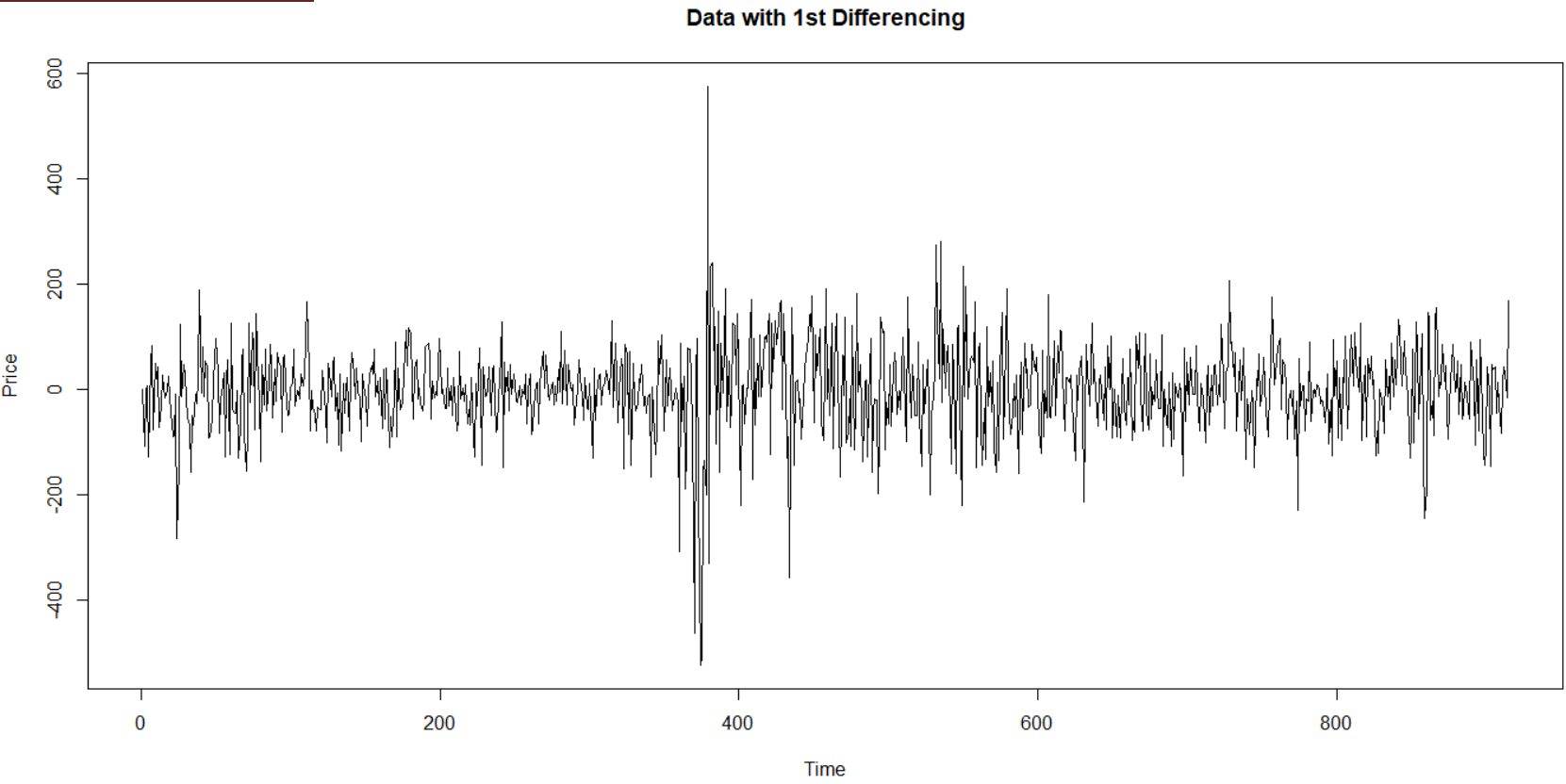


# Objective 2





ADF p-value = 0.1365



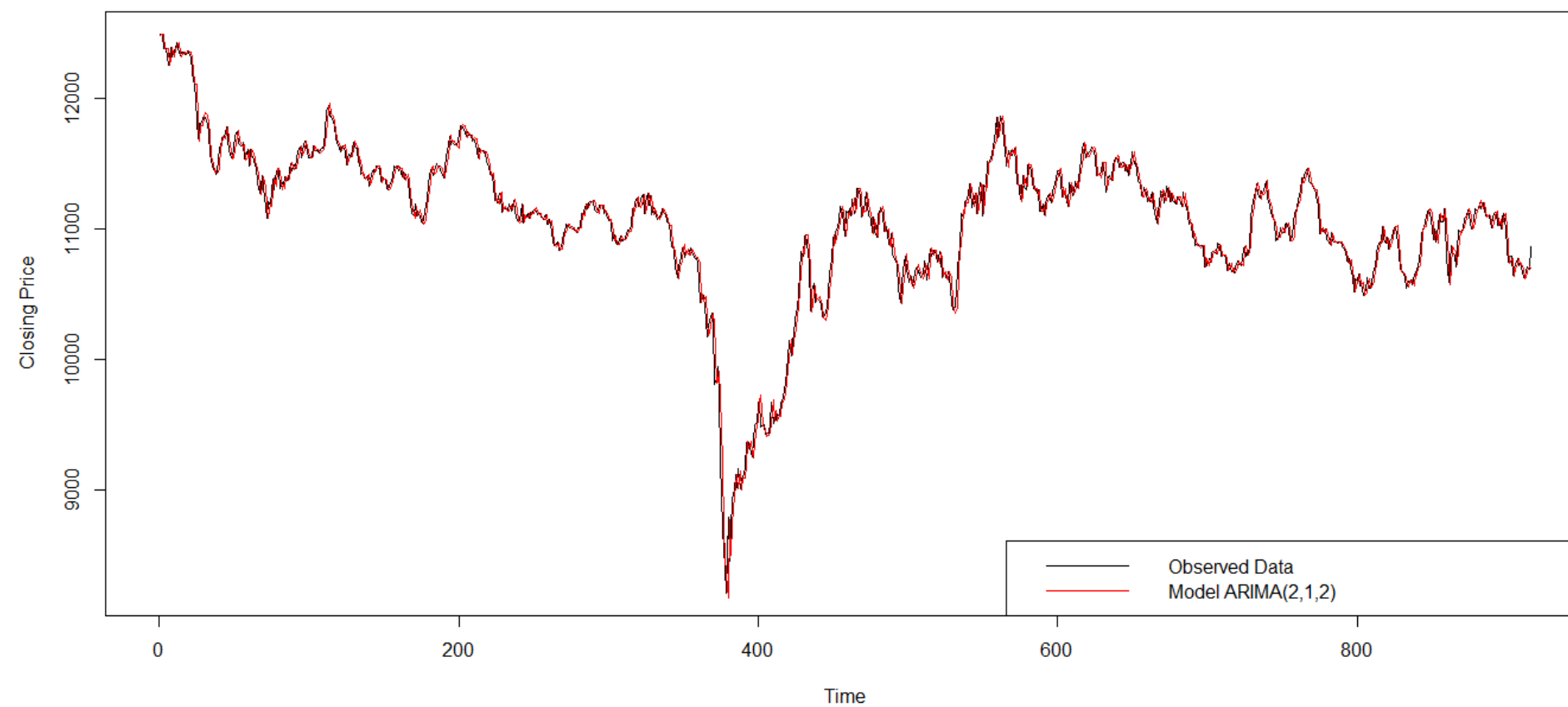
ADF p-value = 0.01

## AIC Values of Each ARIMA Model

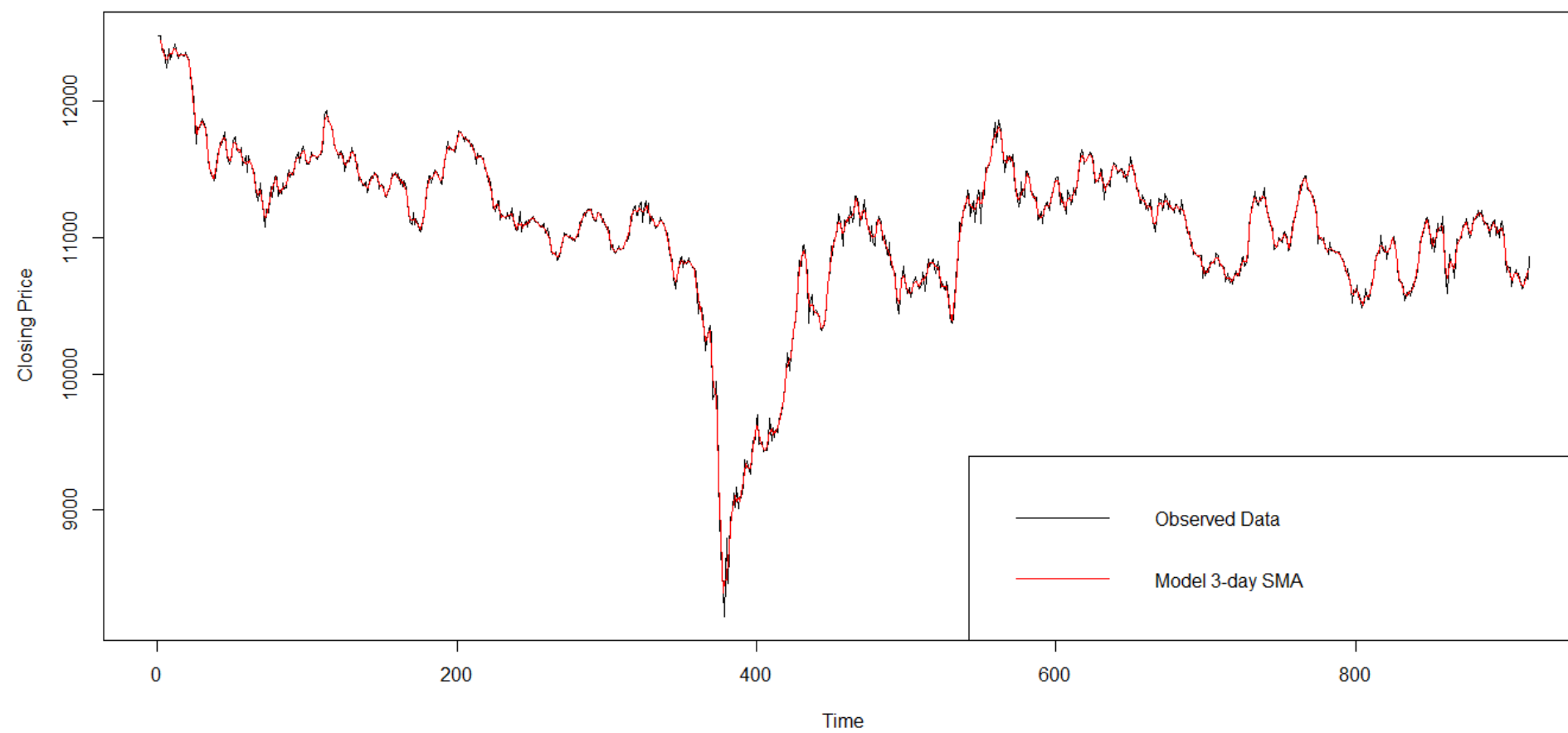
| AR \ MA | MA(0)    | MA(1)    | MA(2)    | MA(3)    | MA(4)    |
|---------|----------|----------|----------|----------|----------|
| AR(0)   | 10753.84 | 10755.61 | 10753.8  | 10754.24 | 10753.74 |
| AR(1)   | 10755.57 | 10753.18 | 10751.98 | 10753.59 | 10754.41 |
| AR(2)   | 10753.33 | 10752.17 | 10749.11 | 10755.81 | 10750.27 |
| AR(3)   | 10753.38 | 10753.9  | 10750.68 | 10753.03 | 10751.9  |
| AR(4)   | 10753.85 | 10755.34 | 10750.2  | 10758.01 | 10754.53 |

**ARIMA(2, 1, 2)**

**ARIMA(2,1,2) Fitted Model**



**3-day SMA Fitted Model**



**3-day Simple  
Moving Average**



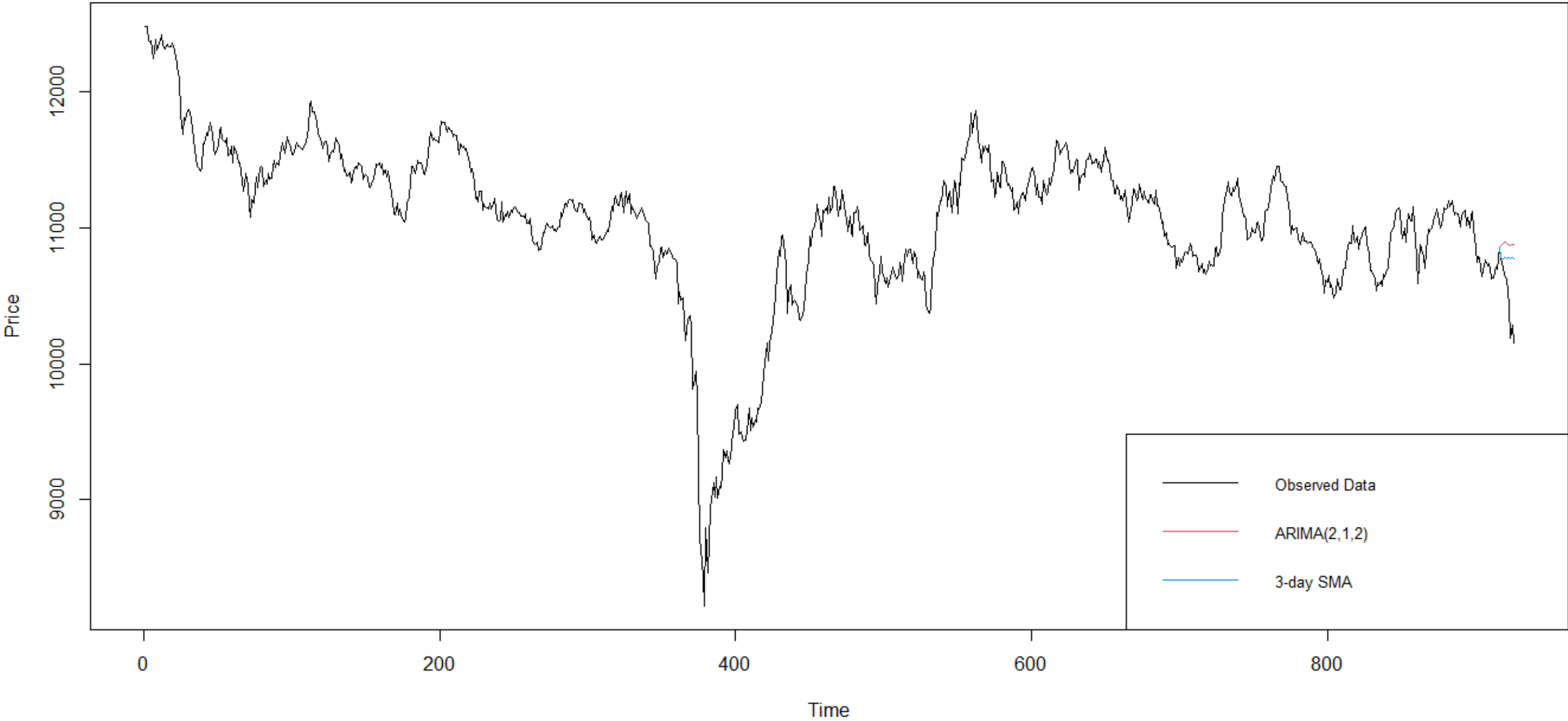
Comparing Models

| Comparison Metrics | ARIMA(2,1,2) | 3-day Simple Moving Average |
|--------------------|--------------|-----------------------------|
| MSE                | 7315.131     | 1620.796                    |
| RMSE               | 85.529       | 62.794                      |
| MAE                | 61.709       | 46.093                      |
| MAPE               | 0.569        | 0.003                       |
| R--Squared         | 0.978        | 0.995                       |



# Forecasting and Probable Cause for the Dip in Prices in June 2022

10-Day Forecasting using SMA vs ARIMA(2,1,2)



## Malaysia's inflation in June 2022 increased 3.4pct - DOSM

By Bernama  
July 22, 2022 @ 12:46pm



Department of Statistics Malaysia (DoSM) chief statistician Datuk Sri Mohd Uzir Mahidin said food inflation increased by 6.1 per cent and remained the main contributor to the rise in inflation during the month.  
- NSTP/AIZUDDIN SAAD

KUALA LUMPUR: Malaysia's Consumer Price Index (CPI) increased by 3.4 per cent year-on-year (y-o-y) to 127.4 in June 2022 from 123.2 in June 2021, surpassing the average inflation in Malaysia for the January 2011 to June 2022 period by 1.9 per cent.

Liew Chee Yoong of the Center for Market Education said poor performance would continue, from a combination of the ringgit's depreciation, scandals in corporate governance, and weak legal enforcement in the capital markets.

Bursa Malaysia recently experienced an eight-day losing streak up to June 14, during which the market index shed more than 100 points or 6.9% and then fluctuated before closing just above 1,455 points on Friday.



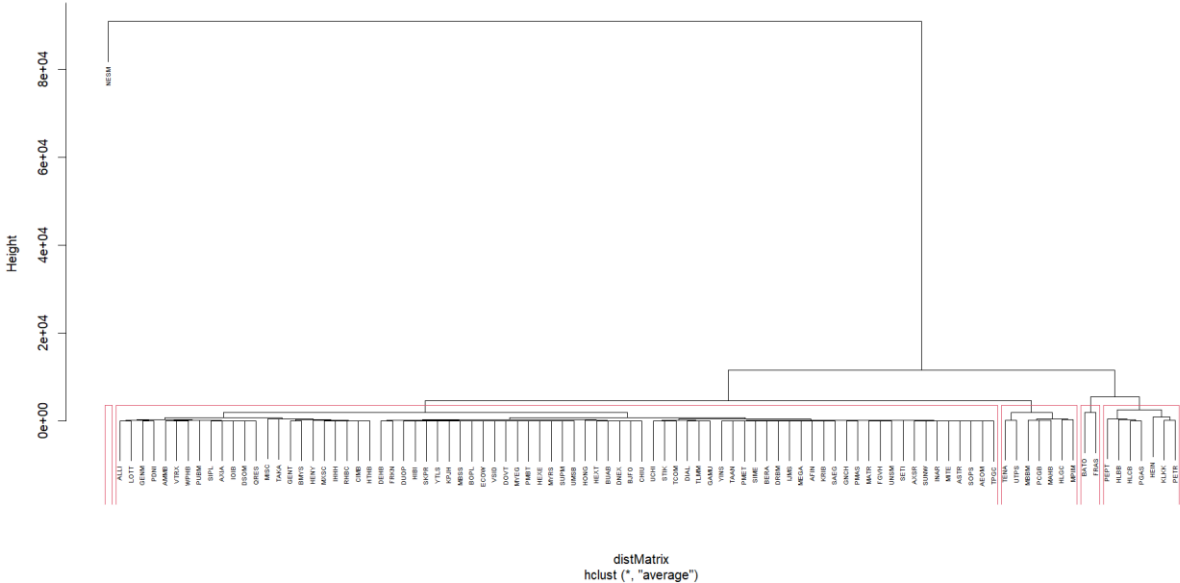
# Objective 3

# Dendrograms

## Pre-COVID-19

```
> table(cutree(TSCluster, k=5))  
  
 1  2  3  4  5  
78  7  7  1  2  
> |
```

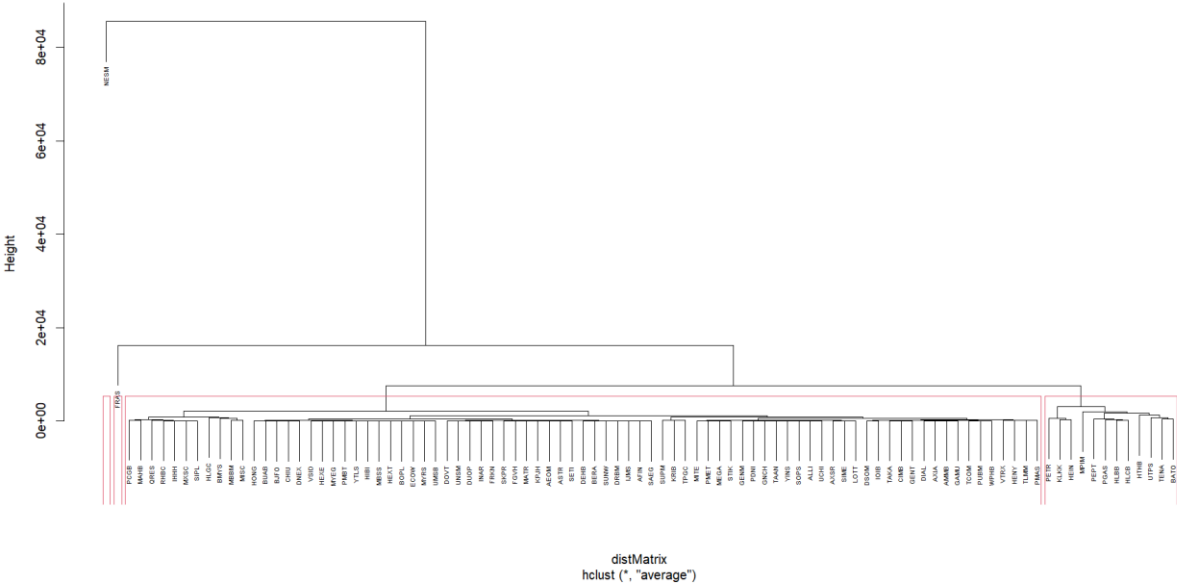
Cluster Dendrogram for Pre-COVID-19 Period



## During COVID-19

```
> table(cutree(TSCluster, k=4))  
  
 1  2  3  4  
81 12  1  1  
> |
```

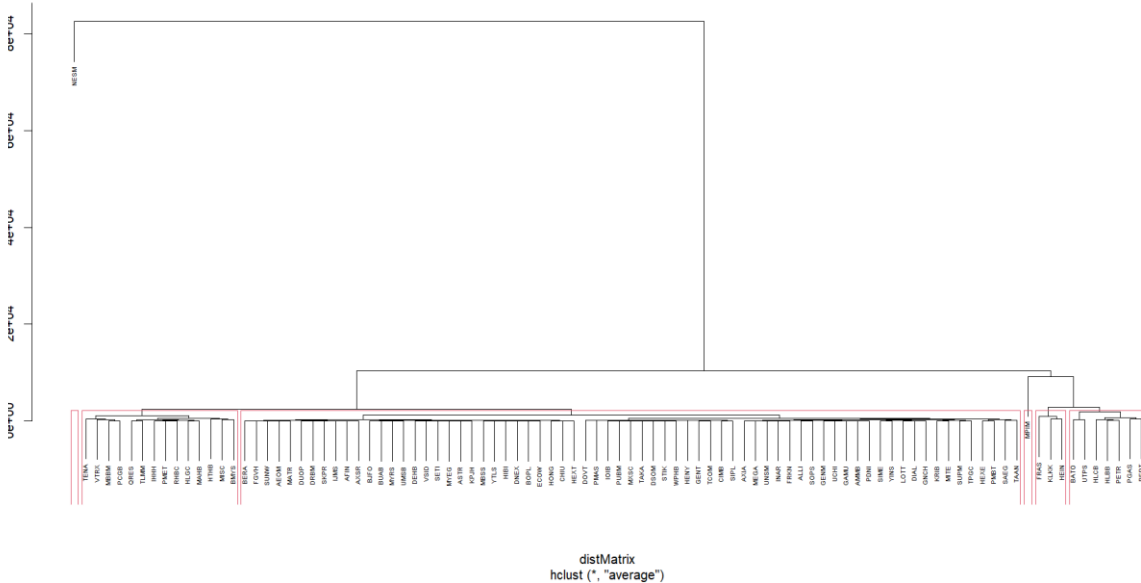
Cluster Dendrogram for During COVID-19 Period



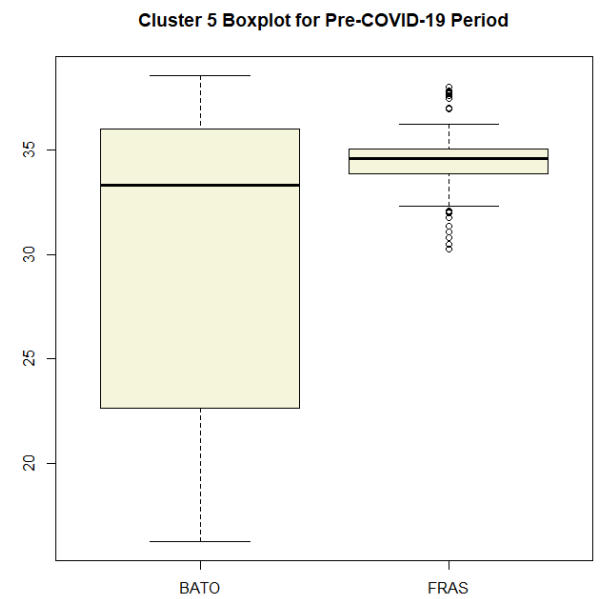
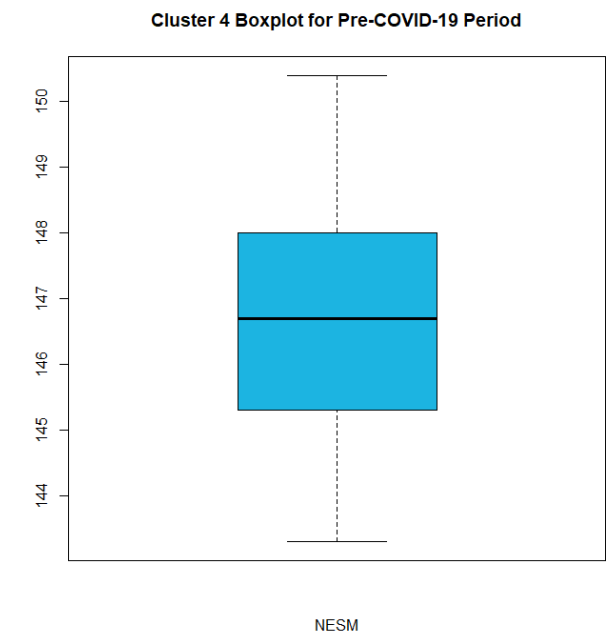
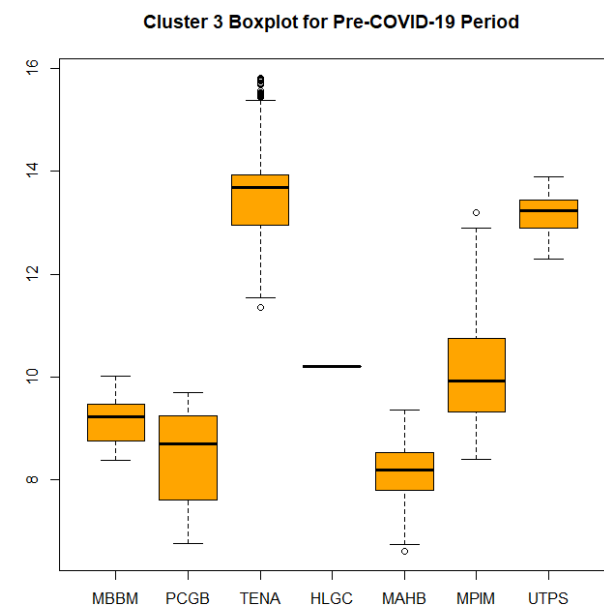
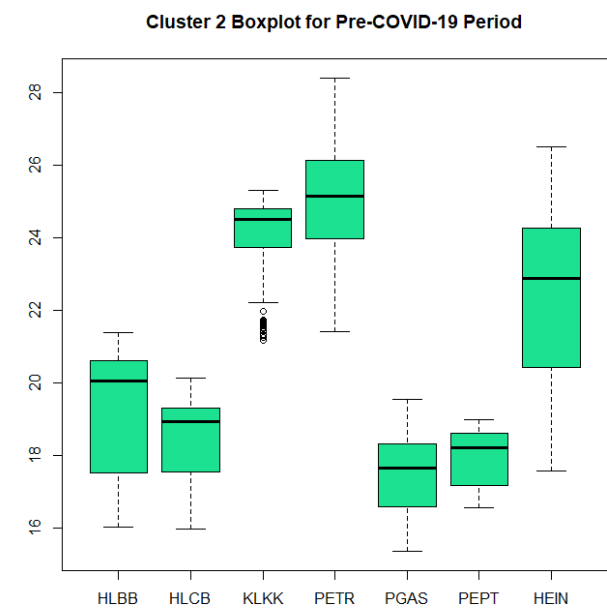
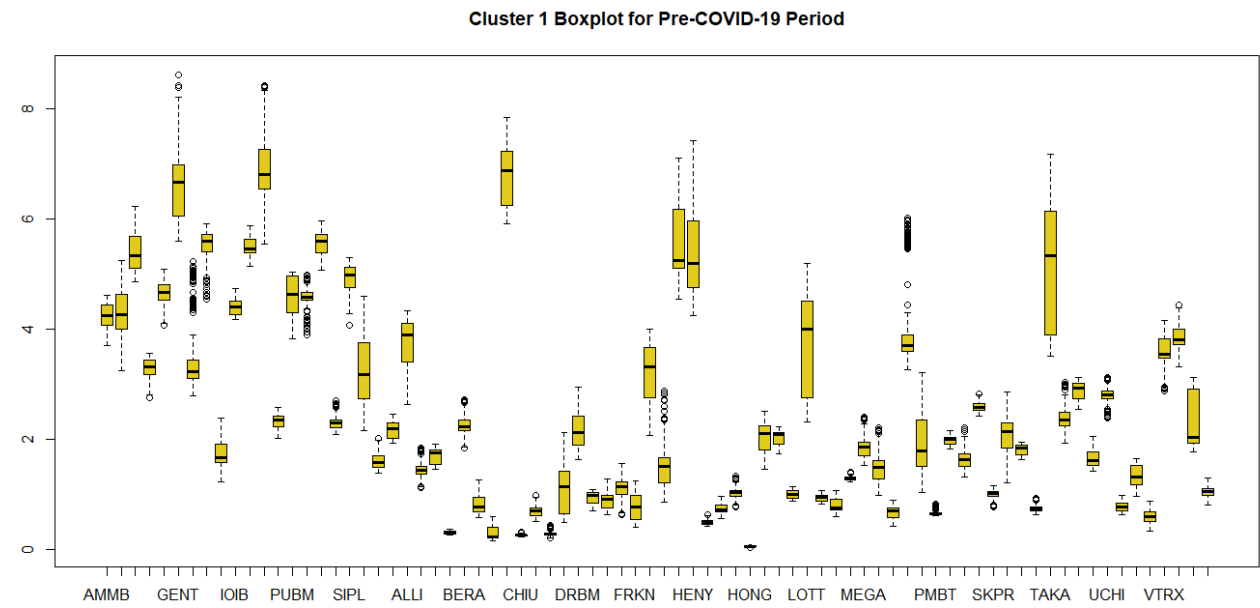
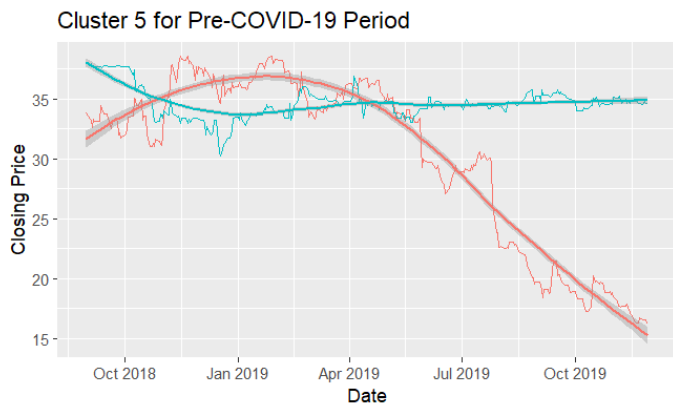
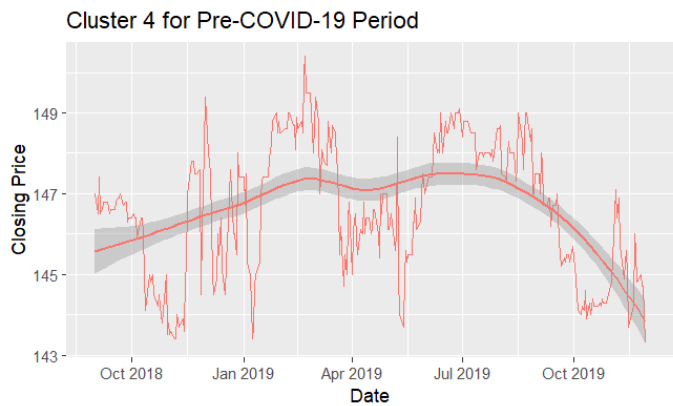
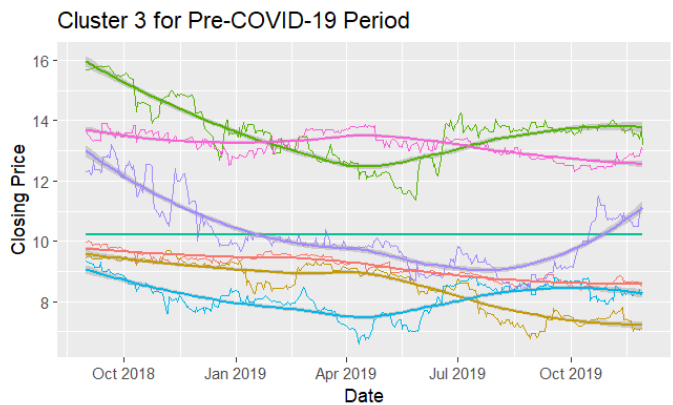
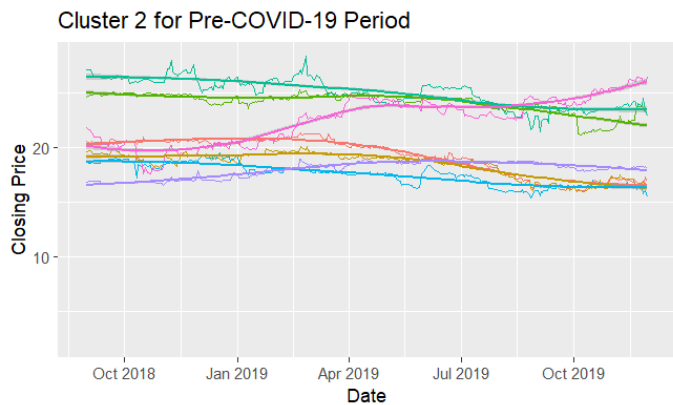
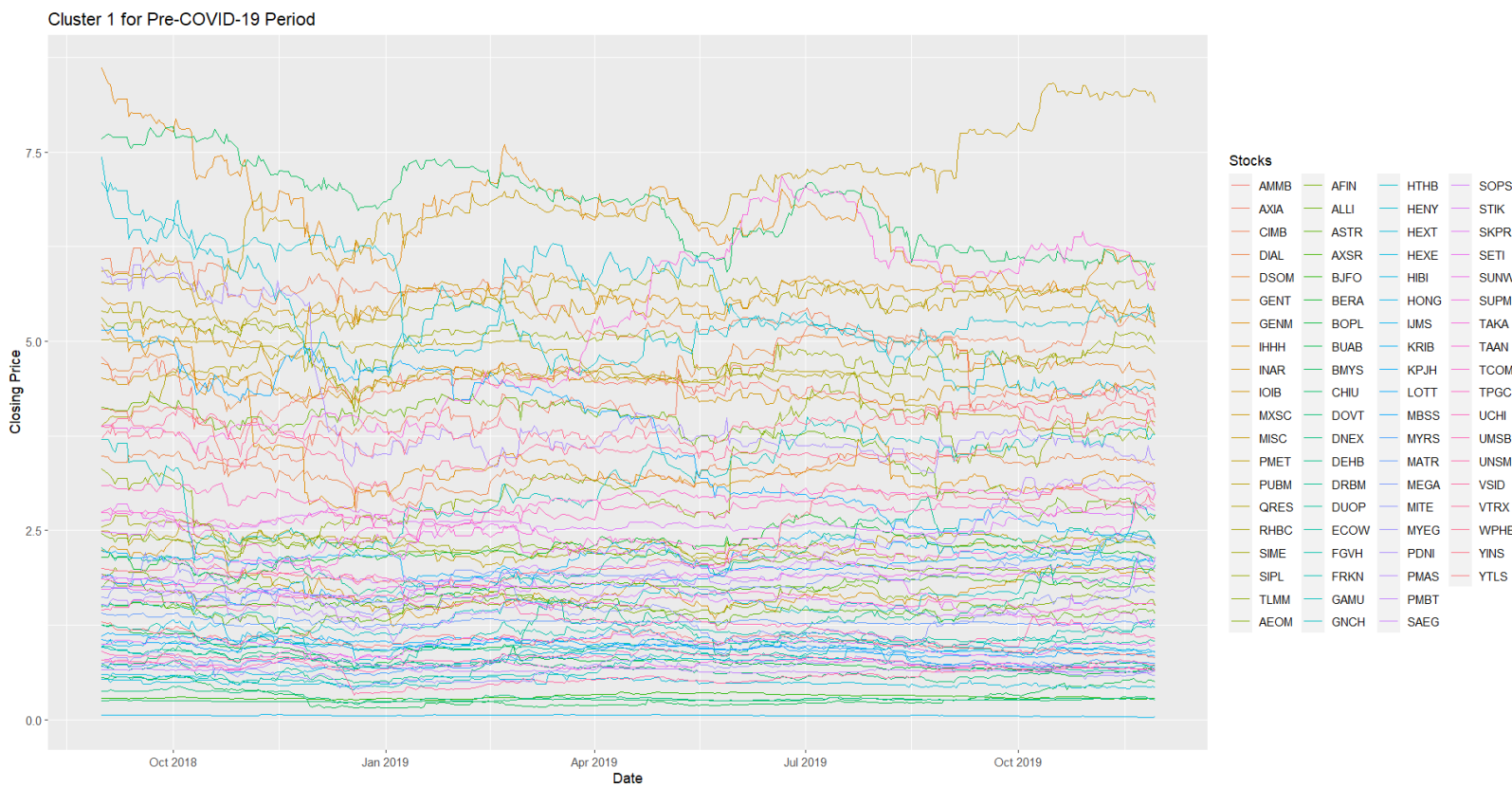
## Post-COVID-19

```
> table(cutree(TSCluster, k=6))  
  
 1  2  3  4  5  6  
69  7 14  3  1  1  
> |
```

Cluster Dendrogram for Post-COVID-19 Period



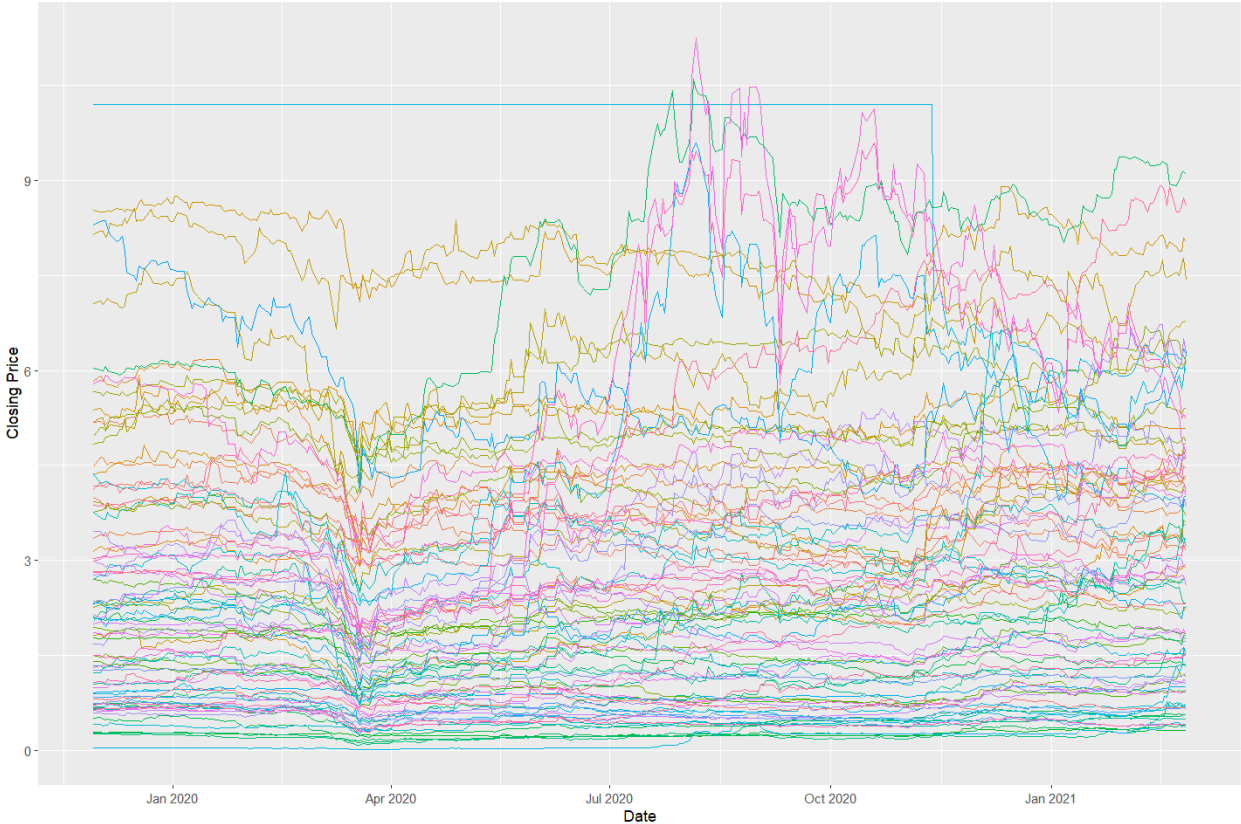
# Pre-COVID-19



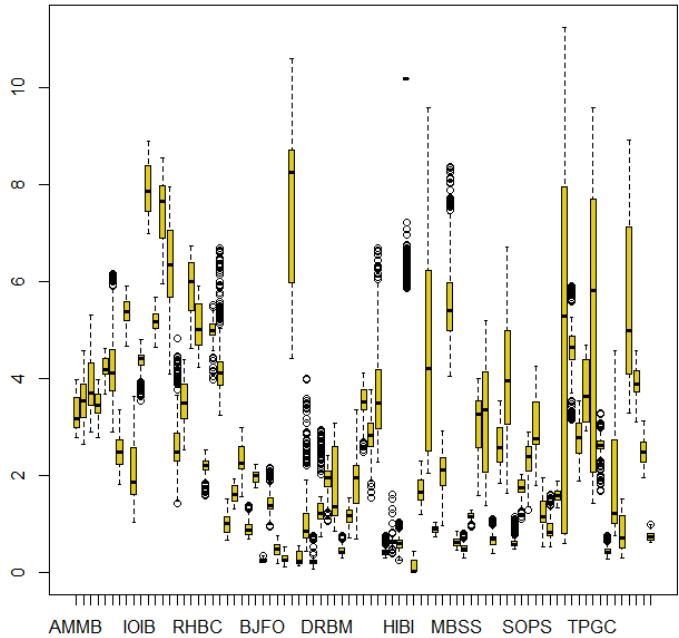


# During COVID-19

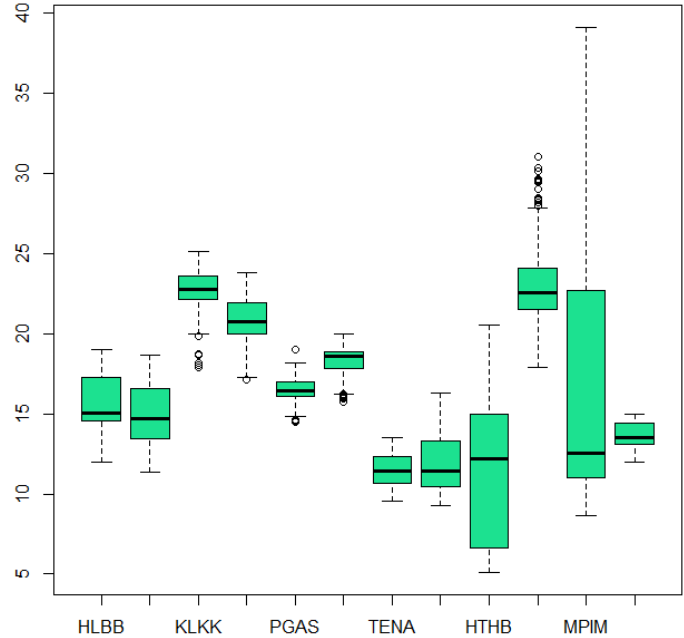
Cluster 1 for During COVID-19 Period



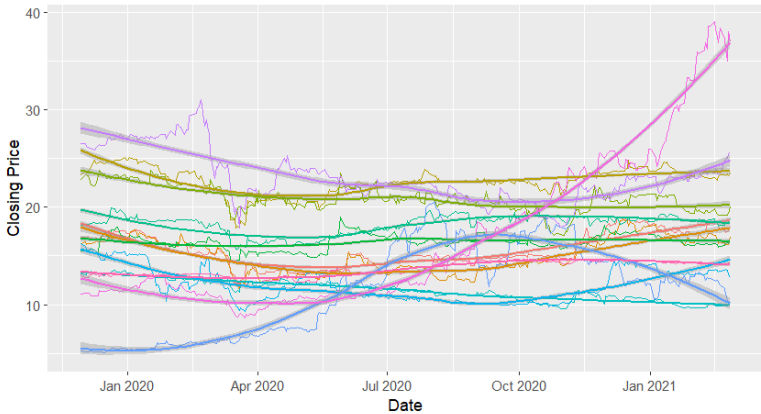
Cluster 1 Boxplot for During COVID-19 Period



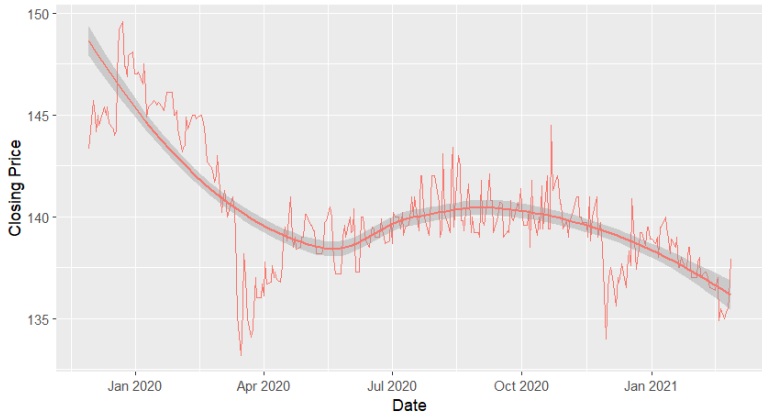
Cluster 2 Boxplot for During COVID-19 Period



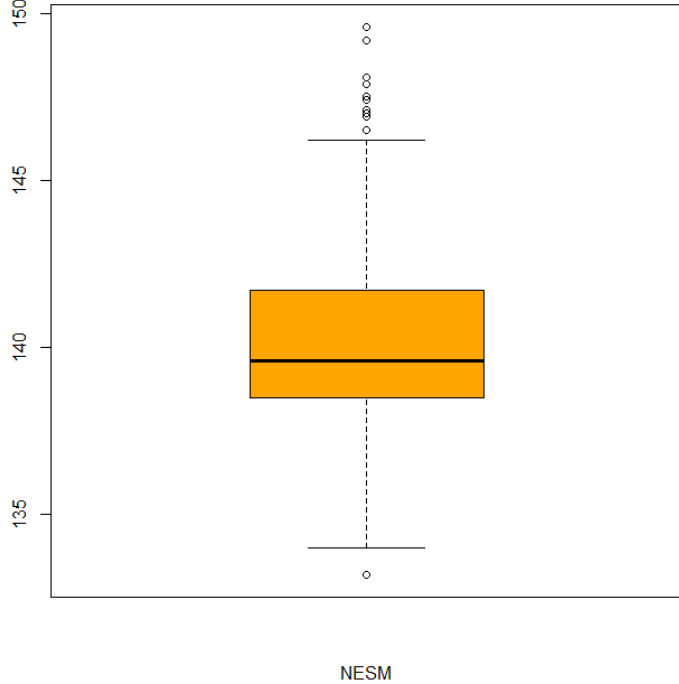
Cluster 2 for During COVID-19 Period



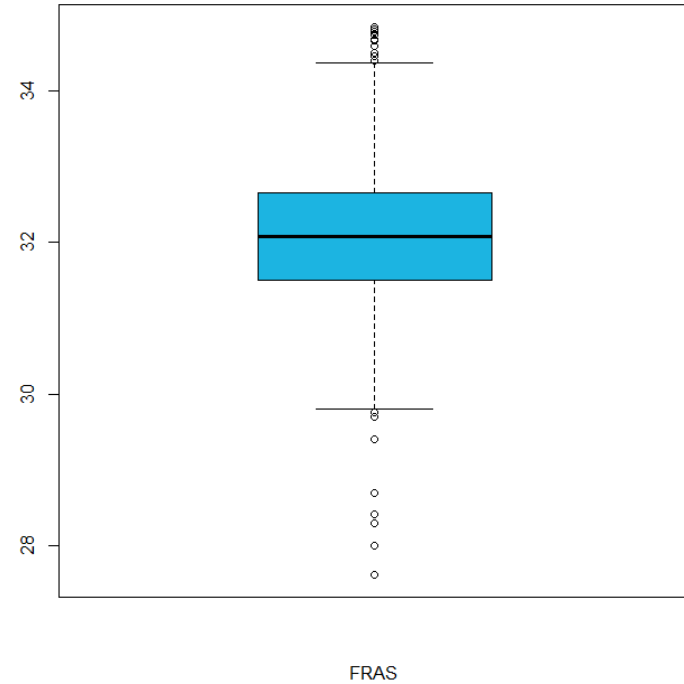
Cluster 3 for During COVID-19 Period



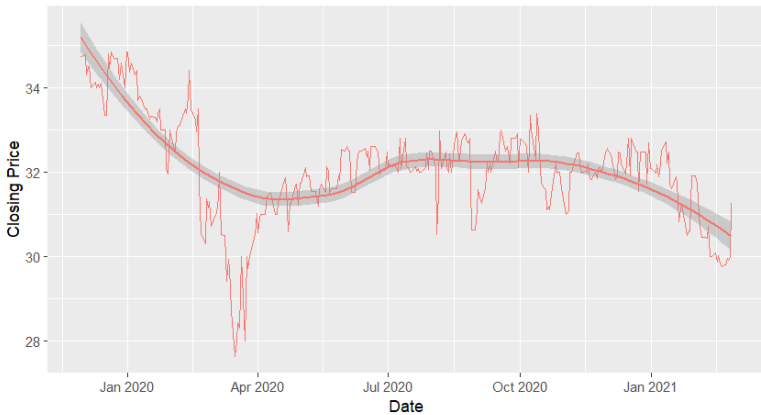
Cluster 3 Boxplot for During COVID-19 Period



Cluster 4 Boxplot for During COVID-19 Period

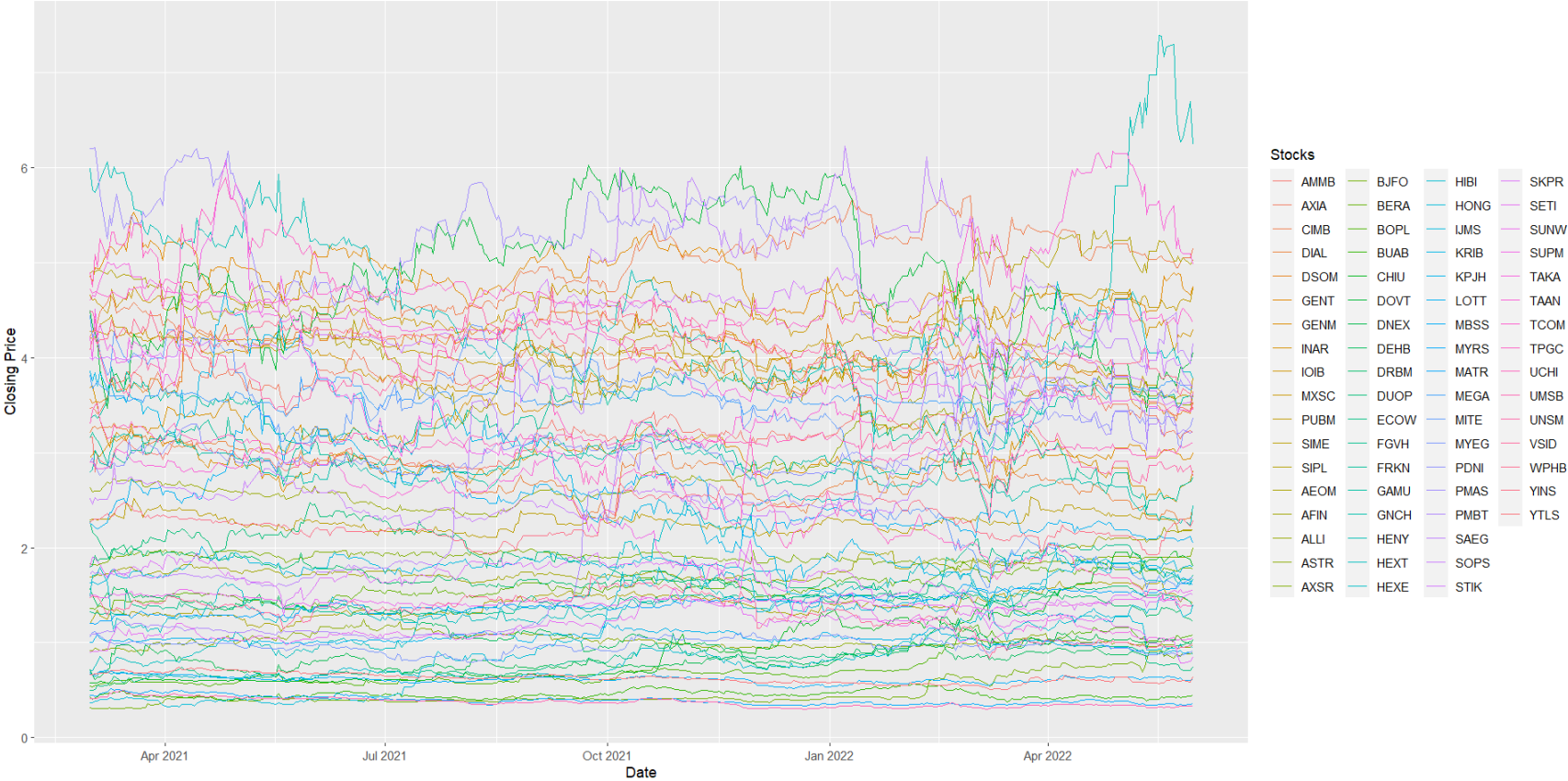


Cluster 4 for During COVID-19 Period

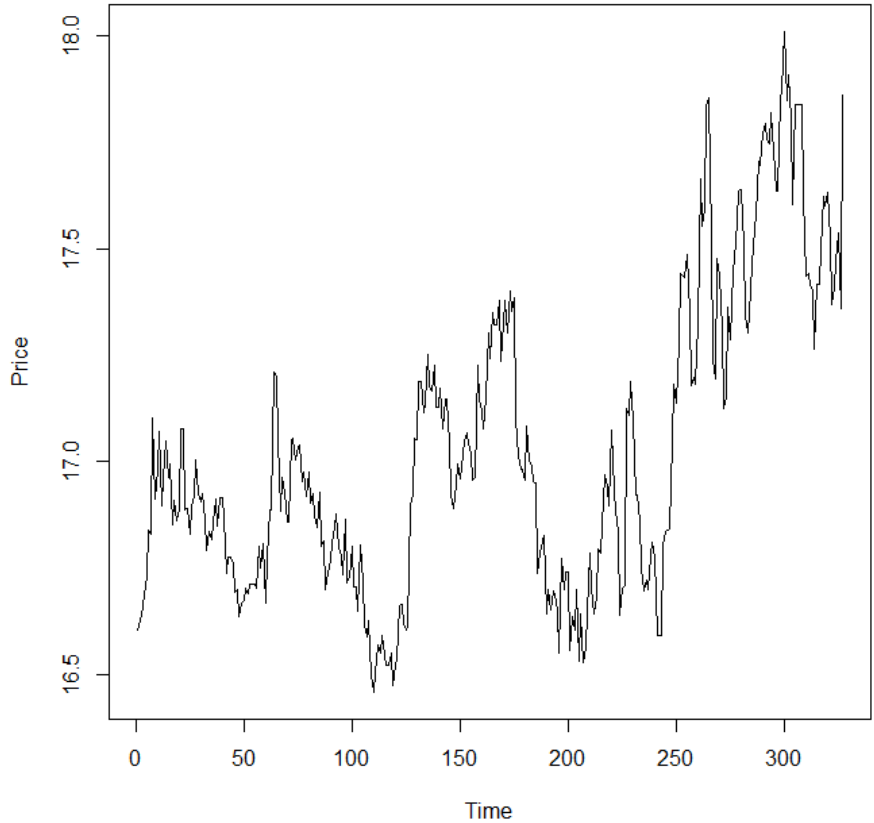


# Post-COVID-19

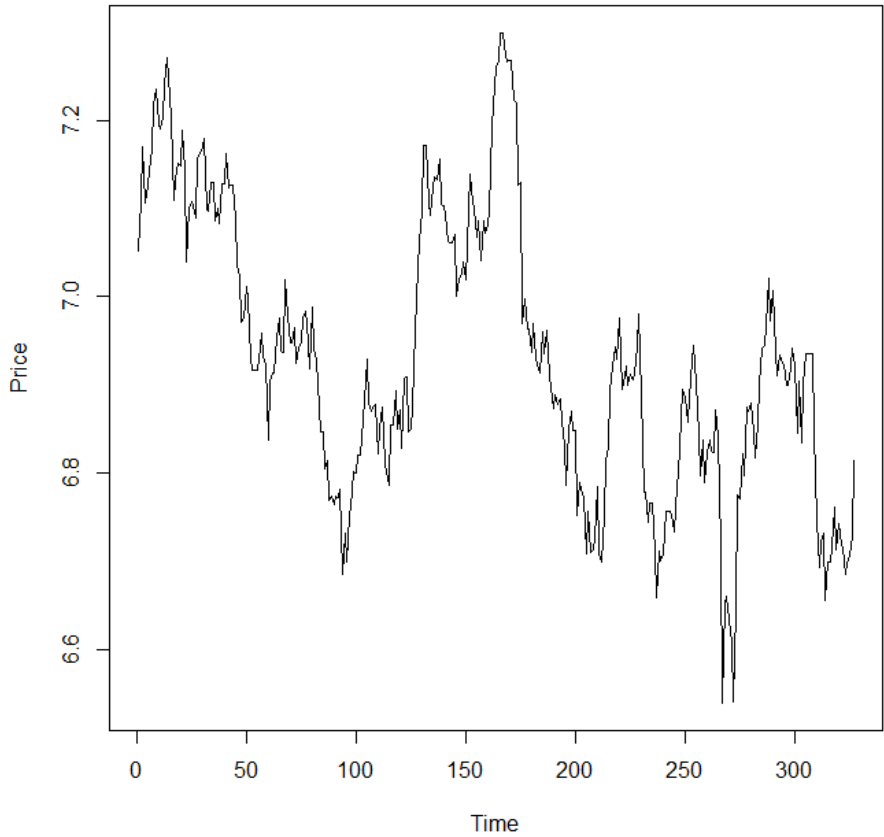
Cluster 1 for Post-COVID-19 Period



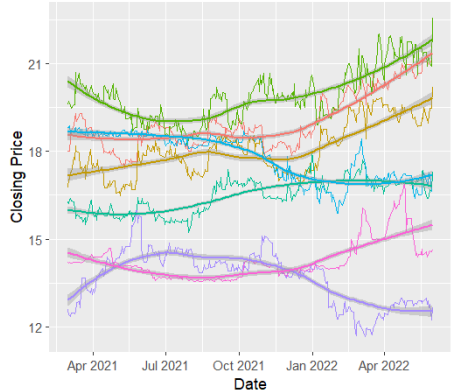
Mean of Stocks in Cluster 2



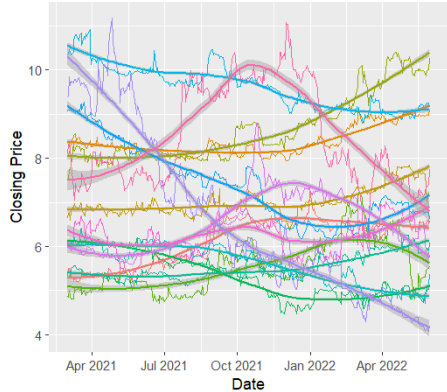
Mean of Stocks in Cluster 3



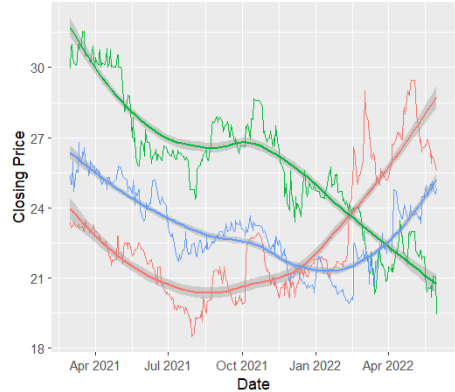
Cluster 2 for Post-COVID-19 Period



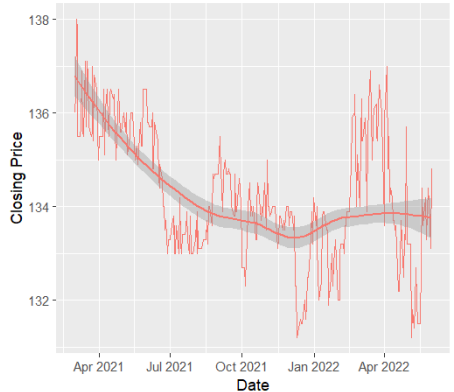
Cluster 3 for Post-COVID-19 Period



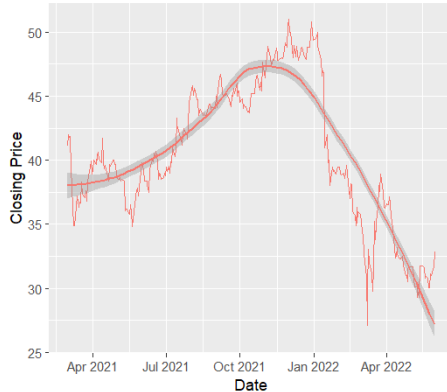
Cluster 4 for Post-COVID-19 Period



Cluster 5 for Post-COVID-19 Period

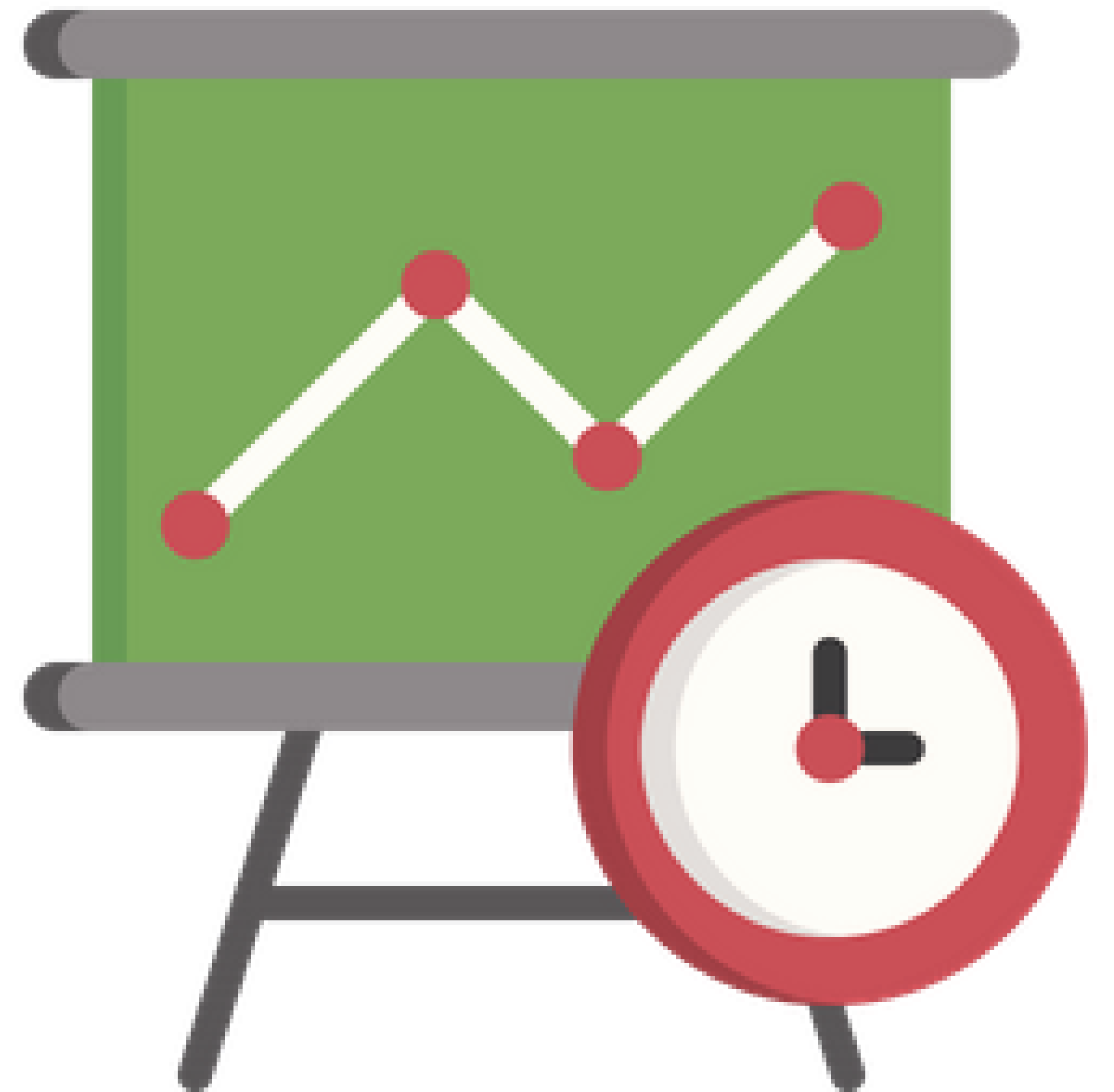


Cluster 6 for Post-COVID-19 Period



# Conclusion

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## KEY FINDINGS

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The log returns of the **during COVID-19** period seem to be more **volatile** and **deviate from the normality** assumption much further compared to the pre and post periods.



The Simple Moving Average (**SMA**) model is a **better** forecasting model as compared to the **ARIMA**(2, 1, 2) model.



Stocks in the FTSE Top 100 Index are clustered according to their **stock price range** when using **hierarchical clustering**. Some stocks within a cluster also exhibit similar characteristics. They do not cluster according to sector.

## KEY TAKEAWAYS

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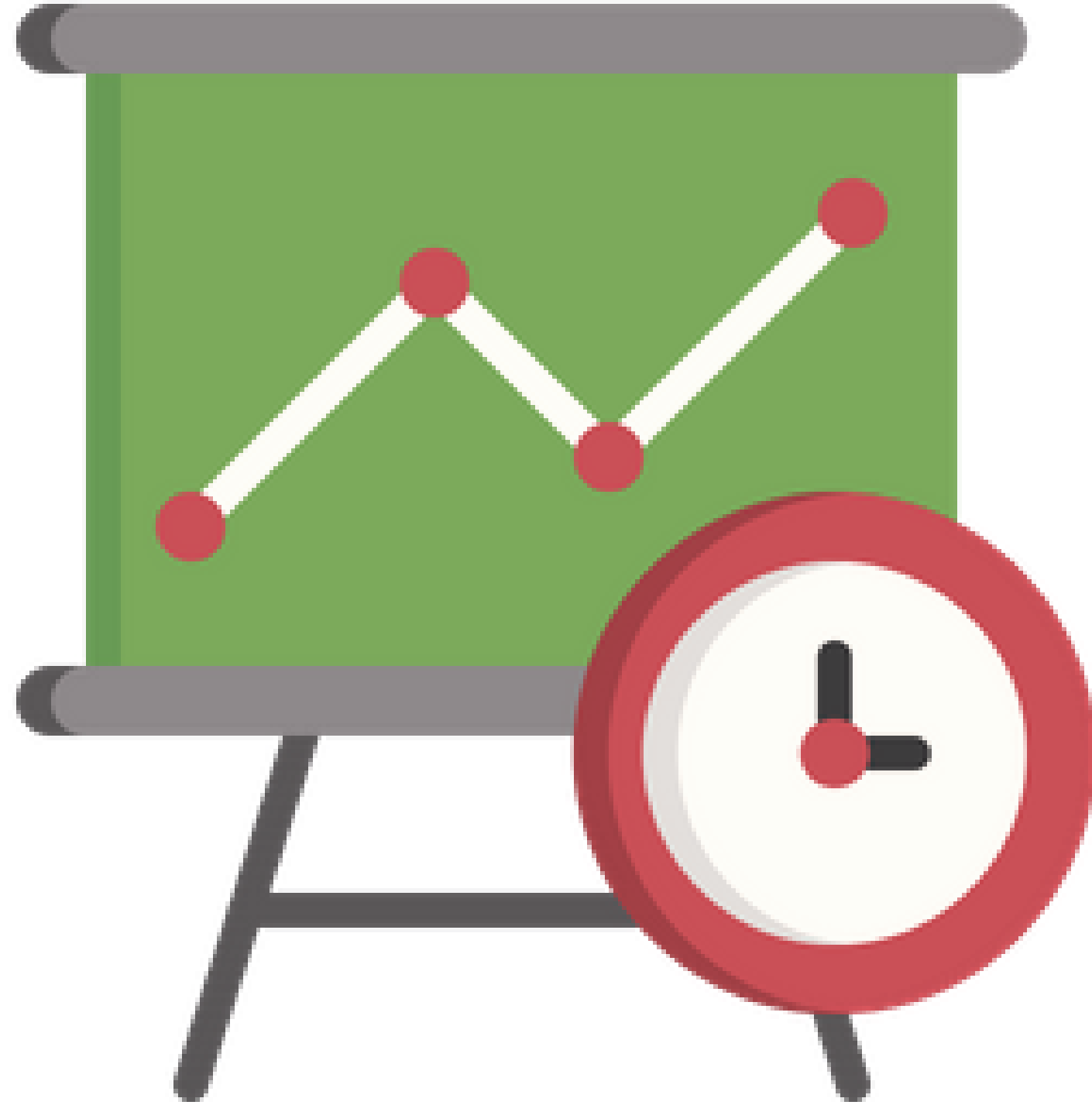
**Regulatory authorities** should implement **policies** to help **mitigate** the **damage** caused to the stock market during crisis. **Market participants** must be more **aware** of the extreme events impacting the stock market in different periods of time.



Investors can take into consideration to **utilise** the **SMA** model **to predict future stock prices** in the short term. However, they should bear in mind that the model is not perfect and cannot capture **external factors** that could affect the stock market.



Market participants who are **risk averse** could diversify their stock selection for their portfolio by considering **stocks from different clusters** that behave differently. For **risk loving** market participants, they could consider **stocks from the same cluster** that behave similarly.



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# Thank You

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for lending us  
your ears

