Hands-on Exercise 10: Financial Data Visualisation and Analysis: R methods

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Overview

By the end of this hands-on exercise, you will be able to:

- extract stock price data from financial portal such as Yahoo Finance by using tidyquant package
- plot horizon graph by using ggHoriPlot package,
- plot static and interactive stock prices line graph(s) by ggplot2 and plotly R packages,
- plot static candlestick chart by using tidyquant package,
- plot static bollinger bands by using tidyquant, and
- plot interactive candlestick chart by using ggplot2 and plotly R.

Getting started

For the purpose of this hands-on exercise, the following R packages will be used.

```r
packages = c('tidyverse', 'lubridate',
             'tidyquant', 'ggHoriPlot',
             'timetk', 'ggthemes',
             'plotly')

for (p in packages){
  if(!require(p, character.only = T)){
    install.packages(p)
  }
  library(p,character.only = T)
}
```

- tidyverse provides a collection of functions for performing data science task such as importing, tidying, wrangling data and visualising data. It is not a single package but a collection of modern R packages including but not limited to readr, tidyr, dplyr, ggplot, tibble, stringr, forcats and purrr.
- lubridate provides functions to work with dates and times more efficiently.
- tidyquant bringing business and financial analysis to the 'tidyverse'. It provides a convenient wrapper to various 'xts', 'zoo', 'quantmod', 'TTR' and 'PerformanceAnalytics' package functions and returns the objects in the tidy 'tibble' format.
- ggHoriPlot: A user-friendly, highly customisable R package for building horizon plots in the 'ggplot2' environment.

Data Extraction with tidyquant

tidyquant integrates resources for collecting and analysing financial data with the tidy data infrastructure of the tidyverse, allowing for seamless interaction between each.

In this section, you will learn how to extract the daily stock values of a selected stocks from Yahoo Finance by using tidyquant.

Step 1: We will import a pre-prepared company list called **companySG.csv** onto R. The list consists of top 45 companies by market capitalisation in Singapore. However, we just want the top 40.

```
company <- read_csv("data/companySG.csv")
Top40 <- company %>%
  slice_max(`marketcap`, n=40) %>%
  select(symbol)
```

Step 2: `tq_get()` method will be used to extract daily values of these stocks from Yahoo Finance via APIs. The time period for the data was set from **1st January 2020** to **31st March 2021**. The data are specified to be returned in **daily** intervals.

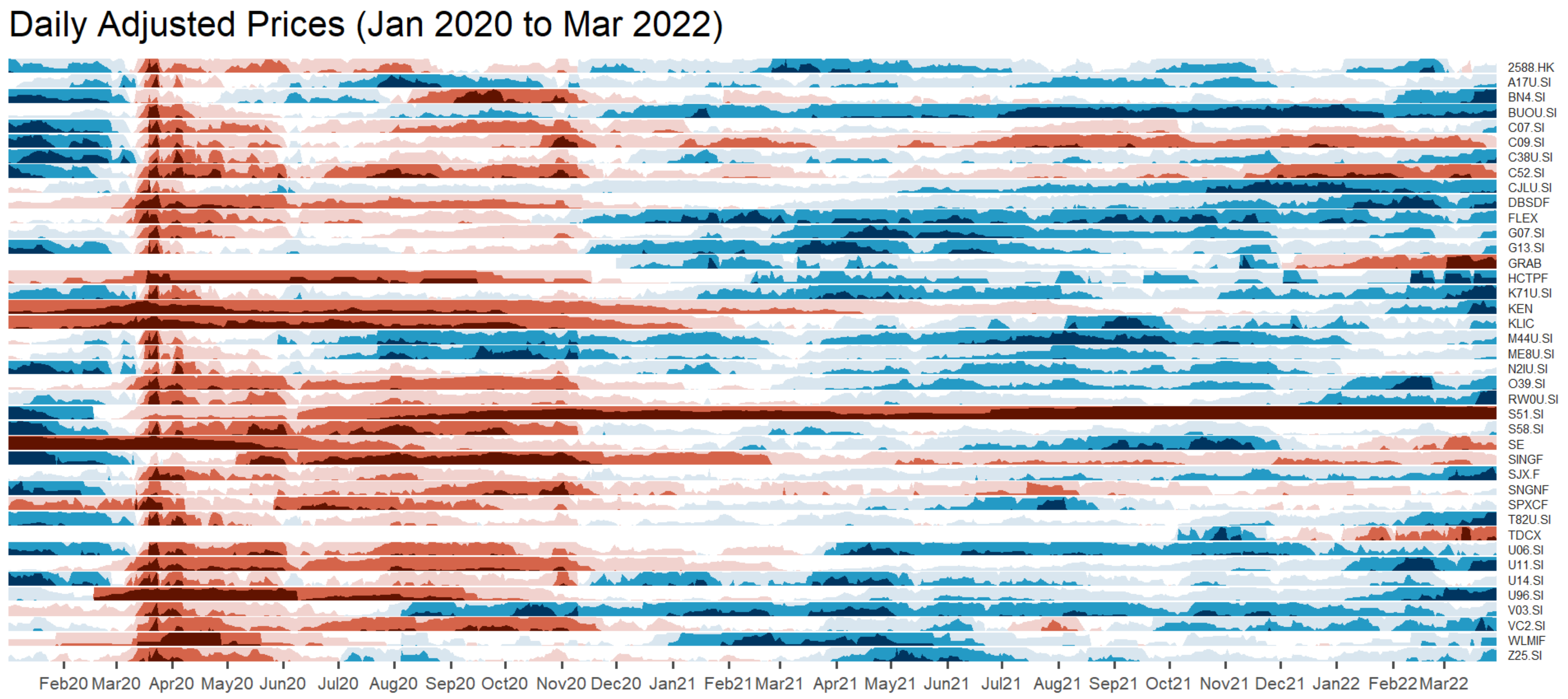
```
Stock40_daily <- Top40 %>%
  tq_get(get = "stock.prices",
         from = "2020-01-01",
         to = "2022-03-31") %>%
  group_by(symbol) %>%
  tq_transmute(select = NULL,
               mutate_fun = to.period,
               period  = "days")
```

Plotting a horizon graph

In this section, you will learn how to plot a horizon graph by using `geom_horizon()` of *ggHoriPlot* package.

```r
Stock40_daily %>%
  ggplot() +
  geom_horizon(aes(x = date, y=adjusted), origin = "midpoint", horizonscale = 6)+
  facet_grid(symbol~.)+
  theme_few() +
  scale_fill_hcl(palette = 'RdBu') +
  theme(panel.spacing.y=unit(0, "lines"), strip.text.y = element_text(
    size = 5, angle = 0, hjust = 0),
    legend.position = 'none',
    axis.text.y = element_blank(),
    axis.text.x = element_text(size=7),
    axis.title.y = element_blank(),
    axis.title.x = element_blank(),
    axis.ticks.y = element_blank(),
    panel.border = element_blank()
    ) +
  scale_x_date(expand=c(0,0), date_breaks = "1 month", date_labels = "%b%y") +
  ggtitle('Daily Adjusted Prices (Jan 2020 to Mar 2022)')
```

Plotting a horizon graph



Horizon graph makeover

- Instead of showing stock code, the stock name will be displayed.
- Adding reference lines

Step 1: `left_join()` of *dplyr* package is used to append fields from **company** data.frame onto **Stock_daily** data.frame. Next `select()` is used to select columns 1 to 8 and 11 to 12.

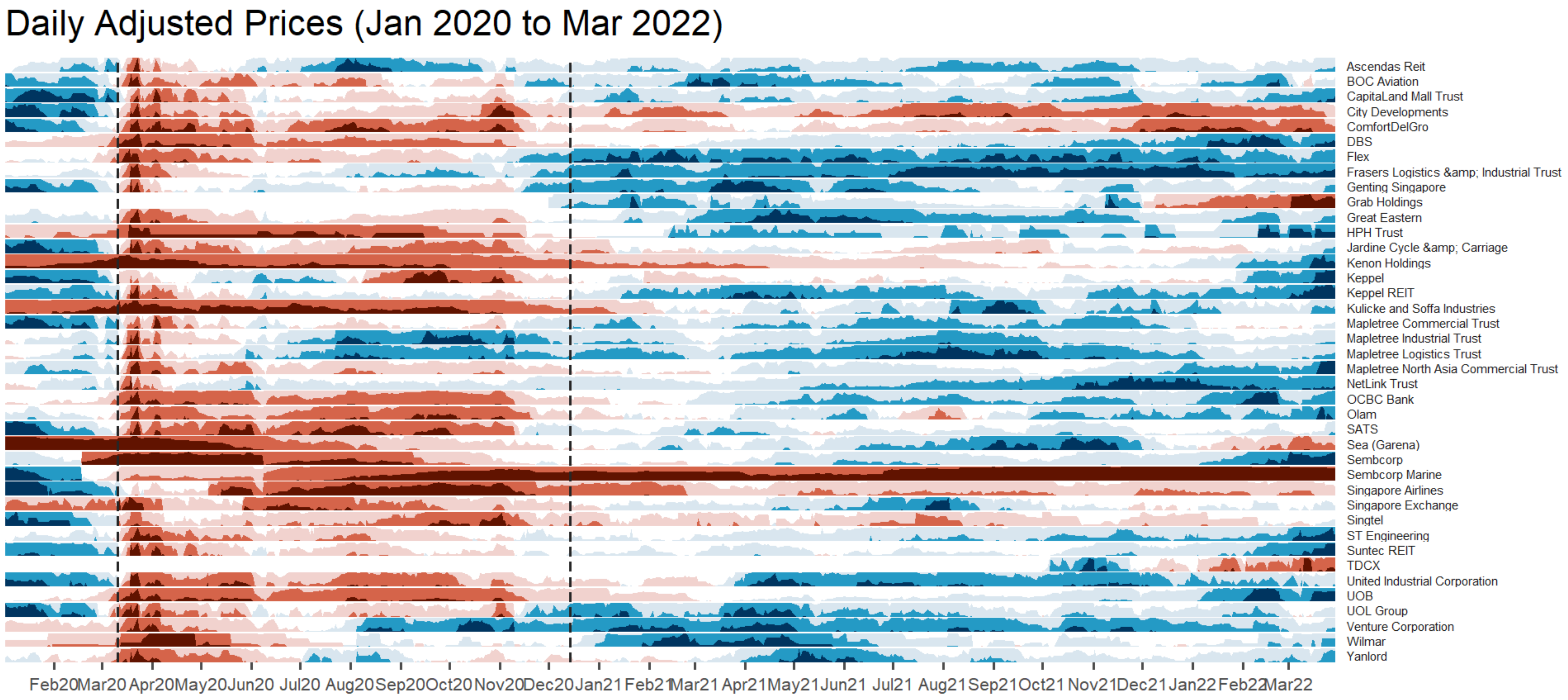
```
Stock40_daily <- Stock40_daily %>%
  left_join(company) %>%
  select(1:8, 11:12)
```

Horizon graph makeover

Step 2: `geom_vline()` is used to add the vertical reference lines.

```r
Stock40_daily %>%
  ggplot() +
  geom_horizon(aes(x = date, y=adjusted), origin = "midpoint", horizonscale = 6)+
  facet_grid(Name~.)+
  geom_vline(xintercept = as.Date("2020-03-11"), colour = "grey15", linetype = "dashed", size = 0.5
  geom_vline(xintercept = as.Date("2020-12-14"), colour = "grey15", linetype = "dashed", size = 0.5
  theme_few() +
  scale_fill_hcl(palette = 'RdBu') +
  theme(panel.spacing.y=unit(0, "lines"),
        strip.text.y = element_text(size = 5, angle = 0, hjust = 0),
    legend.position = 'none',
    axis.text.y = element_blank(),
    axis.text.x = element_text(size=7),
    axis.title.y = element_blank(),
    axis.title.x = element_blank(),
    axis.ticks.y = element_blank(),
    panel.border = element_blank()
    ) +
  scale_x_date(expand=c(0,0), date_breaks = "1 month", date_labels = "%b%y") +
  ggtitle('Daily Adjusted Prices (Jan 2020 to Mar 2022)')
```

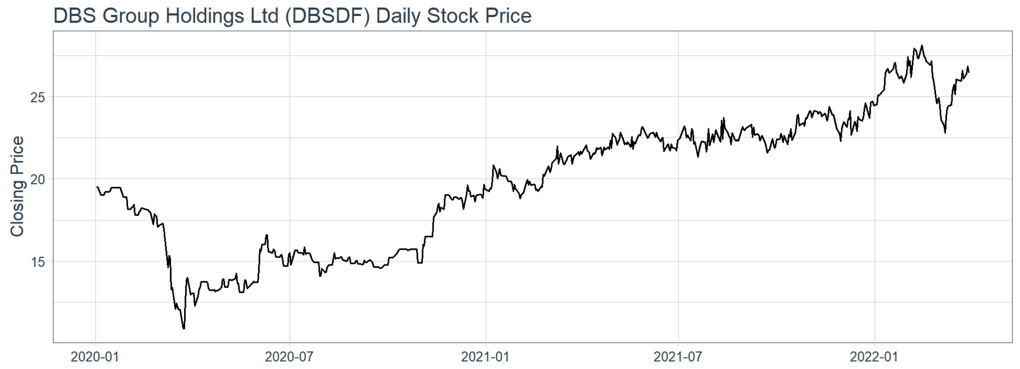
Horizon graph makeover



Plotting Stock Price Line Graph: ggplot methods

In the code chunk below, `geom_line()` of ggplot2 is used to plot the stock prices.

```
Stock40_daily %>%
  filter(symbol == "DBSDF") %>%
  ggplot(aes(x = date, y = close)) +
    geom_line() +
    labs(title = "DBS Group Holdings Ltd (DBSDI
         y = "Closing Price", x = "") +
    theme_tq()
```



Plotting interactive stock price line graphs

In this section, we will create interactive line graphs for four selected stocks.

Step 1: Selecting the four stocks of interest.

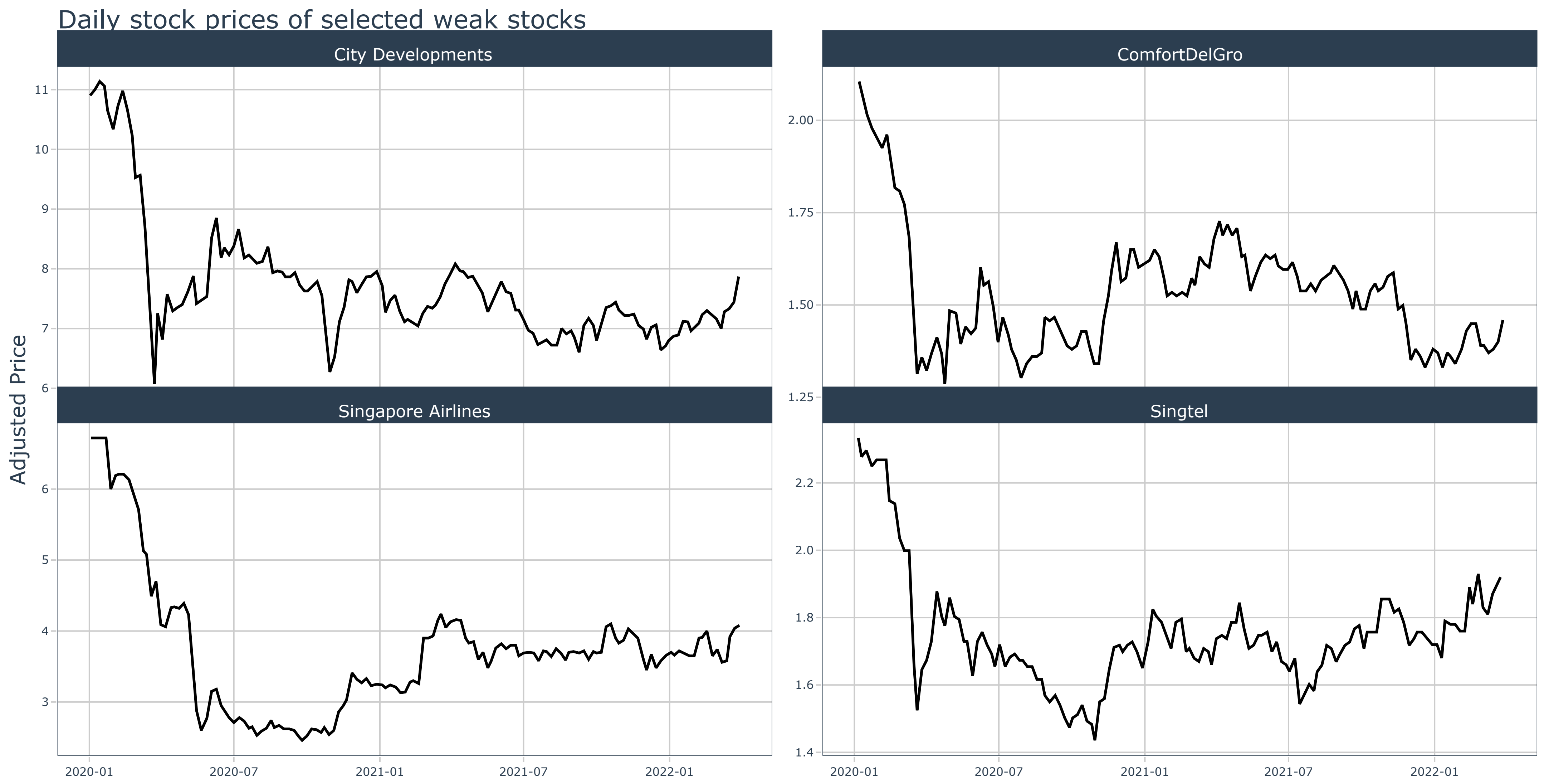
```
selected_stocks <-  Stock40_daily %>%
  filter (`symbol` == c("C09.SI", "SINGF", "SNGNF", "C52.SI"))
```

Step 2: Plotting the line graphs by using *ggplot2* functions and `ggplotly()` of *plotly R* package

```
p <- ggplot(selected_stocks, aes(x = date, y = adjusted))+
        scale_y_continuous() +
        geom_line() +
        facet_wrap(~Name, scales = "free_y",) +
        theme_tq() +
        labs(title = "Daily stock prices of selected weak stocks", x = "", y = "Adjusted Price") +
        theme(axis.text.x = element_text(size = 6), axis.text.y = element_text(size = 6))

ggplotly(p)
```

Plotting interactive stock price line graphs



Plotting Candlestick Chart: tidyquant method

In this section, you will learn how to plot candlestick chart by using `geom_candlestick()` of *tidyquant* package.

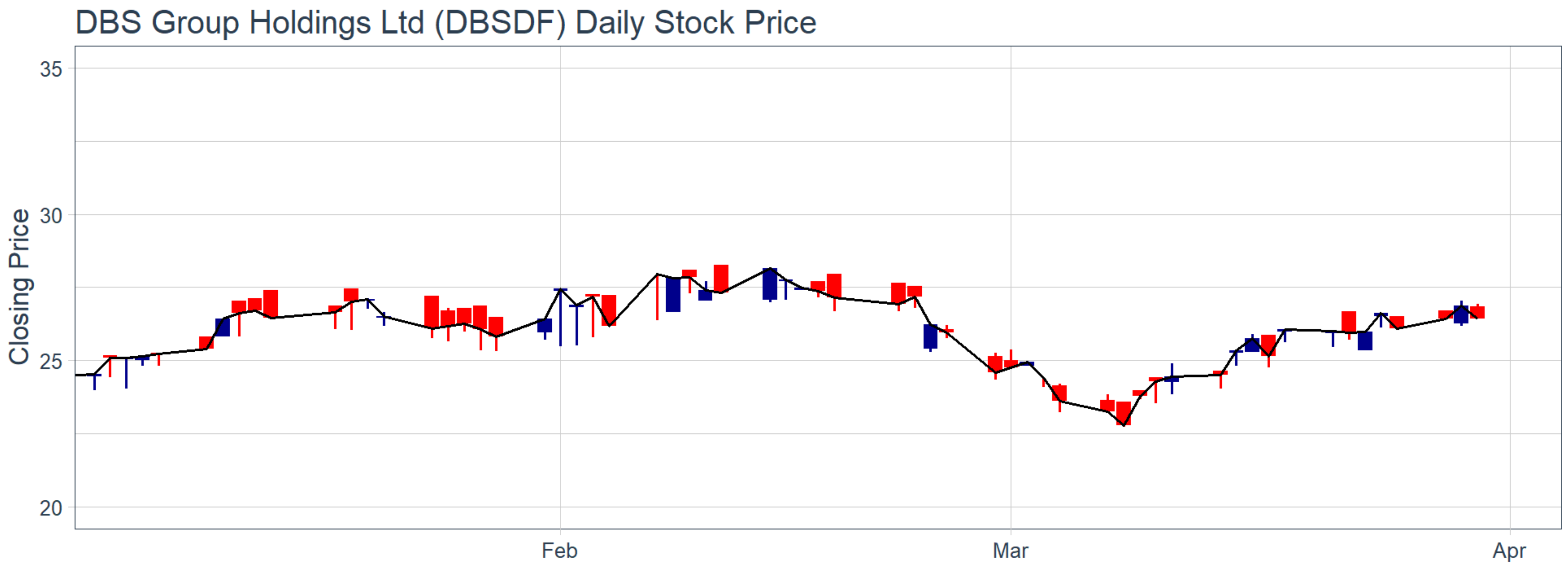
Before plotting the candlesticks, the code chunk below will be used to define the end data parameter. It will be used when setting date limits throughout the examples.

```
end <- as_date("2022-03-31")
```

Now we are ready to plot the candlesticks by using the code chunk below.

```
Stock40_daily %>%
  filter(symbol == "DBSDF") %>%
  ggplot(aes(
    x = date, y = close)) +
  geom_candlestick(aes(
    open = open, high = high,
    low = low, close = close)) +
  geom_line(size = 0.5)+
    coord_x_date(xlim = c(end - weeks(12),
                          end),
                 ylim = c(20, 35),
                 expand = TRUE) +
  labs(title = "DBS Group Holdings Ltd (DBSDF)
      y = "Closing Price", x = "") +
  theme_tq()
```

Plotting candlestick chart: tidyquant method



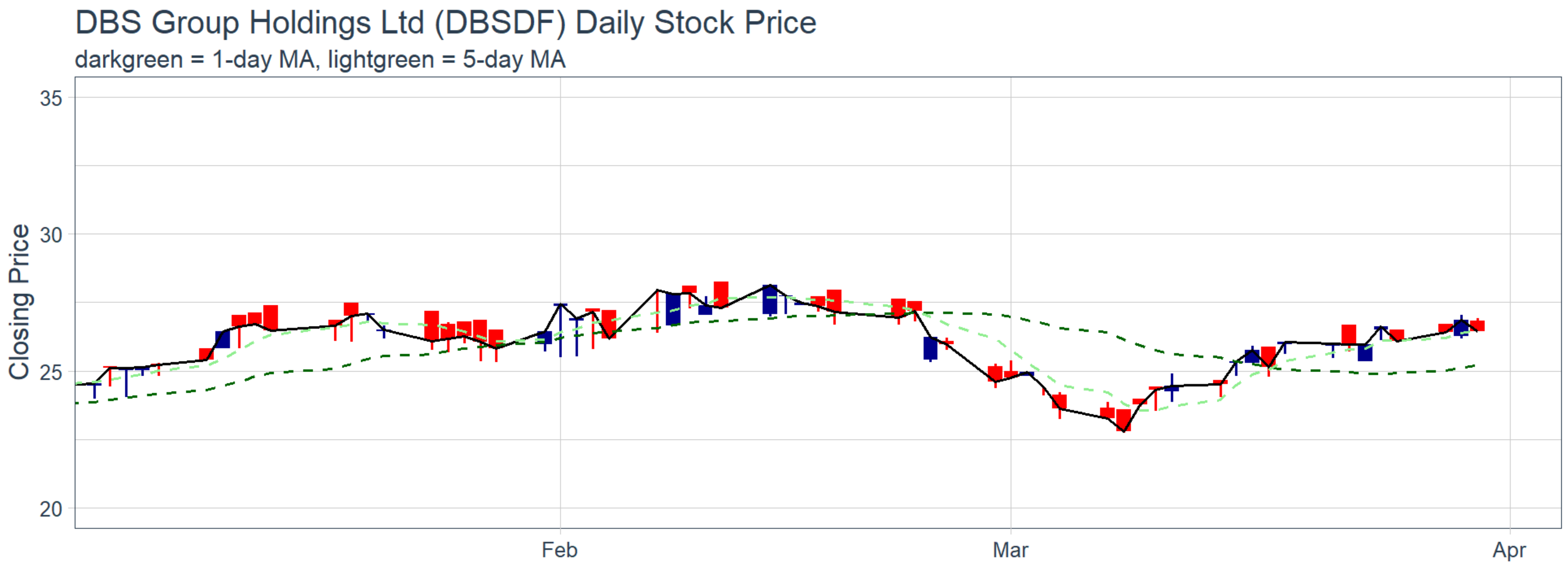
Plotting candlestick chart and MA lines: tidyquant method

```
Stock40_daily %>%
  filter(symbol == "DBSDF") %>%
  ggplot(aes(
    x = date, y = close)) +
  geom_candlestick(aes(
    open = open, high = high,
    low = low, close = close)) +
  geom_line(size = 0.5)+
  geom_ma(color = "darkgreen") +
  geom_ma(color = "lightgreen", n = 5) +
    coord_x_date(xlim = c(end - weeks(12),
                          end),
                 ylim = c(20, 35),
                 expand = TRUE) +
  labs(title = "DBS Group Holdings Ltd (DBSDF)
       subtitle = "darkgreen = 1-day MA, lightg
       y = "Closing Price", x = "") +
  theme_tq()
```

Things to learn from the code chunk:

- `geom_MA` is used to add the moving average line. It is a wrapper function of `SMA()` from the *TTR* package.

Plotting candlestick chart and MA lines: tidyquant method



Plotting Bollinger Bands: tidyquant method

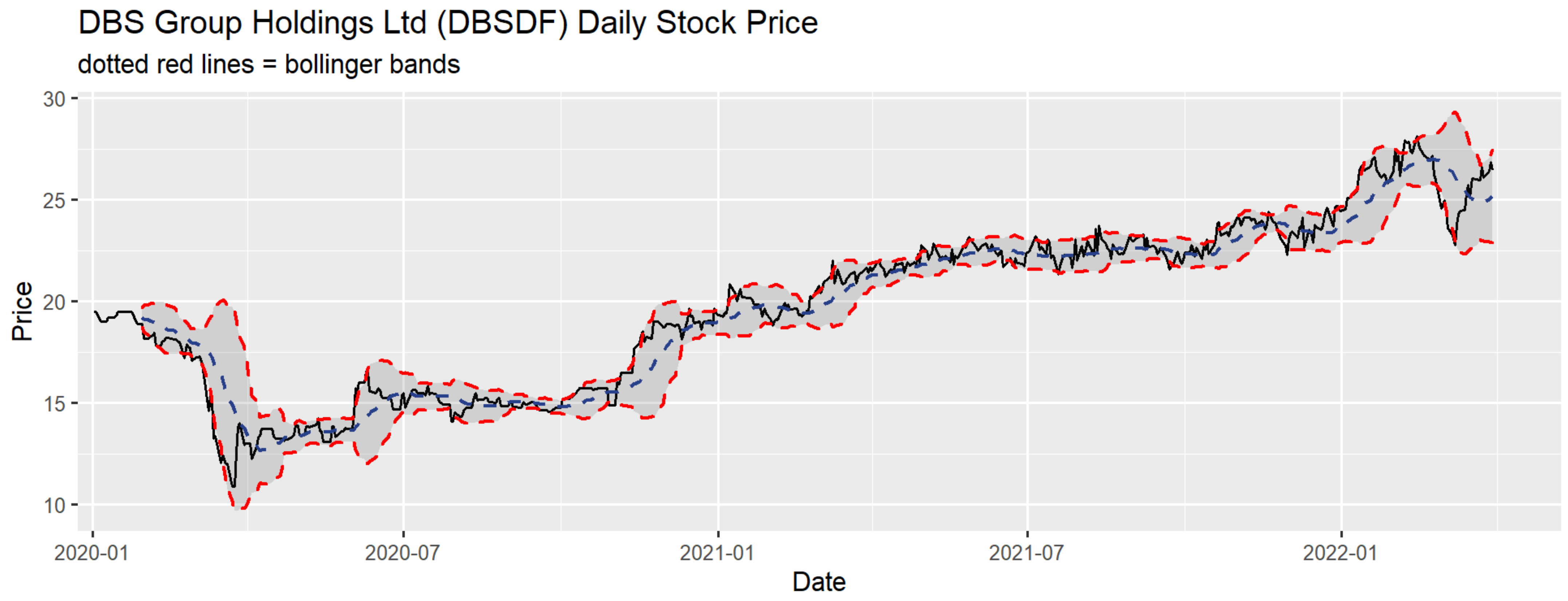
In this section, you will learn how to plot bollinger bands by using `geom_bbands()` of tidyquant package.

```
Stock40_daily %>%
  filter(symbol == "DBSDF") %>%
  ggplot(aes(x=date, y=close))+
  geom_line(size=0.5)+
  geom_bbands(aes(
    high = high, low = low, close = close),
    ma_fun = SMA, sd = 2, n = 20,
    size = 0.75, color_ma = "royalblue4",
    color_bands = "red1")+
    coord_x_date(xlim = c("2020-02-01",
                          "2022-03-31"),
                 expand = TRUE)+
    labs(title = "DBS Group Holdings Ltd (DBSD
         subtitle = "dotted red lines = bollin
         x = "Date", y ="Price") +
theme(legend.position="none")
```

Things you can learn from the code chunk:

- `geom_bbands()` plots a range around a moving average typically two standard deviations up and down. The moving average functions used are specified in `SMA()` from the *TTR* package.

Plotting Bollinger Bands: tidyquant methods



Plotting Interactive Candlesticks Chart: ggplot2 and plotly R method

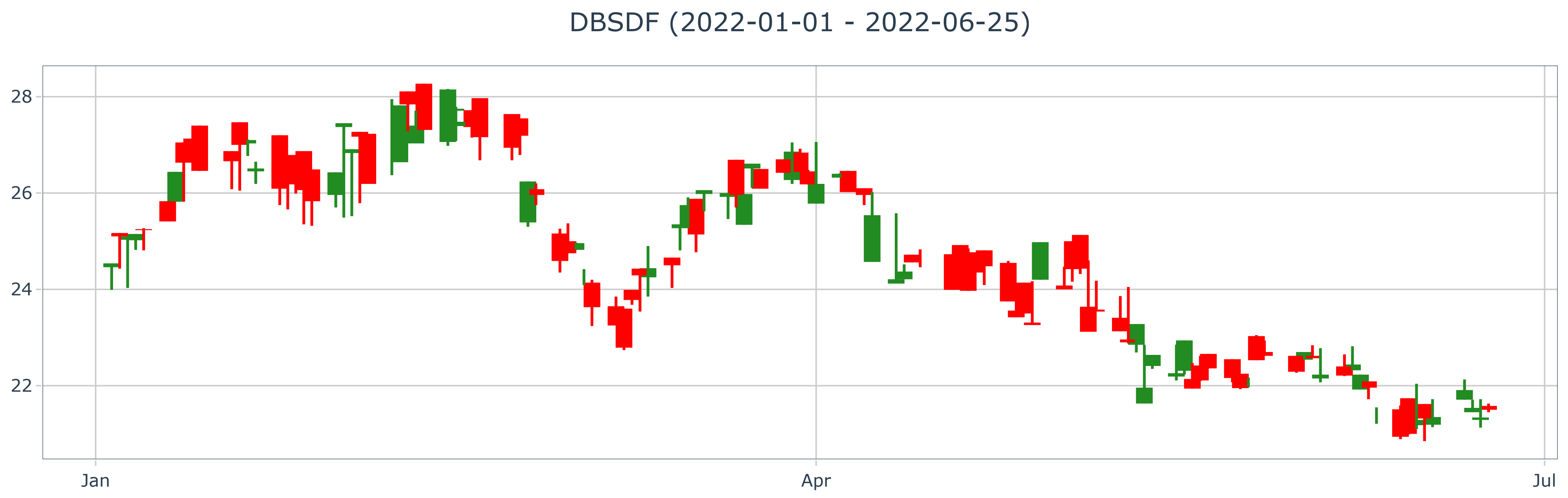
First, a `candleStick_plot` function is written as follows:

```r
candleStick_plot<-function(symbol, from, to){
  tq_get(symbol, from = from, to = to, warnings = FALSE) %>%
    mutate(greenRed=ifelse(open-close>0, "Red", "Green")) %>%
    ggplot()+
    geom_segment(aes(x = date, xend=date, y =open, yend =close, colour=greenRed), size=3)+
    theme_tq()+
    geom_segment(aes(x = date, xend=date, y =high, yend =low, colour=greenRed))+
    scale_color_manual(values=c("ForestGreen","Red"))+
    ggtitle(paste0(symbol," (",from," - ",to,")"))+
    theme(legend.position ="none",
          axis.title.y = element_blank(),
          axis.title.x=element_blank(),
          axis.text.x = element_text(angle = 0, vjust = 0.5, hjust=1),
          plot.title= element_text(hjust=0.5))
}
```

Credit: I learned this trick from RObservations #12: Making a Candlestick plot with the ggplot2 and tidyquant packages

Plotting interactive candlestick chart: ggplot2 and plotly R method

```
p <- candleStick_plot("DBSDF",
                      from = '2022-01-01',
                      to = today())
ggplotly(p)
```


DBSDF (2022-01-01 - 2022-06-25)
Jan
Apr
Jul