

# How to use R to analyze stock market

Use R packages quantmod to analyze stock price of Ford Motor Company and Tesla

## Introduction

Until now, we have learned several ways to draw graphs to analyze the nba data. R is a practical language we could use to analyze the things happened in the real life. For this post, I choose to use R packages quantmod and plotly to analyze the stock price of Ford Motor Company. For the post1, I focused on the stock history of Tesla, this time I will compare the stock of Ford Motor Company with Tesla. For the first part of the post2, I will focus on the stock of the Ford Motor Company, on the last part of the post2, I will compare two company about stock split. The reason why I chose to analyze stock price is I want to become a financial analyst one day, and I want to practice what we learned in class to real life.

## 1. Getting Ford Motor Company data

Let's get Ford Motor Company data; Ford Motor Company's ticker symbol is F. We use the quantmod function getSymbols, and pass a string as a first argument to identify the desired ticker symbol, pass "yahoo" to src for Yahoo! Finance, and from and to specify date ranges. The default behavior for getSymbols is to load data directly into the global environment, with the object being named after the loaded ticker symbol.

```
library(quantmod)
```

```
## Warning: package 'quantmod' was built under R version 3.4.2
```

```
## Loading required package: xts
```

```
## Loading required package: zoo
```

```
##  
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':  
##  
## as.Date, as.Date.numeric
```

```
## Loading required package: TTR
```

```
## Version 0.4-0 included new data defaults. See ?getSymbols.
```

```
start <- as.Date("2016-01-01")  
end <- as.Date("2017-12-01")  
  
getSymbols("F", src="yahoo", from = start, to = end)
```

```
## 'getSymbols' currently uses auto.assign=TRUE by default, but will  
## use auto.assign=FALSE in 0.5-0. You will still be able to use  
## 'loadSymbols' to automatically load data. getOption("getSymbols.env")  
## and getOption("getSymbols.auto.assign") will still be checked for  
## alternate defaults.  
##  
## This message is shown once per session and may be disabled by setting  
## options("getSymbols.warning4.0"=FALSE). See ?getSymbols for details.
```

```
##  
## WARNING: There have been significant changes to Yahoo Finance data.  
## Please see the Warning section of '?getSymbols.yahoo' for details.  
##  
## This message is shown once per session and may be disabled by setting  
## options("getSymbols.yahoo.warning"=FALSE).
```

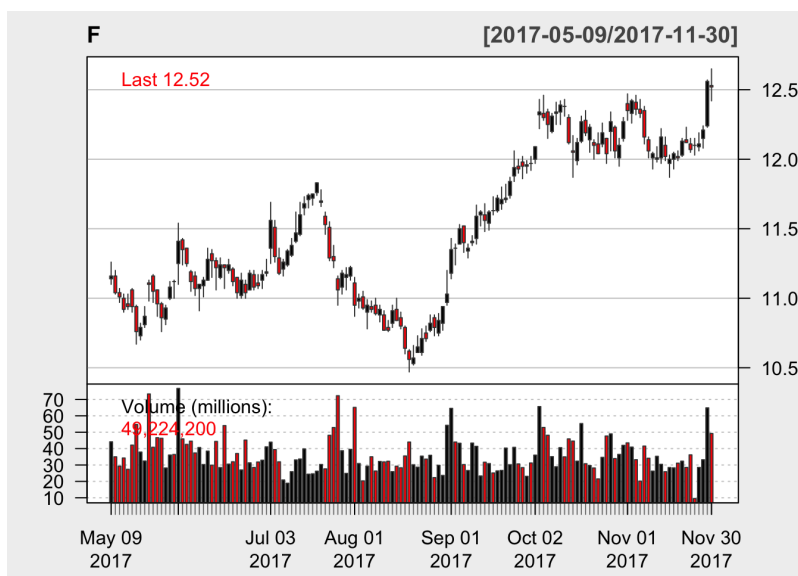
```
## [1] "F"
```

## 2. Visualizing Stock Data

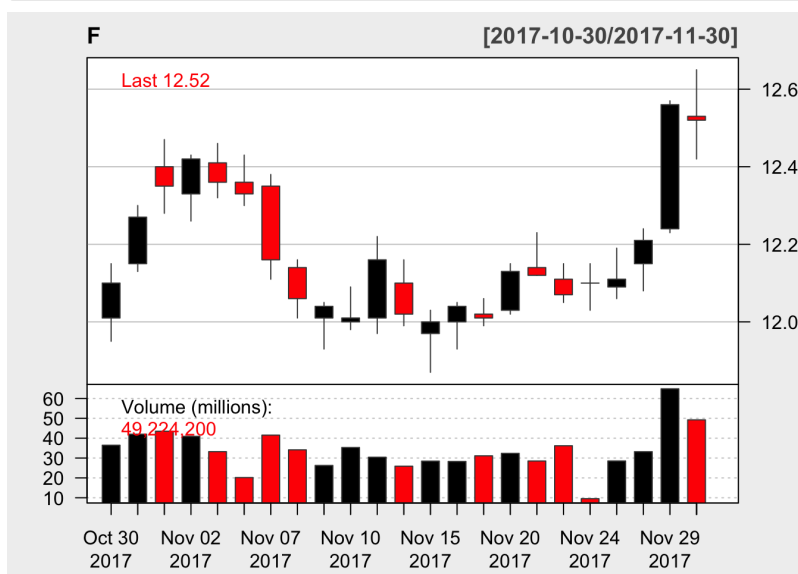
There is a one of famous chart in financial market called Japanese candlestick plot and it was named because it was first created by 18th century Japanese rice traders. In the trading system, candlestick plot is the main chart we need to deal with. And there are several ways to get the candlestick plot. I will show three ways to get the candlestick chart.

1) Use the function candleChart() in package quantmod to create the candlestick chart. I chose the date from May 9th to Nov 30th 2017. We could change the subset to also get the date from Oct 28th to Nov 30th 2017.

```
candleChart(F, up.col = "black", dn.col = "red", theme = "white", subset = "2017-05-09/")
```



```
candleChart(F, up.col = "black", dn.col = "red", theme = "white", subset = "2017-10-28/")
```



2) Use the function `chartSeries()` in package `quantmod` to create the candlestick chart. I chose the date from Oct 28th to Nov 30th 2017. We could change the subset to also get the date from Oct 28th to Nov 30th 2017

```
chartSeries(F, subset = '20170509/', type='candlesticks')
```



```
chartSeries(F, subset = '20171028/', type='candlesticks')
```



3) Use the function `plot_ly()` from `plotly` to create such a chart. And this chart is much useful, since we could get the data from the chart based on date. Take October 3rd as an example, we could immediately know that the price for open, close, high, and low are: 335.9, 348.55, 331.28, and 348.14. We could change the subset to also get the date from Oct 28th to Nov 30th 2017.

```
# basic example of ohlc charts
library(plotly)
```

```
## Loading required package: ggplot2
```

```
##
## Attaching package: 'plotly'
```

```
## The following object is masked from 'package:ggplot2':
##
## last_plot
```

```
## The following object is masked from 'package:stats':
##
## filter
```

```
## The following object is masked from 'package:graphics':
##
## layout
```

```
getSymbols("TSLA", src = "yahoo")
```

```
## [1] "TSLA"
```

```
df <- data.frame(Date=index(TSLA),coredata(TSLA))
df <- tail(df, 200)
```

```
p <- df %>%
  plot_ly(x = ~Date, type="candlestick",
    open = ~TSLA.Open, close = ~TSLA.Close,
    high = ~TSLA.High, low = ~TSLA.Low) %>%
  layout(title = "Basic Candlestick Chart")
p
```

```
library(plotly)
getSymbols("TSLA", src = "yahoo")
```

```
## [1] "TSLA"
```

```
df <- data.frame(Date=index(TSLA),coredata(TSLA))
df <- tail(df, 30)

p <- df %>%
  plot_ly(x = ~Date, type="candlestick",
    open = ~TSLA.Open, close = ~TSLA.Close,
    high = ~TSLA.High, low = ~TSLA.Low) %>%
  layout(title = "Basic Candlestick Chart")
p
```

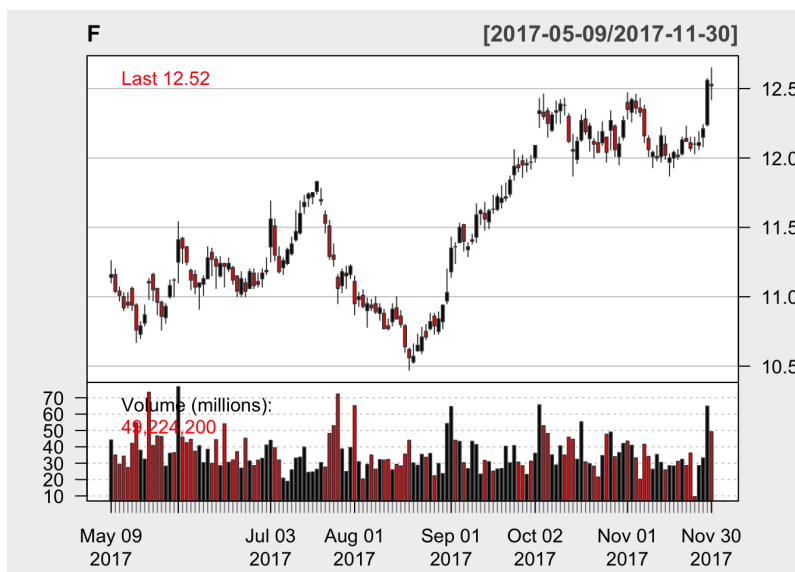
### 3. Use moving average crossover strategy to analyze data.

After we create the candlestick chart we need to use it to analyze the market otherwise the chart means worthless. I will display an important strategy called moving average strategy. We will use two moving averages, one we consider "fast", and the other "slow". The strategy is: Trade the asset when the fast moving average crosses over the slow moving average. Exit the trade when the fast moving average crosses over the slow moving average again. From the graph we could tell, there are five crosses over during the period and it is the important signal to tell us the tendency of the market will change.

```
getSymbols("F", src="yahoo", from = start, to = end)
```

```
## [1] "F"
```

```
candleChart(F, up.col = "black", dn.col = "red", theme = "white", subset = "2017-05-09/")
```



```

F_sma_20 <- SMA(
  Cl(F), # The closing price of F, obtained by quantmod's Cl() function
  n = 20 # The number of days in the moving average window, 20 days
)

F_sma_50 <- SMA(
  Cl(F),
  n = 50
)

F_sma_200 <- SMA(
  Cl(F),
  n = 200
)

zoomChart("2017") # Zoom into the year 2017 in the chart

```



```

addTA(F_sma_20, on = 1, col = "red") # on = 1 plots the SMA with price

```



```

addTA(F_sma_50, on = 1, col = "blue")

```



```
addTA(F_sma_200, on = 1, col = "green")
```



## 4.Ford Motor Company compare with Tesla

There are 8 splits in Ford Motor stock split history. However, there is no split history in TESLA. The reason this happens because to growth stock addicts, that's a sign that Ford doesn't have enough growth, so it returns to shareholders. Tesla needs every dime because it has so much high demand. Tesla has 0.8 billion net loss, and 7 billion revenue in 2016. Ford had 4.6 billion net income, and 151.8 billion revenue in 2017. But in the stock market, the market capital of Tesla and Ford are: 51 billion and 44.8 billion. The reason this is happening is because Tesla growth is much faster and people have confidence in Tesla and willing to pay for it.

```
library(plotly)
library(quantmod)

getSymbols("TSLA", src='yahoo')
```

```
## [1] "TSLA"
```

```

df <- data.frame(Date=index(TSLA),coredata(TSLA))

# annotation
a <- list(text = "Stock Split",
          x = '2010-09-06',
          y = 1.02,
          xref = 'x',
          yref = 'paper',
          xanchor = 'left',
          showarrow = FALSE
)

# use shapes to create a line
l <- list(type = line,
          x0 = '2017-09-06',
          x1 = '2017-09-06',
          y0 = 0,
          y1 = 1,
          xref = 'x',
          yref = 'paper',
          line = list(color = 'black',
                      width = 0.5)
)

p <- df %>%
  plot_ly(x = ~Date, type="candlestick",
          open = ~TSLA.Open, close = ~TSLA.Close,
          high = ~TSLA.High, low = ~TSLA.Low) %>%
  layout(title = "TESLA Stock",
          annotations = a,
          shapes = l)
p

```

```

library(plotly)
library(quantmod)

getSymbols("F",src='yahoo')

```

```
## [1] "F"
```

```

df <- data.frame(Date=index(F),coredata(F))

# annotation
a <- list(text = "Stock Split",
          x = '1998-07-27',
          y = 1.02,
          xref = 'x',
          yref = 'paper',
          xanchor = 'left',
          showarrow = FALSE
        )

# use shapes to create a line
l <- list(type = line,
          x0 = '2000-07-27',
          x1 = '2000-07-27',
          y0 = 0,
          y1 = 1,
          xref = 'x',
          yref = 'paper',
          line = list(color = 'black',
                      width = 0.5)
        )

p <- df %>%
  plot_ly(x = ~Date, type="candlestick",
          open = ~F.Open, close = ~F.Close,
          high = ~F.High, low = ~F.Low) %>%
  layout(title = "Ford Motor Stock",
          annotations = a,
          shapes = l)

p

```

## Conclusion

In the post2, at the beginning, I talked about how to get the data, and create candlestick chart. Then, I displayed the important stragedy in trading system to analyze the candlestick chart. The last part of the post, I took Tesla and Ford Motor Company to compare their stock split history and how this could show us the situation of Tesla raised more capital until 2017 compared with Ford Motor Company.

## Closing thoughts

I think quantmod package is a powerful package to the people who are interested finance and there are some videos on Youtube could help you to learn more about the quantmod package.

## References

- 1.<https://finance.yahoo.com/lookup/>
- 2.<https://www.analyticsvidhya.com/blog/2017/09/comparative-stock-analysis/>
- 3.<http://www.thertrader.com>
- 4.<https://ntguardian.wordpress.com/2017/04/03/introduction-stock-market-data-r-2/>
- 5.<http://www.investopedia.com/articles/technical/02/121702.asp>
- 6.<http://www.investopedia.com/terms/s/stocksplit.asp>
- 7.<https://www.splithistory.com/tesla/>
- 8.<https://www.stocksplithistory.com/ford-motor/>
- 9.[https://www.google.com/search?client=safari&channel=mac\\_bm&tbm=fin&q=NYSE:+F&stick=H4slIAAAAAAAAAAONgecRoi3w8sc9YSmdSWtOXmNU4-ILKzsgvd80rySypFJLgYoOy-KR4uLj0c\\_UNzKtyDflqeADRGjYIOgAAAA&sa=X&ved=0ahUKEwjc6uqxsu7XAhVM0FQKHf3mB2QQ6c8CCDYwAA&biw=1279&bih=625#scso=uid\\_WiQ4nQAA7okKVPpEA](https://www.google.com/search?client=safari&channel=mac_bm&tbm=fin&q=NYSE:+F&stick=H4slIAAAAAAAAAAONgecRoi3w8sc9YSmdSWtOXmNU4-ILKzsgvd80rySypFJLgYoOy-KR4uLj0c_UNzKtyDflqeADRGjYIOgAAAA&sa=X&ved=0ahUKEwjc6uqxsu7XAhVM0FQKHf3mB2QQ6c8CCDYwAA&biw=1279&bih=625#scso=uid_WiQ4nQAA7okKVPpEA)
- 10.<http://www.businessinsider.com/tesla-value-vs-ford-gm-chart-2017-4>