Assignment-1_Naravitch.R

naravitch

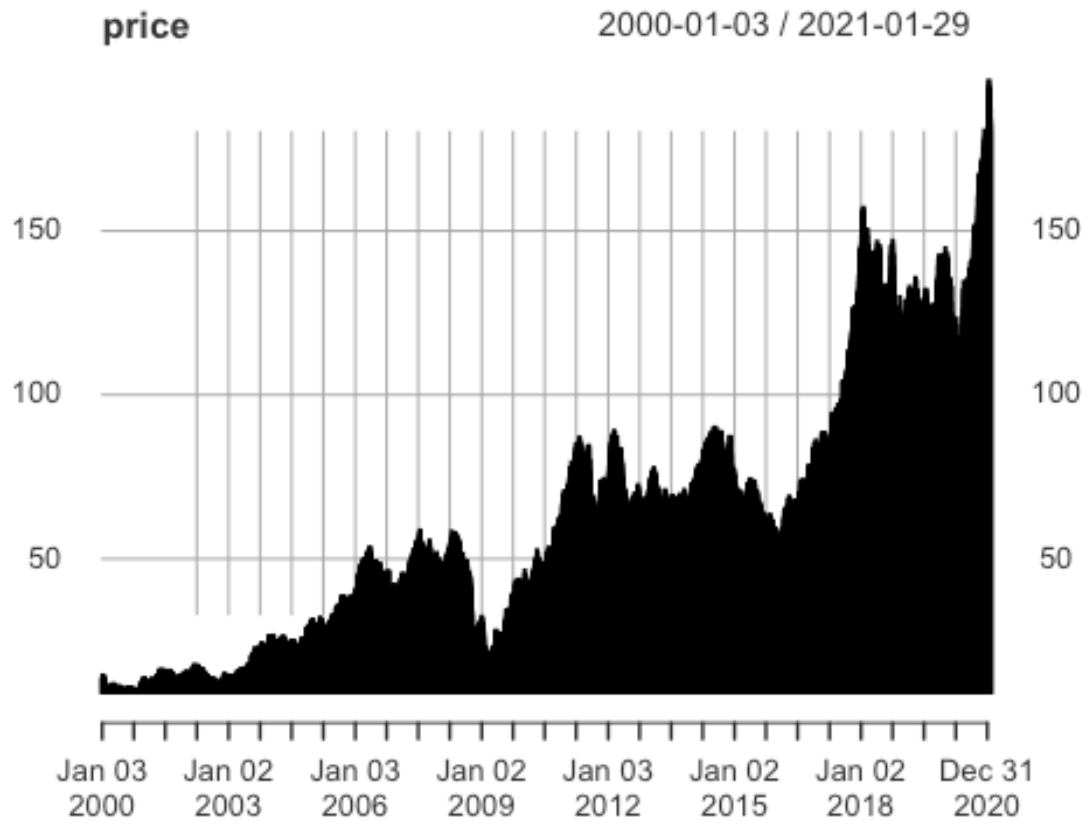
2021-02-09

```
#EE 435 Naravitch Assignment 2
setwd("/Users/naravitch/Desktop/BE/EE435")
cat(rep("\n",50))  #clear R Console

#install.packages("quantmod")
#install.packages("fBasics")
#install.packages("sn")
#install.packages("PerformanceAnalytics")
#install.packages("car")
#install.packages("tseries")
#install.packages("forecast")
library(quantmod)

## 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

## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo

library(fBasics)

## Loading required package: timeDate

## Loading required package: timeSeries

##
## Attaching package: 'timeSeries'

## The following object is masked from 'package:zoo':
##
##     time<-
```

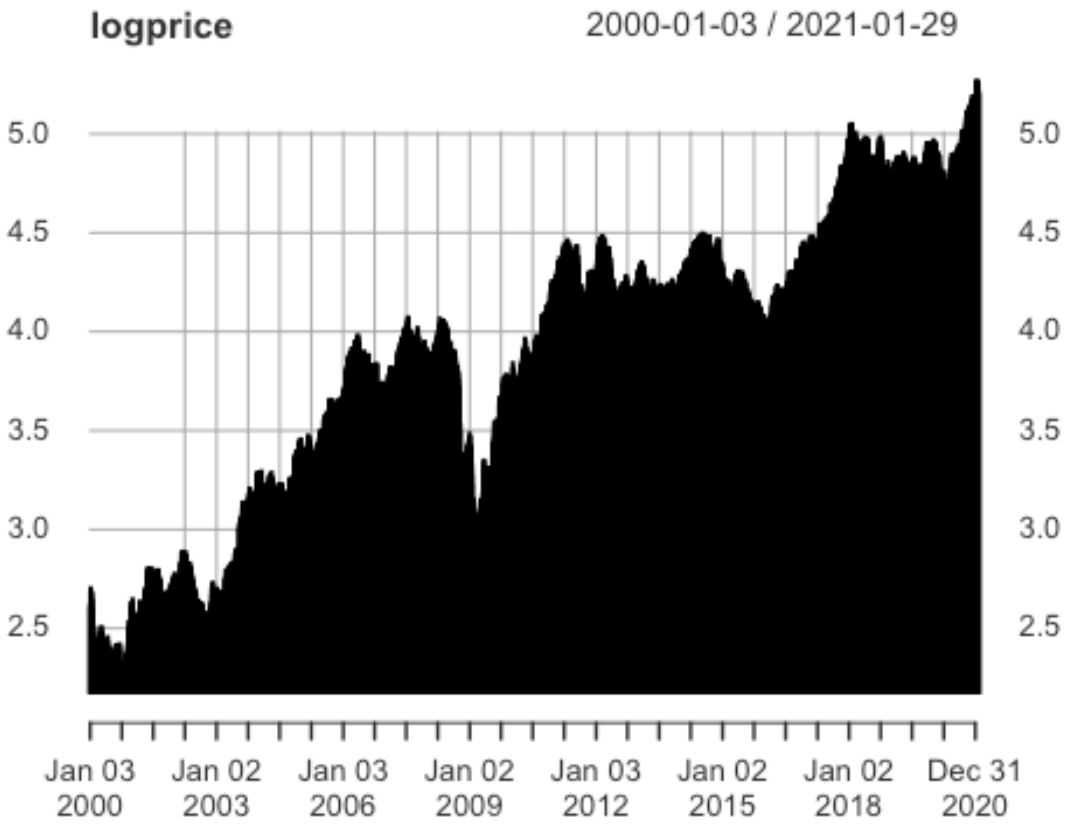
```
##
## Attaching package: 'fBasics'

## The following object is masked from 'package:TTR':
##
##     volatility

library(sn)

## Loading required package: stats4

##
## Attaching package: 'sn'

## The following object is masked from 'package:fBasics':
##
##     vech

## The following object is masked from 'package:stats':
##
##     sd

library(PerformanceAnalytics)

##
## Attaching package: 'PerformanceAnalytics'

## The following objects are masked from 'package:timeDate':
##
##     kurtosis, skewness

## The following object is masked from 'package:graphics':
##
##     legend

library(car)

## Loading required package: carData

##
## Attaching package: 'car'

## The following object is masked from 'package:fBasics':
##
##     densityPlot

library(tseries)
library(forecast)
getSymbols("CAT",from="2000-01-03",to="2021-02-01")

## '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.

## [1] "CAT"

dim(CAT)

## [1] 5303    6

head(CAT)

##            CAT.Open CAT.High  CAT.Low CAT.Close CAT.Volume CAT.Adjusted
## 2000-01-03 23.84375 24.50000 23.84375  24.31250    5055000     13.75500
## 2000-01-04 24.31250 24.87500 24.00000  24.00000    6181400     13.57821
## 2000-01-05 24.00000 25.09375 24.00000  24.56250    6398600     13.89644
## 2000-01-06 25.28125 26.12500 25.28125  25.81250    5140600     14.60364
## 2000-01-07 26.37500 27.56250 26.37500  26.65625    6360200     15.08100
## 2000-01-10 26.65625 27.28125 25.75000  25.78125    3682200     14.58597

tail(CAT)

##            CAT.Open CAT.High CAT.Low CAT.Close CAT.Volume CAT.Adjusted
## 2021-01-22   190.85   192.82  189.31    191.94    2027000       191.94
## 2021-01-25   190.56   191.37  186.97    187.34    3837100       187.34
## 2021-01-26   187.60   189.41  186.83    187.21    2506000       187.21
## 2021-01-27   184.20   185.55  179.34    180.63    4095300       180.63
## 2021-01-28   182.26   187.61  181.31    184.34    3445400       184.34
## 2021-01-29   183.50   188.82  180.73    182.84    4540100       182.84

da=CAT
chartSeries(CAT,theme="white")
```

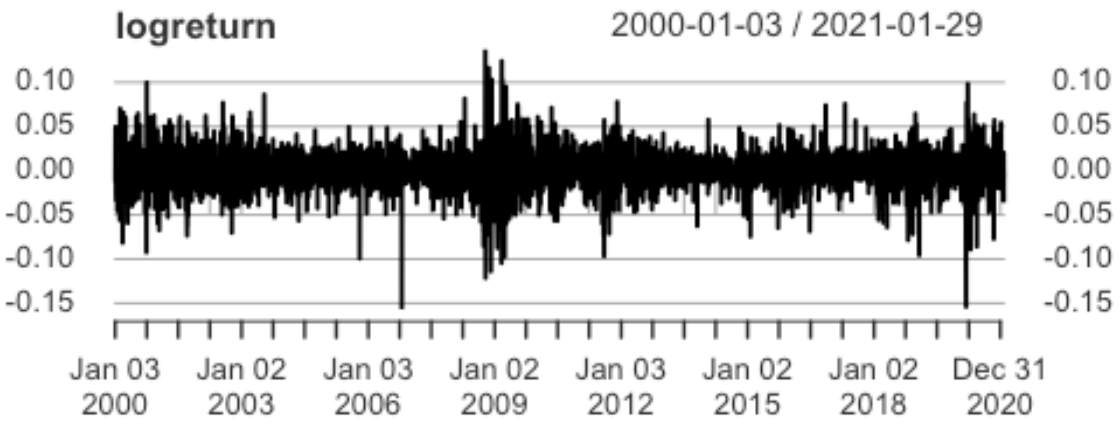

```
price=da[,6]

plot(price,type=1)
```

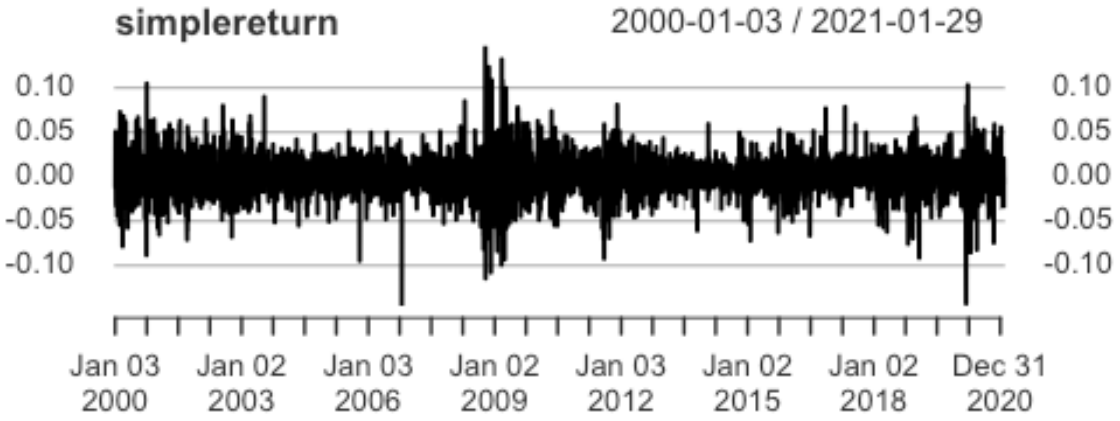



```
logprice=log(price)
plot(logprice,type=1)
```




```r
logreturn=diff(log(price))
simplereturn <-exp(logreturn)-1

#1 Plot the series of log return and simple return
par(mfrow=c(2,1))
plot(logreturn,type='l')
plot(simplereturn)
```



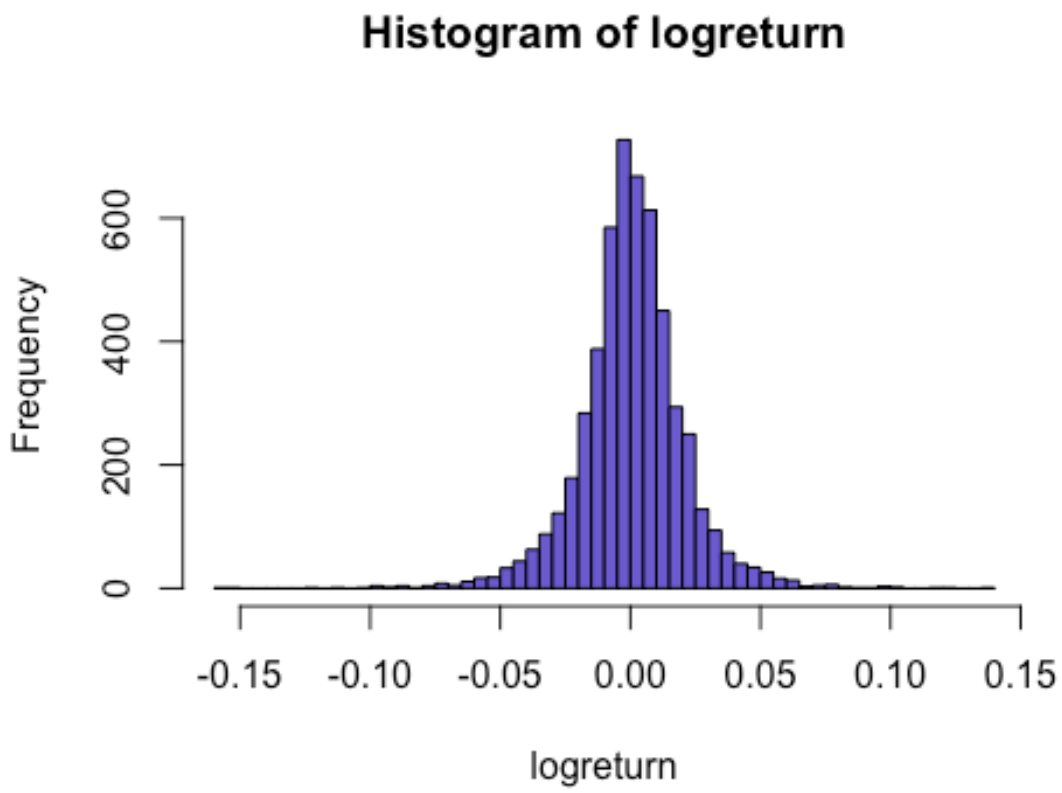



```
table.Stats(simplereturn)
```

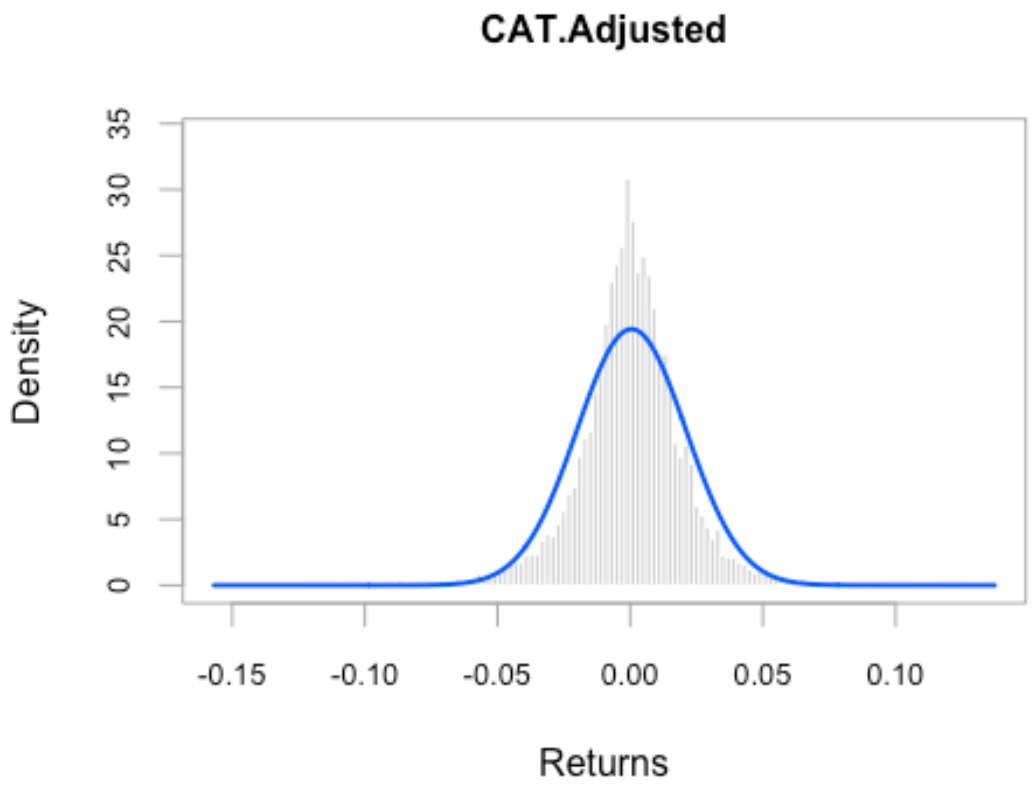
```
##                  CAT.Adjusted
## Observations       5302.0000
## NAs                   1.0000
## Minimum              -0.1452
## Quartile 1           -0.0095
## Median                0.0005
## Arithmetic Mean       0.0007
## Geometric Mean        0.0005
## Quartile 3            0.0110
## Maximum               0.1472
## SE Mean               0.0003
## LCL Mean (0.95)       0.0001
## UCL Mean (0.95)       0.0013
## Variance              0.0004
## Stdev                 0.0205
## Skewness              0.0197
## Kurtosis              4.5480
```

```
newlogreturn <-logreturn[2:nrow(logreturn),]
newsimplereturn <-simplereturn[2:nrow(simplereturn),]
```

```
par(mfrow=c(1,1))
hist(logreturn, breaks=100, col="slateblue")
```




```
chart.Histogram(logreturn,methods = c("add.normal"))
```

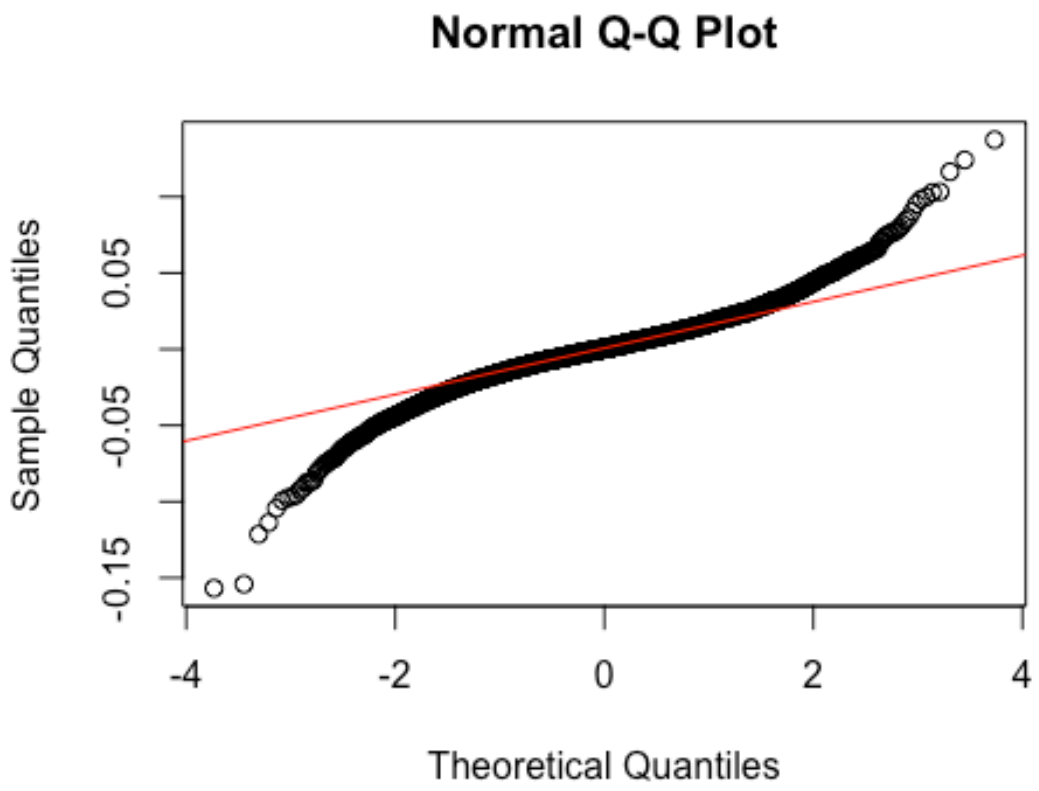



```
table.Stats(logreturn)
```

```
##                  CAT.Adjusted
## Observations       5302.0000
## NAs                   1.0000
## Minimum              -0.1569
## Quartile 1           -0.0095
## Median                0.0005
## Arithmetic Mean       0.0005
## Geometric Mean        0.0003
## Quartile 3            0.0110
## Maximum               0.1373
## SE Mean               0.0003
## LCL Mean (0.95)      -0.0001
## UCL Mean (0.95)       0.0010
## Variance              0.0004
## Stdev                 0.0205
## Skewness             -0.1836
## Kurtosis              4.6982
```

```
#3 QQ-plots and tests for normality
# use qqnorm function
par(mfrow=c(1,1))
```

```
qqnorm(newlogreturn)
qqline(newlogreturn, col = 2)
```




```
jarque.bera.test(newlogreturn)

##
##  Jarque Bera Test
##
## data:  newlogreturn
## X-squared = 4906.1, df = 2, p-value < 2.2e-16

table.Stats(logreturn)

##                 CAT.Adjusted
## Observations       5302.0000
## NAs                   1.0000
## Minimum              -0.1569
## Quartile 1           -0.0095
## Median                0.0005
## Arithmetic Mean       0.0005
## Geometric Mean        0.0003
## Quartile 3            0.0110
## Maximum               0.1373
## SE Mean               0.0003
```

```
## LCL Mean (0.95)      -0.0001
## UCL Mean (0.95)       0.0010
## Variance              0.0004
## Stdev                 0.0205
## Skewness             -0.1836
## Kurtosis              4.6982
```

```
#Test mean = 0
t.test(newlogreturn)
```

```
## Warning in tstat + c(-cint, cint): Recycling array of length 1 in array-ve
ctor arithmetic is deprecated.
##   Use c() or as.vector() instead.
```

```
## Warning in cint * stderr: Recycling array of length 1 in vector-array arit
hmetic is deprecated.
##   Use c() or as.vector() instead.
```

```
##
##  One Sample t-test
##
## data:  newlogreturn
## t = 1.7296, df = 5301, p-value = 0.08377
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -6.513168e-05  1.041069e-03
## sample estimates:
##    mean of x
## 0.0004879685
```

```
#5 Test Skewness = 0
T=length(newlogreturn)
s3=skewness(newlogreturn)
tst = s3/sqrt(6/T)
tst
```

```
## [1] -5.458812
```

```
pv = 2*pnorm(tst)
pv
```

```
## [1] 4.793299e-08
```

```
#6 Test excess kurtosis = 0
k4=kurtosis(newlogreturn)
tst=k4/sqrt(24/T)
tst
```

```
## [1] 69.83078
```

```
pv = 2*(1-pnorm(tst))
pv
```

```
## [1] 0
```

```
getSymbols("AOT.BK",from="2000-01-03",to="2021-02-01")
```

```
## [1] "AOT.BK"
```

```
dim(AOT.BK)
```

```
## [1] 4159    6
```

```
head(AOT.BK)
```

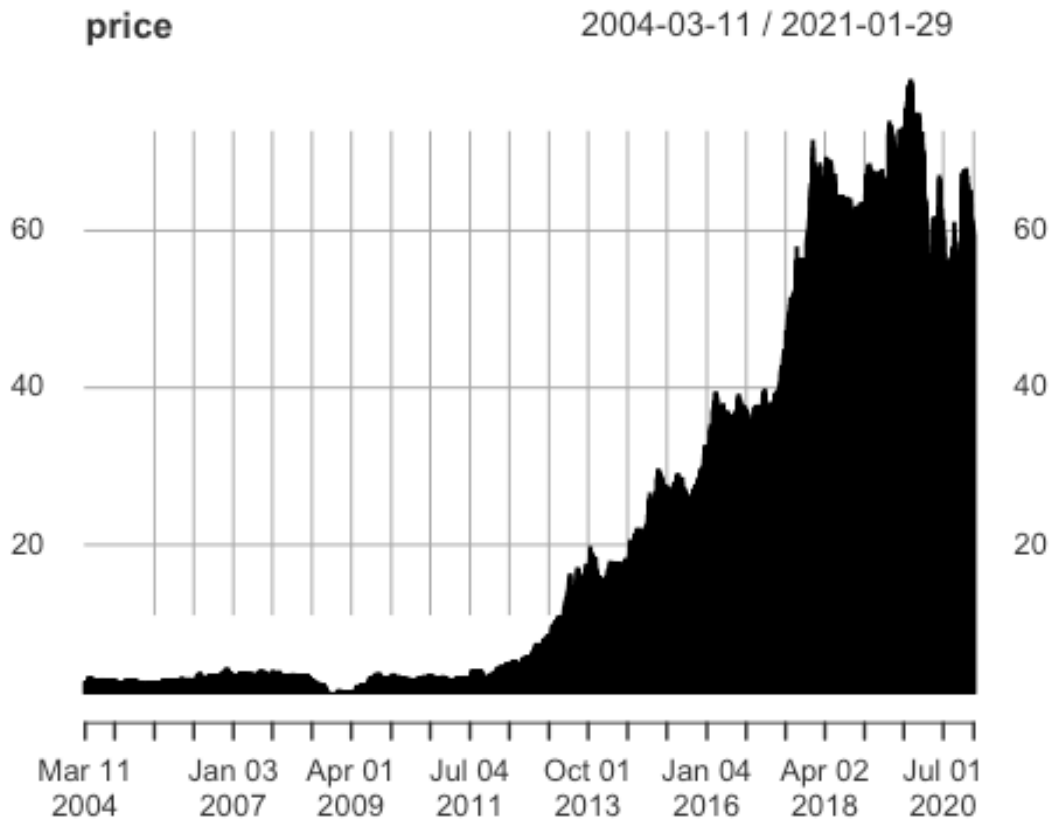
```
##            AOT.BK.Open AOT.BK.High AOT.BK.Low AOT.BK.Close AOT.BK.Volume
## 2004-03-11       4.500       4.800      4.425        4.800      17414690
## 2004-03-12       4.700       4.775      4.600        4.600     668350000
## 2004-03-15       4.625       4.650      4.550        4.550     346345000
## 2004-03-16       4.525       4.575      4.500        4.525     136384000
## 2004-03-17       4.550       4.600      4.550        4.600      88608000
## 2004-03-18       4.650       4.925      4.650        4.775     434665000
##            AOT.BK.Adjusted
## 2004-03-11        2.668538
## 2004-03-12        2.557348
## 2004-03-15        2.529552
## 2004-03-16        2.515653
## 2004-03-17        2.557348
## 2004-03-18        2.654639
```

```
tail(AOT.BK)
```

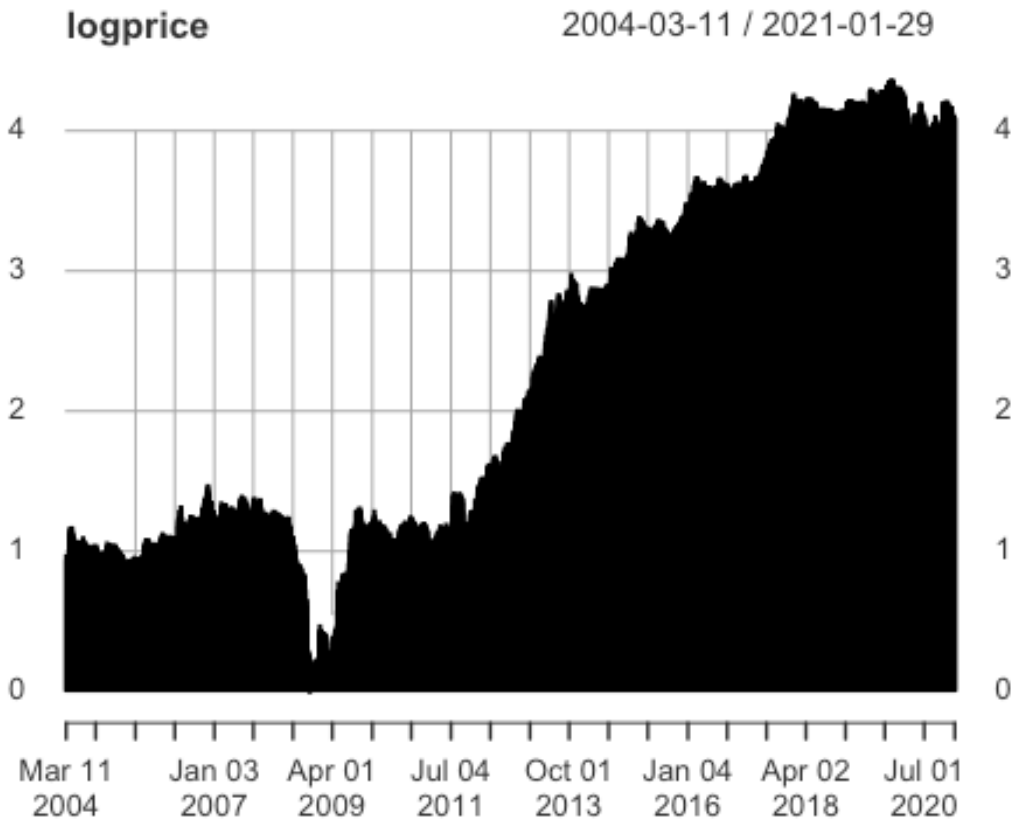
```
##            AOT.BK.Open AOT.BK.High AOT.BK.Low AOT.BK.Close AOT.BK.Volume
## 2021-01-22       60.50       60.75       59.5        59.75      27812300
## 2021-01-25       59.75       60.50       59.5        59.75      10446500
## 2021-01-26       59.75       60.75       59.5        60.25      15439500
## 2021-01-27       60.25       60.75       60.0        60.25      12355000
## 2021-01-28       59.50       60.50       59.5        60.00      19675400
## 2021-01-29       60.25       60.50       59.5        59.50      23994200
##            AOT.BK.Adjusted
## 2021-01-22           59.75
## 2021-01-25           59.75
## 2021-01-26           60.25
## 2021-01-27           60.25
## 2021-01-28           60.00
## 2021-01-29           59.50
```

```
da=AOT.BK
chartSeries(AOT.BK,theme="white")
```

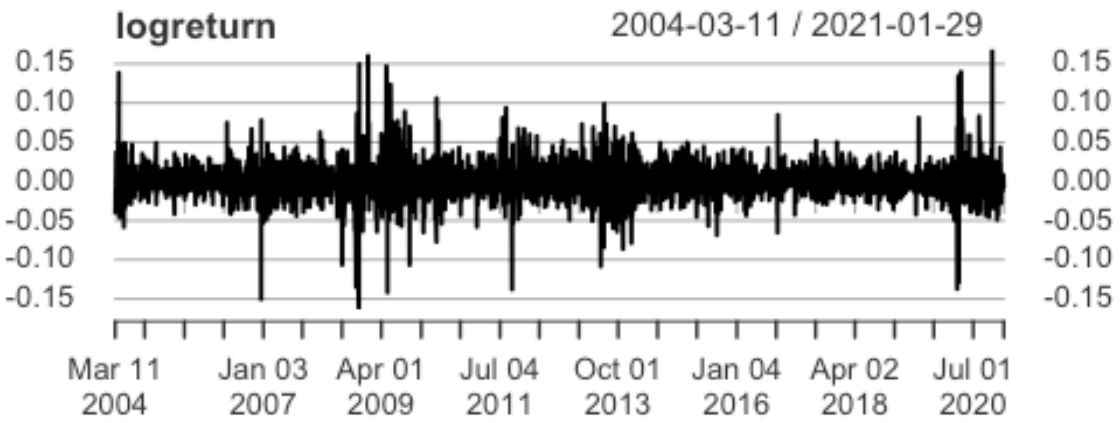

```
price=da[,6]

plot(price,type=1)
```

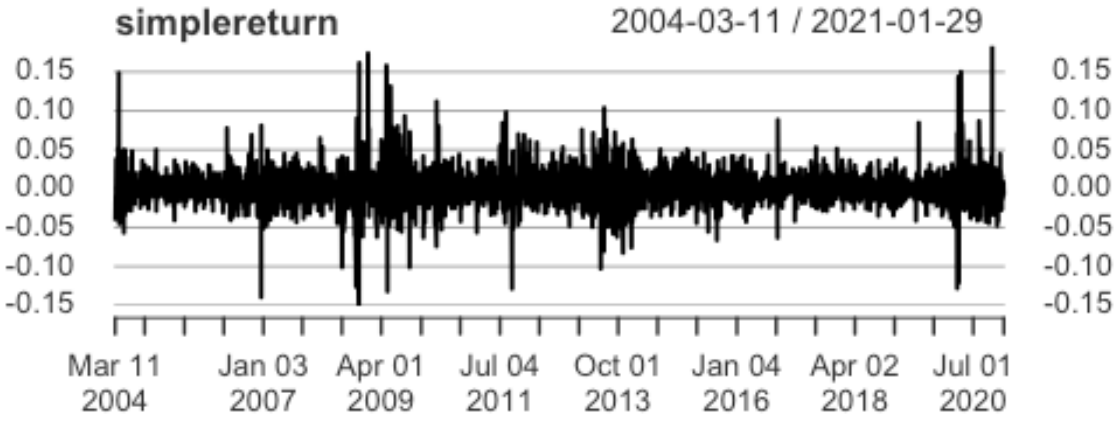



```
logprice=log(price)
plot(logprice,type=1)
```




```
logreturn=diff(log(price))
simplereturn <-exp(logreturn)-1

#1 Plot the series of log return and simple return
par(mfrow=c(2,1))
plot(logreturn,type='l')
plot(simplereturn)
```



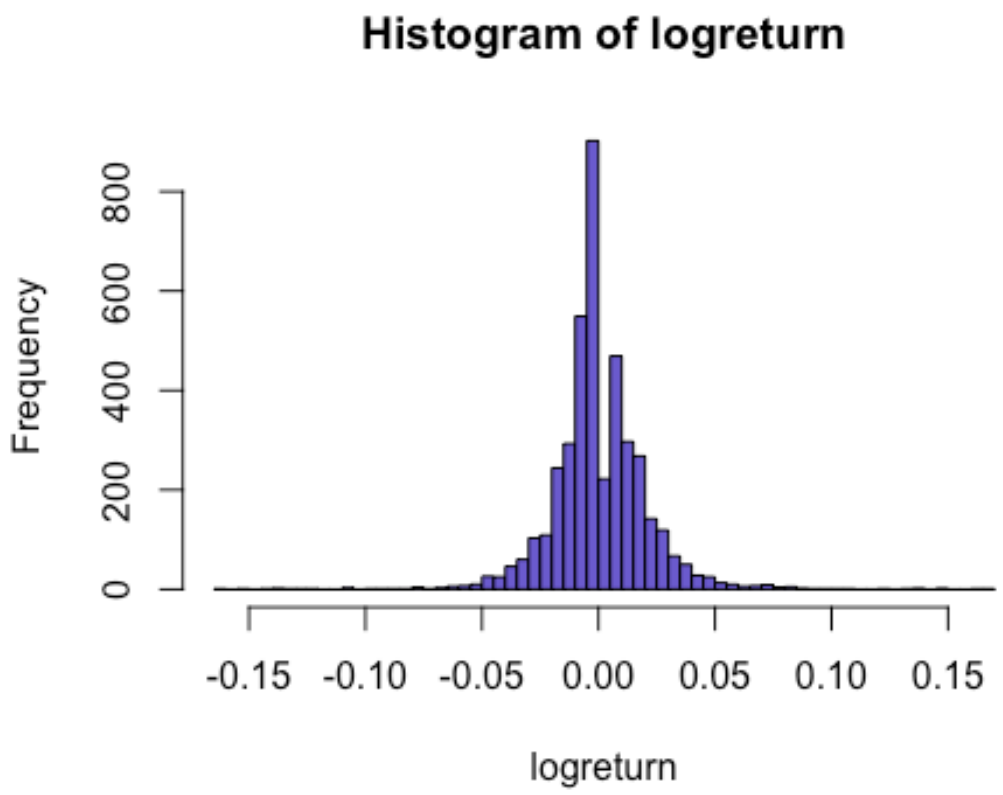



```
table.Stats(simplereturn)
```

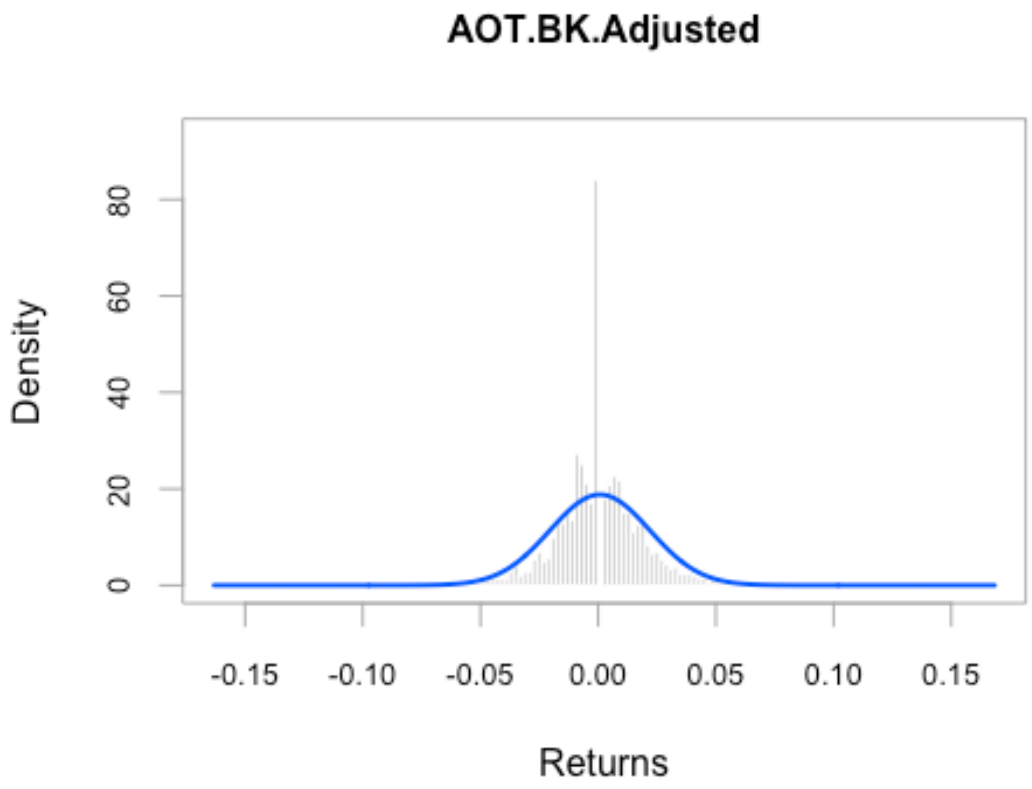
```
##                  AOT.BK.Adjusted
## Observations          4158.0000
## NAs                     1.0000
## Minimum                -0.1505
## Quartile 1             -0.0093
## Median                  0.0000
## Arithmetic Mean         0.0010
## Geometric Mean          0.0007
## Quartile 3              0.0103
## Maximum                 0.1834
## SE Mean                 0.0003
## LCL Mean (0.95)         0.0003
## UCL Mean (0.95)         0.0016
## Variance                0.0005
## Stdev                   0.0213
## Skewness                0.5443
## Kurtosis               10.0827
```

```
newlogreturn <-logreturn[2:nrow(logreturn),]
newsimplereturn <-simplereturn[2:nrow(simplereturn),]
```

```
par(mfrow=c(1,1))
hist(logreturn, breaks=100, col="slateblue")
```




```
chart.Histogram(logreturn,methods = c("add.normal"))
```

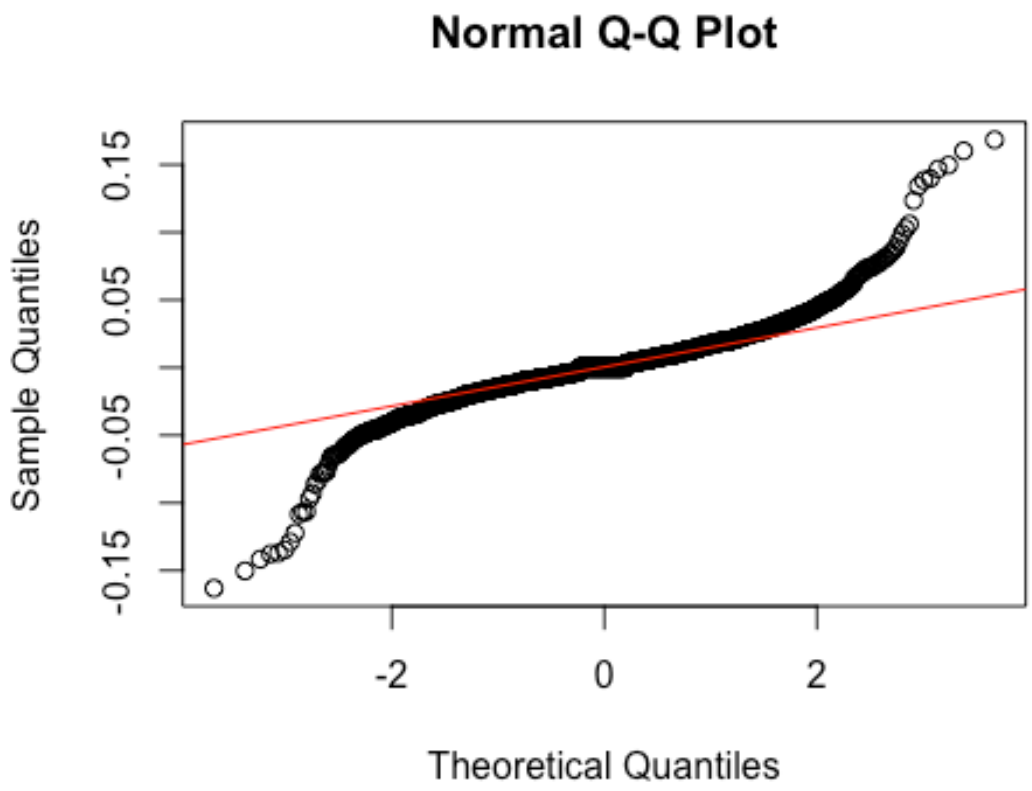



```
table.Stats(logreturn)
```

```
##                  AOT.BK.Adjusted
## Observations          4158.0000
## NAs                      1.0000
## Minimum                 -0.1632
## Quartile 1              -0.0093
## Median                   0.0000
## Arithmetic Mean          0.0007
## Geometric Mean           0.0005
## Quartile 3               0.0102
## Maximum                  0.1684
## SE Mean                  0.0003
## LCL Mean (0.95)          0.0001
## UCL Mean (0.95)          0.0014
## Variance                 0.0004
## Stdev                    0.0212
## Skewness                 0.1746
## Kurtosis                 9.6096
```

```
#3 QQ-plots and tests for normality
# use qqnorm function
par(mfrow=c(1,1))
```

```
qqnorm(newlogreturn)
qqline(newlogreturn, col = 2)
```




```
jarque.bera.test(newlogreturn)

##
##  Jarque Bera Test
##
## data:  newlogreturn
## X-squared = 16020, df = 2, p-value < 2.2e-16

table.Stats(logreturn)

##                 AOT.BK.Adjusted
## Observations          4158.0000
## NAs                      1.0000
## Minimum                 -0.1632
## Quartile 1              -0.0093
## Median                   0.0000
## Arithmetic Mean          0.0007
## Geometric Mean           0.0005
## Quartile 3               0.0102
## Maximum                  0.1684
## SE Mean                  0.0003
```

```
## LCL Mean (0.95)          0.0001
## UCL Mean (0.95)          0.0014
## Variance                 0.0004
## Stdev                    0.0212
## Skewness                 0.1746
## Kurtosis                 9.6096
```

```
#Test mean = 0
t.test(newlogreturn)
```

```
## Warning in tstat + c(-cint, cint): Recycling array of length 1 in array-ve
ctor arithmetic is deprecated.
##   Use c() or as.vector() instead.

## Warning in tstat + c(-cint, cint): Recycling array of length 1 in vector-a
rray arithmetic is deprecated.
##   Use c() or as.vector() instead.

##
##  One Sample t-test
##
## data:  newlogreturn
## t = 2.2696, df = 4157, p-value = 0.02328
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.0001016629 0.0013915769
## sample estimates:
##    mean of x
## 0.0007466199
```

```
#5 Test Skewness = 0
T=length(newlogreturn)
s3=skewness(newlogreturn)
tst = s3/sqrt(6/T)
tst
```

```
## [1] 4.596526
```

```
pv = 2*(1-pnorm(tst))
pv
```

```
## [1] 4.29594e-06
```

```
#6 Test excess kurtosis = 0
k4=kurtosis(newlogreturn)
tst = k4/sqrt(24/T)
tst
```

```
## [1] 126.4855
```

```
pv = 2*(1-pnorm(tst))
pv
```

```
## [1] 0
```