Assigment2_6004641236.R

Admin

2021-02-09

```
setwd("D:/MyGames/RStudio/works")
cat(rep("\n",50))

#Direction and clear cache

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)
#Basic libraries

getSymbols("CAT", from="2000-01-03",to="2021-01-31")

## '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"
```

```
getSymbols("AOT.BK", from="2000-01-03",to="2020-01-31")
```

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

```
#get the data from CAT and AOT.BK
```

```
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
```

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

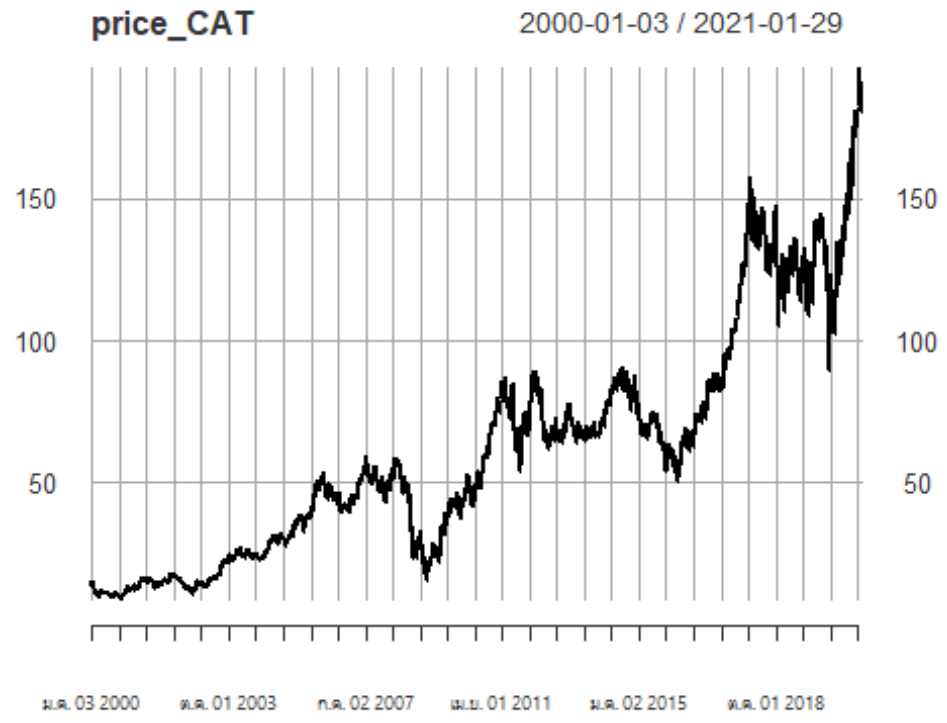
```
## [1] 3917    6
```

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

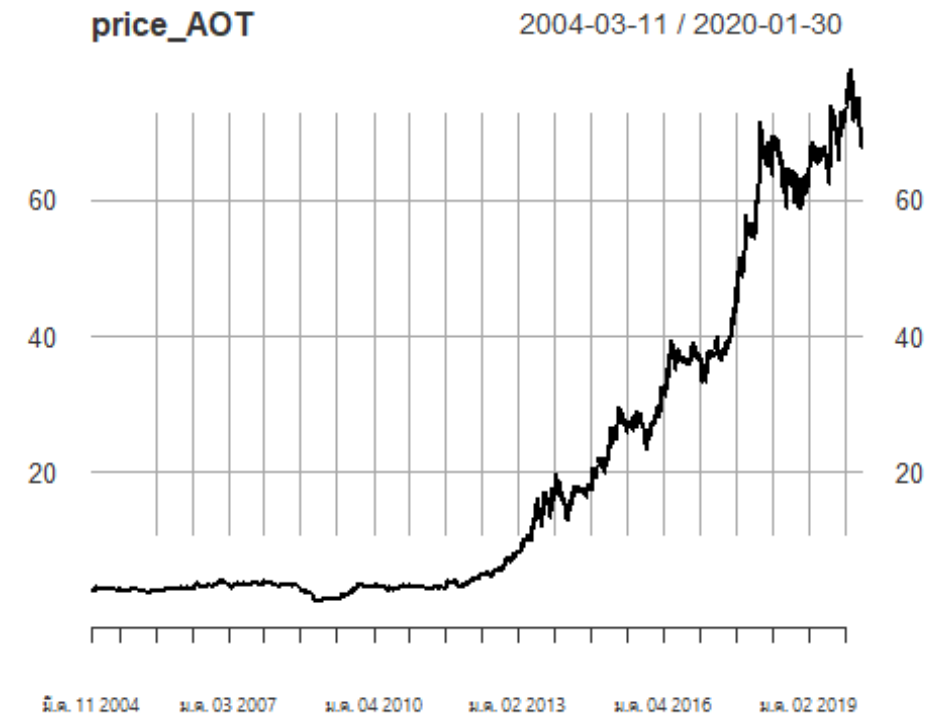
```
##            AOT.BK.Open AOT.BK.High AOT.BK.Low AOT.BK.Close AOT.BK.Volume
## 2004-03-11       4.500       4.800      4.425        4.800      17414690
## 2004-03-12       4.700       4.775      4.600        4.600     668350000
## 2004-03-15       4.625       4.650      4.550        4.550     346345000
## 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)
```

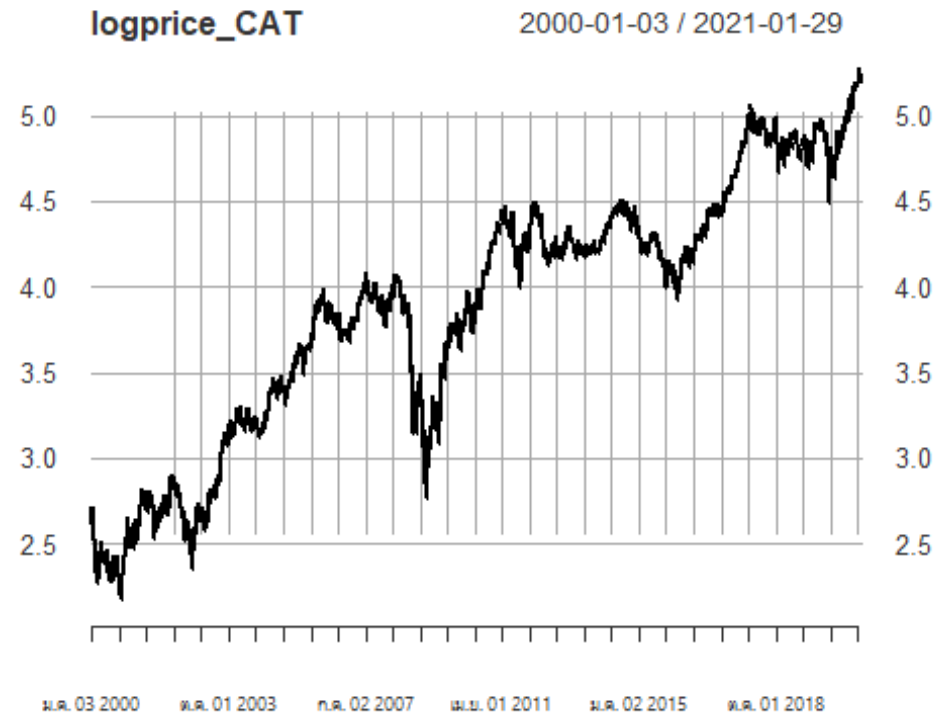
```
##            AOT.BK.Open AOT.BK.High AOT.BK.Low AOT.BK.Close AOT.BK.Volume
## 2020-01-23       70.75       72.00      70.75        71.25      25763400
## 2020-01-24       71.00       72.00      71.00        71.50      17997100
## 2020-01-27       67.50       69.25      67.25        68.75      98120100
## 2020-01-28       68.00       68.75      67.75        68.00      87751400
## 2020-01-29       68.50       70.25      68.25        69.50      66506800
## 2020-01-30       69.00       70.00      68.75        69.50      32592900
##            AOT.BK.Adjusted
## 2020-01-23        70.83719
## 2020-01-24        71.08574
## 2020-01-27        68.35167
## 2020-01-28        67.60602
## 2020-01-29        69.09733
## 2020-01-30        69.09733

#check dim, head, and tail

da_CAT= CAT
da_AOT= AOT.BK
price_CAT=da_CAT[,6]
price_AOT=da_AOT[,6]

dim(price_CAT)

## [1] 5303    1

head(price_CAT) #check the data set

##            CAT.Adjusted
## 2000-01-03     13.75500
## 2000-01-04     13.57821
## 2000-01-05     13.89644
## 2000-01-06     14.60364
## 2000-01-07     15.08100
## 2000-01-10     14.58597

tail(price_CAT)

##            CAT.Adjusted
## 2021-01-22       191.94
## 2021-01-25       187.34
## 2021-01-26       187.21
## 2021-01-27       180.63
## 2021-01-28       184.34
## 2021-01-29       182.84

#create data sets and price

#log and simple figures
plot(price_CAT,type='l') #plot price of CAT and AOT
```



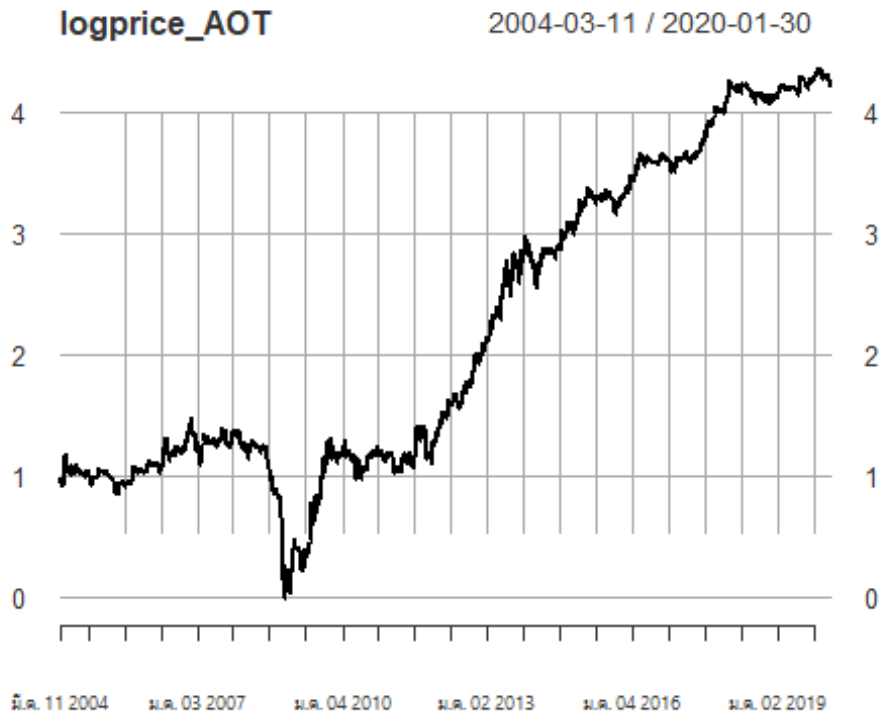

```
plot(price_AOT,type='l')
```



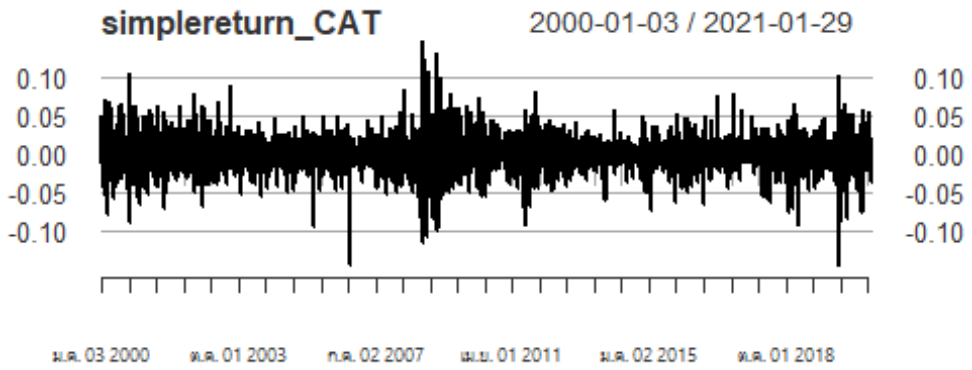
```
logprice_CAT=log(price_CAT) #creates log price for CAT and AOT
logprice_AOT=log(price_AOT)

plot(logprice_CAT,type='l') # plot the logprices
```

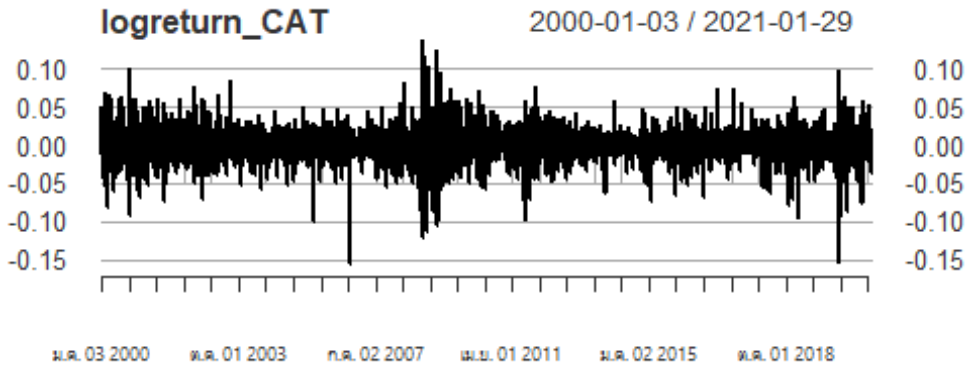



```
plot(logprice_AOT,type='l')
```

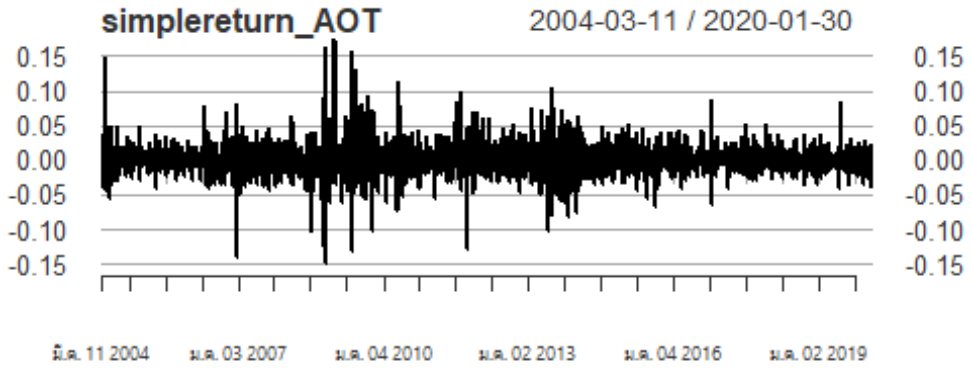


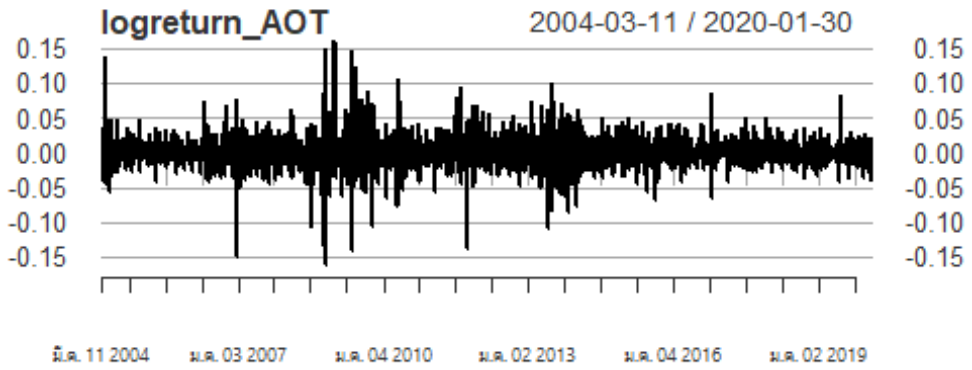

```
logreturn_CAT=diff((log(price_CAT))) #create logreturns
logreturn_AOT=diff((log(price_AOT)))

simplereturn_CAT <-exp(logreturn_CAT)-1 #create simple returns
simplereturn_AOT <-exp(logreturn_AOT)-1

par(mfrow=c(2,1))
plot(simplereturn_CAT,type='l') #plot simple returns and log return,,, same
figure?
plot(logreturn_CAT)
```






```
par(mfrow=c(2,1))
plot(simplereturn_AOT,type='l')
plot(logreturn_AOT, type='l')
```





```r
#These codes answer question a)

#Statistical table for simple return
table.Stats(simplereturn_CAT)
```

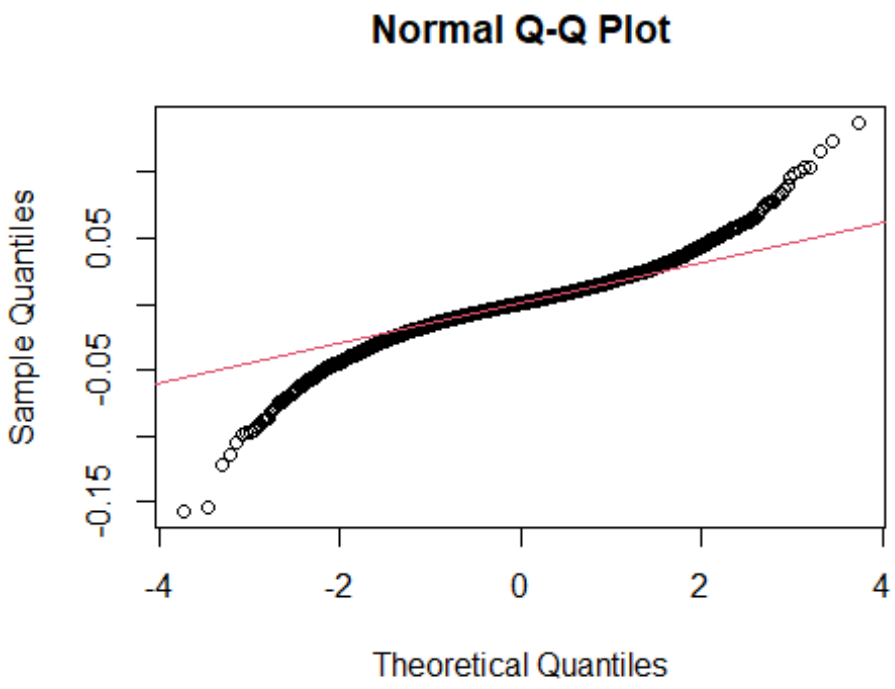
```
##                 CAT.Adjusted
## Observations       5302.0000
## NAs                   1.0000
## Minimum              -0.1452
## Quartile 1           -0.0095
## Median                0.0005
## Arithmetic Mean       0.0007
## Geometric Mean        0.0005
## Quartile 3            0.0110
## Maximum               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
```

```r
table.Stats(simplereturn_AOT)
```

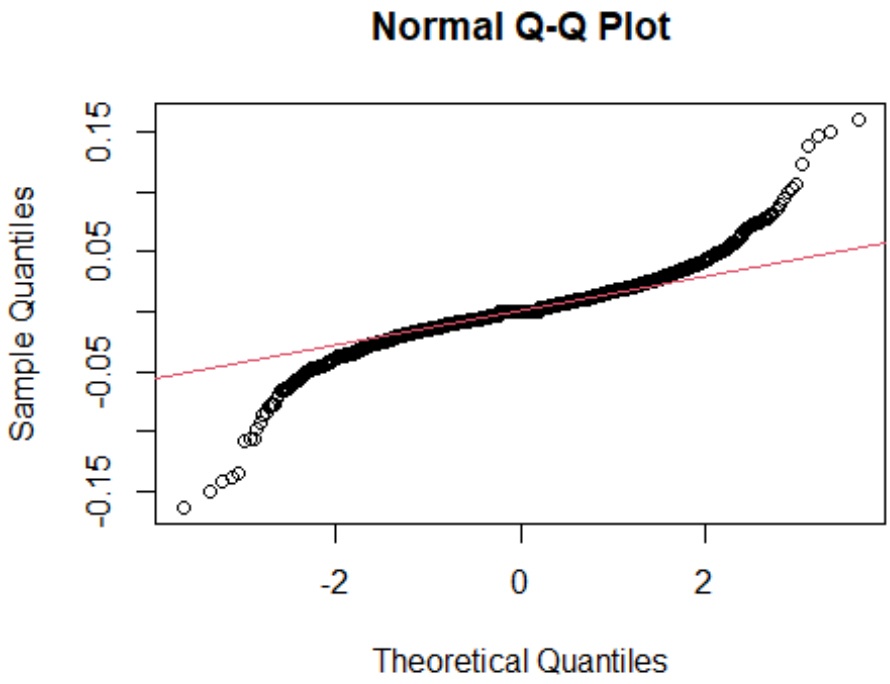
```
##                 AOT.BK.Adjusted
## Observations          3916.0000
## NAs                      1.0000
## Minimum                 -0.1505
## Quartile 1              -0.0089
## Median                   0.0000
## Arithmetic Mean          0.0010
## Geometric Mean           0.0008
## Quartile 3               0.0102
## Maximum                  0.1738
## SE Mean                  0.0003
## LCL Mean (0.95)          0.0004
## UCL Mean (0.95)          0.0017
## Variance                 0.0004
## Stdev                    0.0205
## Skewness                 0.4047
## Kurtosis                 8.9007
```

```r
#These codes answer question b)

#QQ-plots and tests for normality
newlogreturn_CAT <- logreturn_CAT[2:nrow(logreturn_CAT)]
newlogreturn_AOT <- logreturn_AOT[2:nrow(logreturn_AOT)]

newsimplereturn_CAT <- simplereturn_CAT[2:nrow(logreturn_CAT)]
newsimplereturn_AOT <- simplereturn_AOT[2:nrow(logreturn_AOT)]
```

```
par(mfrow=c(1,1))
qqnorm((newlogreturn_CAT))
qqline(newlogreturn_CAT, col = 2)
```




```
jarque.bera.test(newlogreturn_CAT)

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

par(mfrow=c(1,1))
qqnorm((newlogreturn_AOT))
qqline(newlogreturn_AOT, col = 2)
```

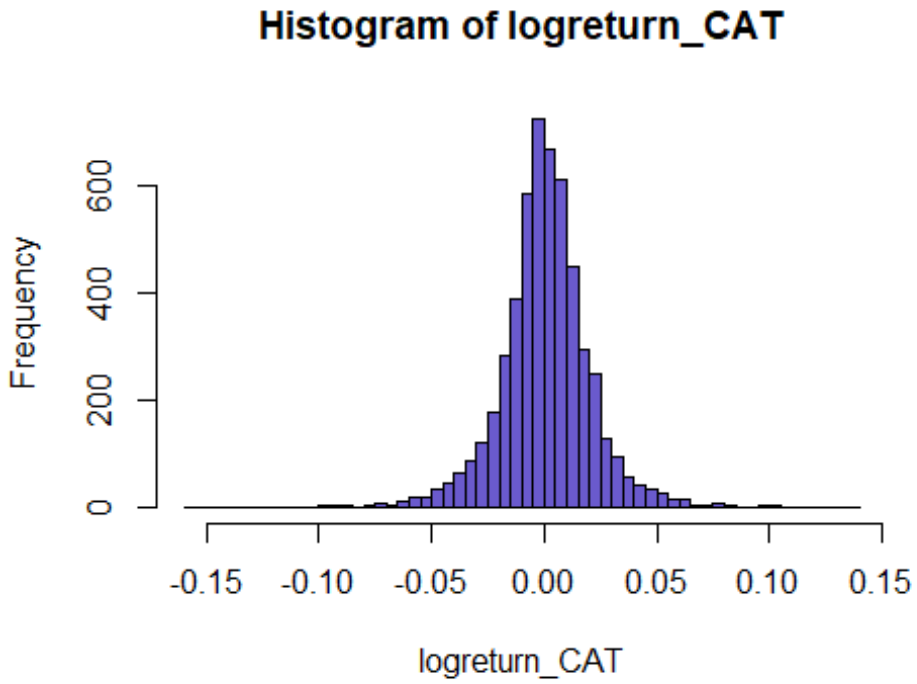



```
jarque.bera.test(newlogreturn_AOT)

##
##  Jarque Bera Test
##
## data:  newlogreturn_AOT
## X-squared = 12410, df = 2, p-value < 2.2e-16

#These codes answer c)
#The data is heavy tailed, therefore the extreme values are more than what we
are expected from the normal distribution

#Statistical table for logreturn
table.Stats(logreturn_CAT)

##                 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
```

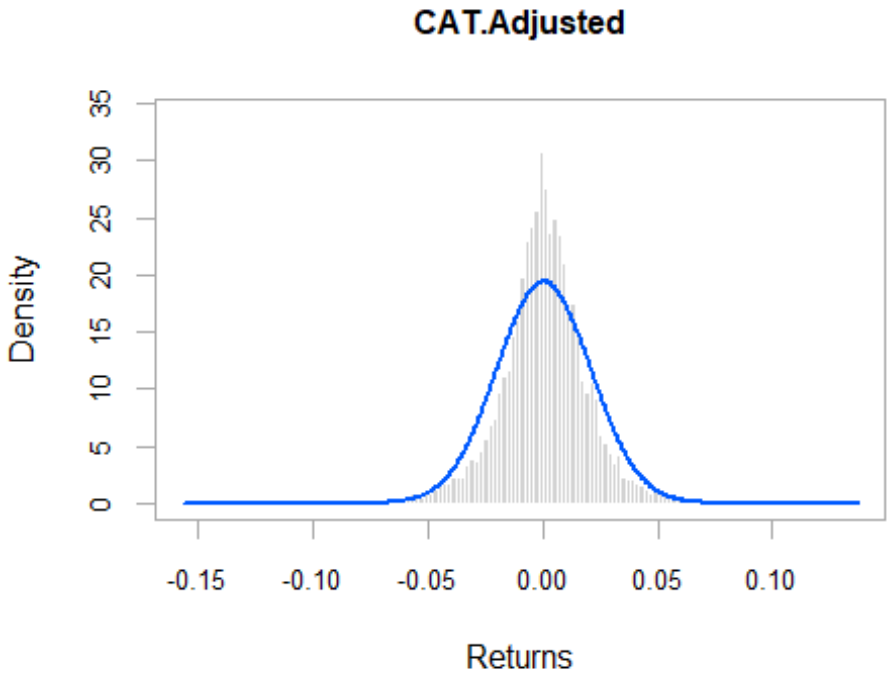
```
## UCL Mean (0.95)       0.0010
## Variance              0.0004
## Stdev                 0.0205
## Skewness             -0.1836
## Kurtosis              4.6982

table.Stats(logreturn_AOT)

##                 AOT.BK.Adjusted
## Observations          3916.0000
## NAs                      1.0000
## Minimum                 -0.1632
## Quartile 1              -0.0090
## Median                   0.0000
## Arithmetic Mean          0.0008
## Geometric Mean           0.0006
## Quartile 3               0.0102
## Maximum                  0.1602
## SE Mean                  0.0003
## LCL Mean (0.95)          0.0002
## UCL Mean (0.95)          0.0015
## Variance                 0.0004
## Stdev                    0.0204
## Skewness                 0.0772
## Kurtosis                 8.7199

table.Stats(newlogreturn_CAT)

##                 CAT.Adjusted
## Observations       5302.0000
## NAs                   0.0000
## 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

#These codes answer d)

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

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

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

##
##  One Sample t-test
##
## data:  newlogreturn_CAT
## 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

t.test(newlogreturn_AOT)

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

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

##
##  One Sample t-test
##
## data:  newlogreturn_AOT
## t = 2.5437, df = 3915, p-value = 0.01101
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.0001904936 0.0014713988
## sample estimates:
##    mean of x
## 0.0008309462

#t.test(logreturn_CAT)
#t.test(logreturn_AOT)
#These codes answer e and g)
#e)
#The t value of newlogreturn_CAT is less than the critical point,~2. The p-
value is not significant at 95% level.
#Therefore we cannot reject that the mean of log CAT is equal to 0

#The t value of newlogreturn_AOT is more than the critical point,~2. The p-
```

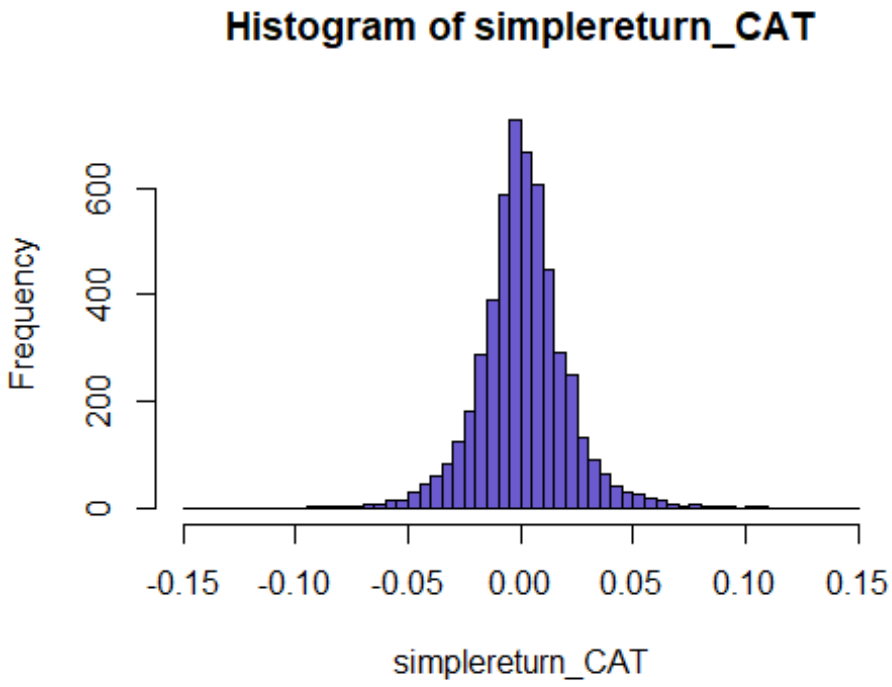
```
value is significant at 95% level.
#Therefore we cannot reject that the mean of log AOT is equal to 0

#Histogram
par(mfrow=c(1,1))
hist(logreturn_CAT, breaks = 100, col="slateblue")
```



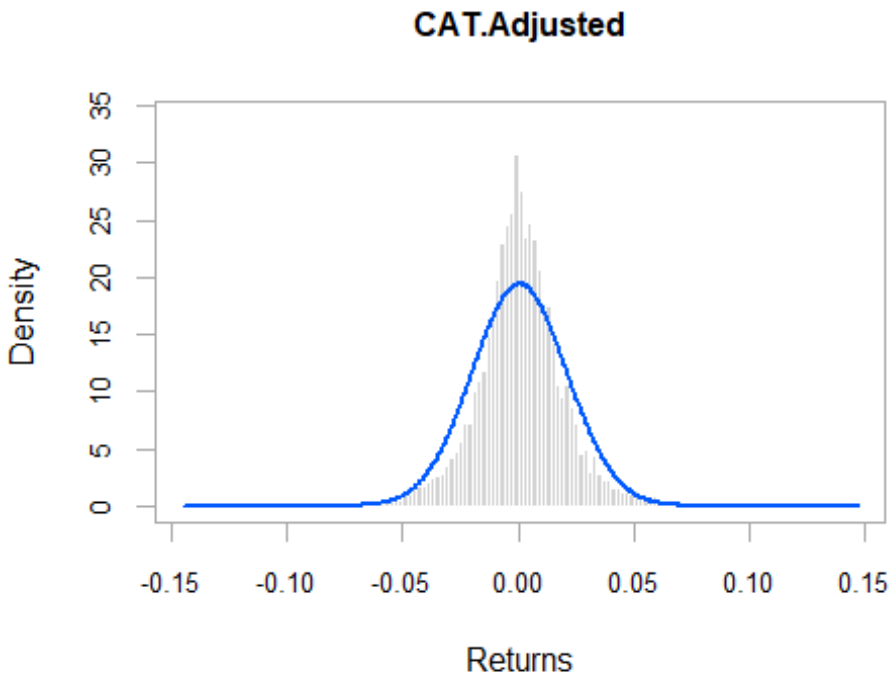

```
chart.Histogram(logreturn_CAT, methods = c("add.normal"))
```



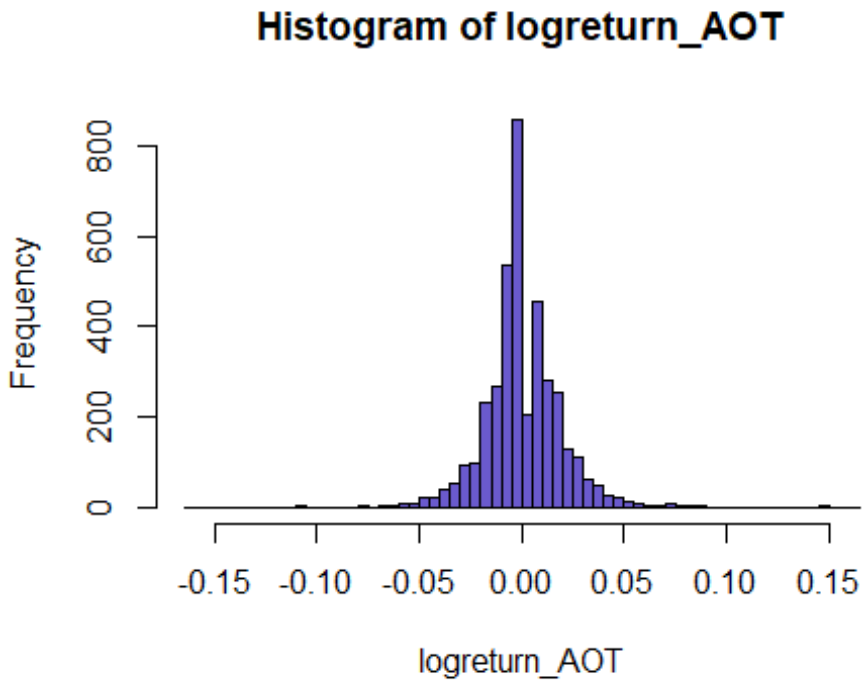

```
par(mfrow=c(1,1))
hist(simplereturn_CAT, breaks = 100, col="slateblue")
```



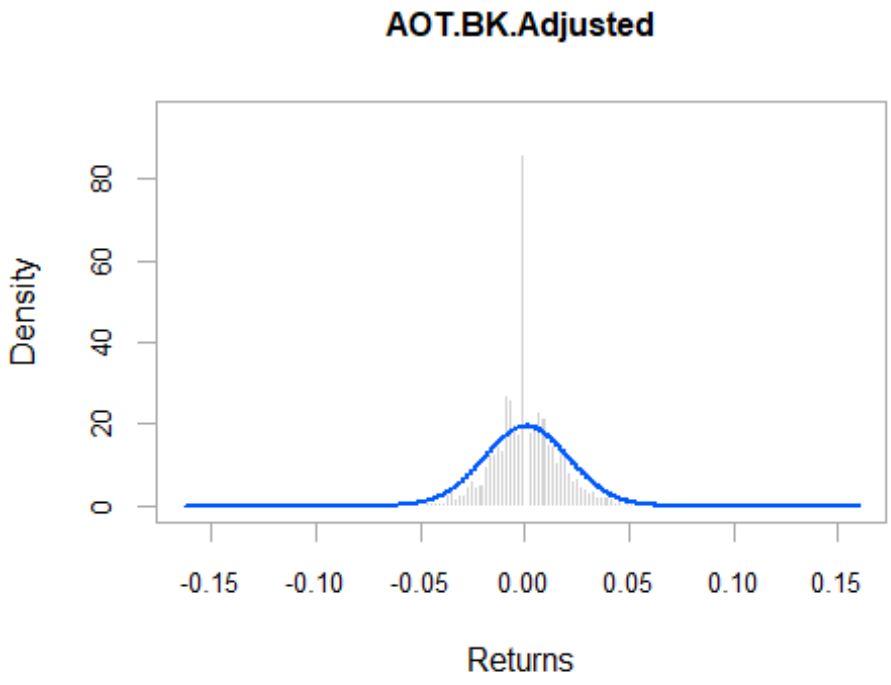
```
chart.Histogram(simplereturn_CAT, methods = c("add.normal"))
```



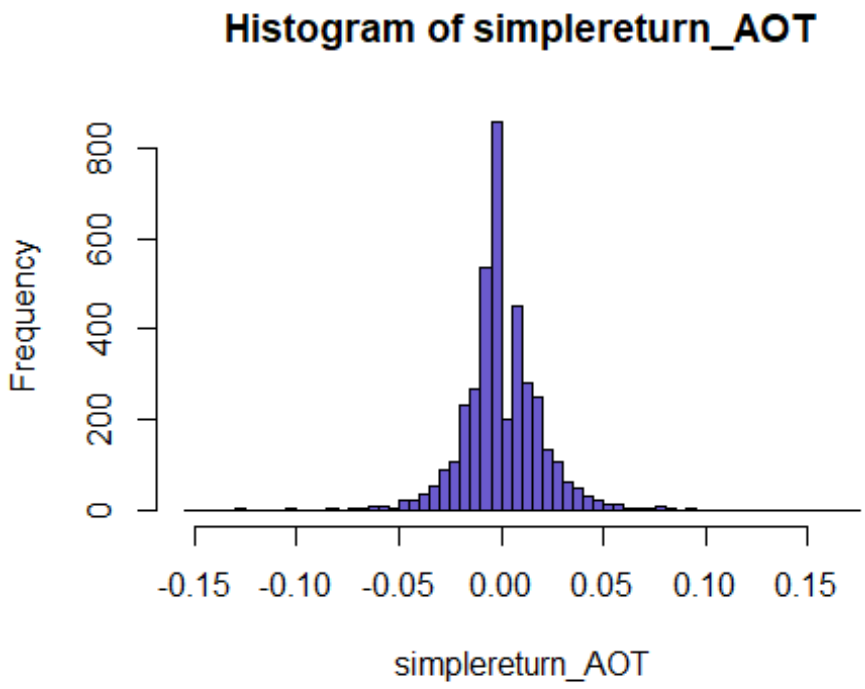

```
par(mfrow=c(1,1))
hist(logreturn_AOT, breaks = 100, col="slateblue")
```



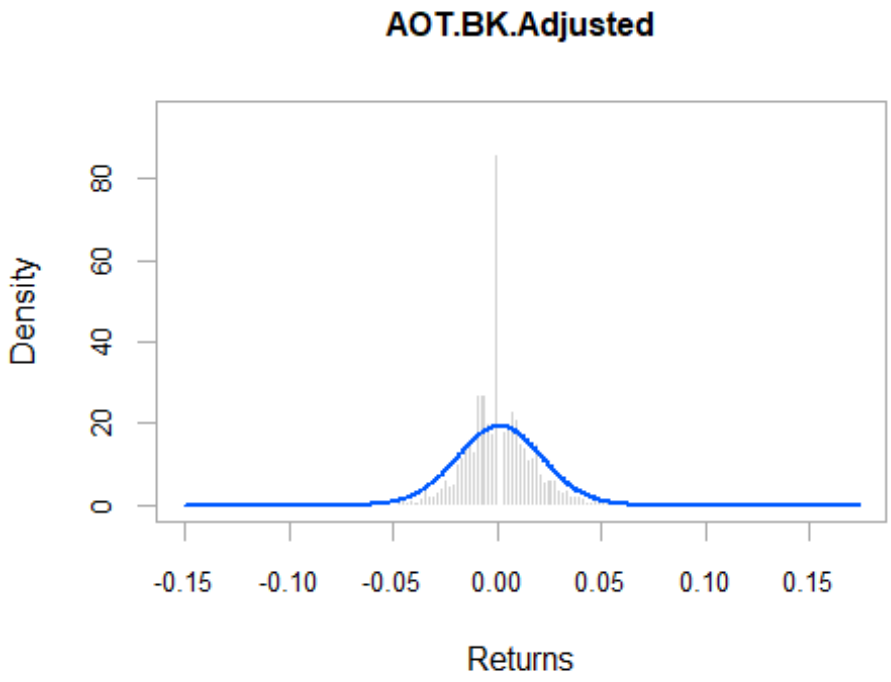

```
chart.Histogram(logreturn_AOT, methods = c("add.normal"))
```



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




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




```
#These codes answer f)

#Test Skewness = 0
T_CAT=length(newlogreturn_CAT)
S_CAT= skewness(newlogreturn_CAT)
tstS_CAT = S_CAT/sqrt(6/T)
tstS_CAT
```

```
## [1] -0.07496841
```

```
pvS_CAT = 2*(pnorm(tstS_CAT))
pvS_CAT
```

```
## [1] 0.9402398
```

```
T_AOT=length(newlogreturn_AOT)
S_AOT= skewness(newlogreturn_AOT)
tstS_AOT = S_AOT/sqrt(6/T)
tstS_AOT
```

```
## [1] 0.0315171
```

```
pvS_AOT = 2*(1-pnorm(tstS_AOT))
pvS_AOT
```

```
## [1] 0.9748572
```

```
#These codes answer h)

#The t value of newlogreturn_CAT is less than the critical point,~2. The p-
value is not significant at 95% level.
#Therefore we cannot reject that the sknewness of CAT is equal to 0

#The t value of newlogreturn_AOT is less than the critical point,~2. The p-
value is not significant at 95% level.
#Therefore we cannot reject that the sknewness of log AOT is equal to 0

#Test excess kurtosis = 0
k_CAT = kurtosis(newlogreturn_CAT)
tstK_CAT = k_CAT/sqrt(24/T)
tstK_CAT

## [1] 0.9590186

pv_CAT = 2*(1-pnorm(tstK_CAT))
pv_CAT

## [1] 0.3375494

k_AOT = kurtosis(newlogreturn_AOT)
tstK_AOT = k_AOT/sqrt(24/T)
tstK_AOT

## [1] 1.779939

pv_AOT = 2*(1-pnorm(tstK_AOT))
pv_AOT

## [1] 0.07508595

#These codes answer i)

#The t value of newlogreturn_CAT is less than the critical point,~2. The p-
value is not significant at 95% level.
#Therefore we cannot reject that the kurtosis of CAT is equal to 3

#The t value of newlogreturn_AOT is less than the critical point,~2. The p-
value is not significant at 95% level.
#Therefore we cannot reject that the kurtosis of log AOT is equal to 3
```