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assignment2_Harit.R

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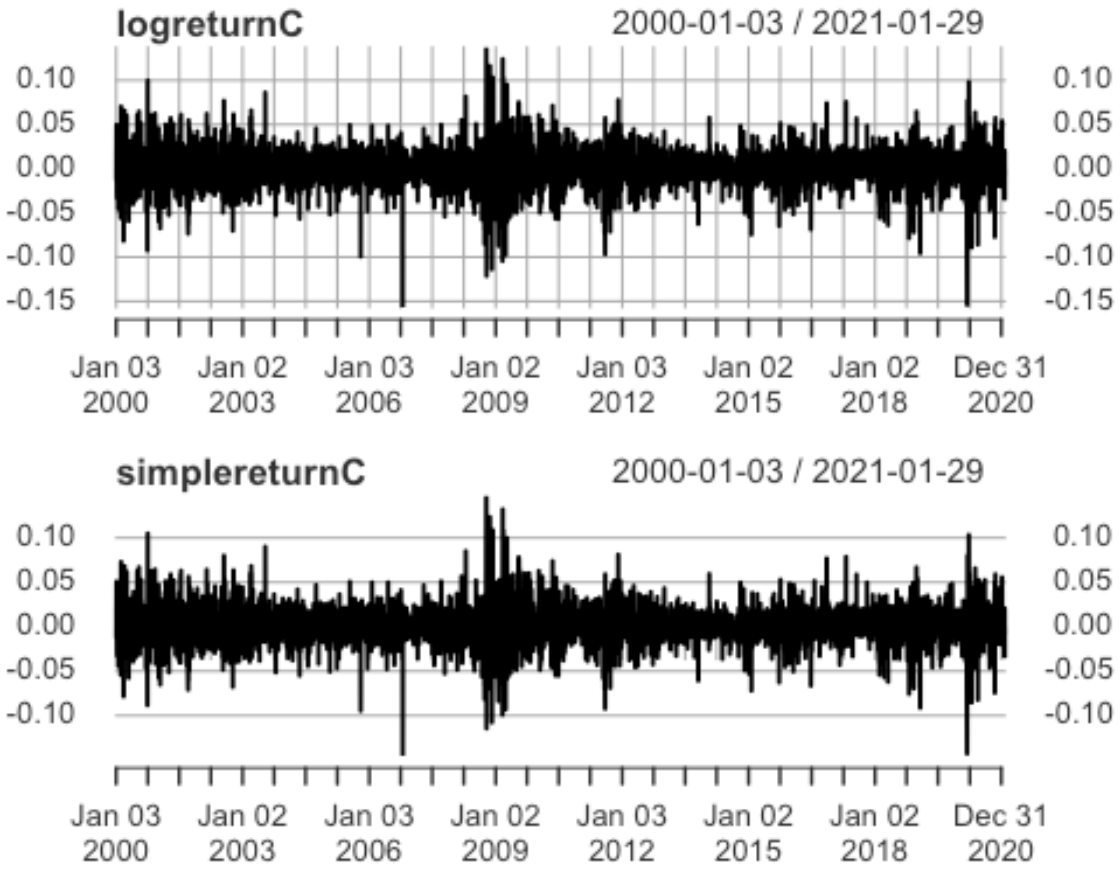
```
# EE435 Assigment 2 ID:6104640112
setwd("/Users/jharit/Desktop")
cat(rep("\n",50))  #clear R Console

library(quantmod)

## Warning: package 'quantmod' was built under R version 3.6.2

## Loading required package: xts

## Warning: package 'xts' was built under R version 3.6.2

## Loading required package: zoo

## Warning: package 'zoo' was built under R version 3.6.2

##
## Attaching package: 'zoo'

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

## Loading required package: TTR

## Warning: package 'TTR' was built under R version 3.6.2

## 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)

## Warning: package 'sn' was built under R version 3.6.2

## 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)

## Warning: package 'car' was built under R version 3.6.2

## Loading required package: carData

## Warning: package 'carData' was built under R version 3.6.2

##
## Attaching package: 'car'

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

library(tseries)
```

```
## Warning: package 'tseries' was built under R version 3.6.2

library(forecast)

## Warning: package 'forecast' was built under R version 3.6.2

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="2021-01-31")

## [1] "AOT.BK"

#get each adjusted price for CAT and AOT
PriceC=CAT[,6]
PriceA=AOT.BK[,6]
logPriceC=log(PriceC)
logPriceA=log(PriceA)
```

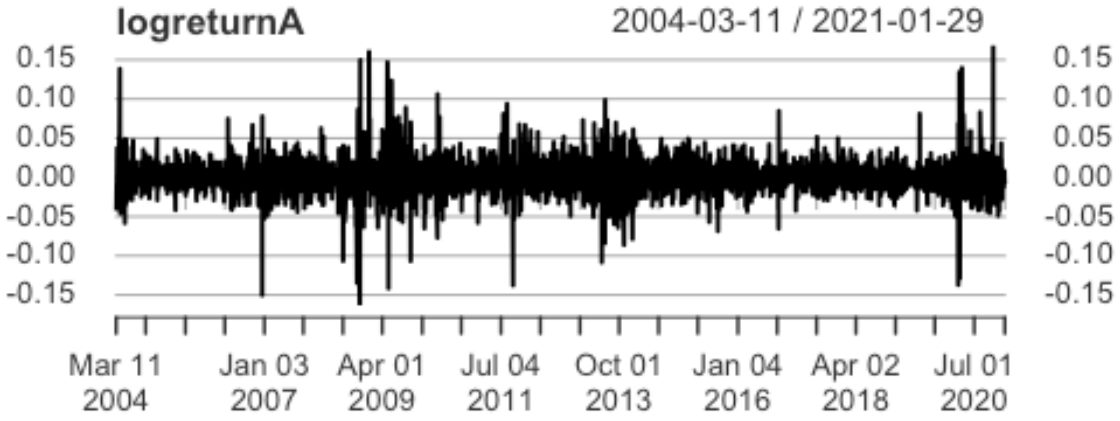

```
#answer for question a.
#calculate for returns
logreturnC=diff(log(PriceC))
logreturnA=diff(log(PriceA))
simplereturnC=exp(logreturnC)-1
simplereturnA=exp(logreturnA)-1

#ploting for CAT return
par(mfrow=c(2,1))
plot(logreturnC,type='l')
plot(simplereturnC)
```

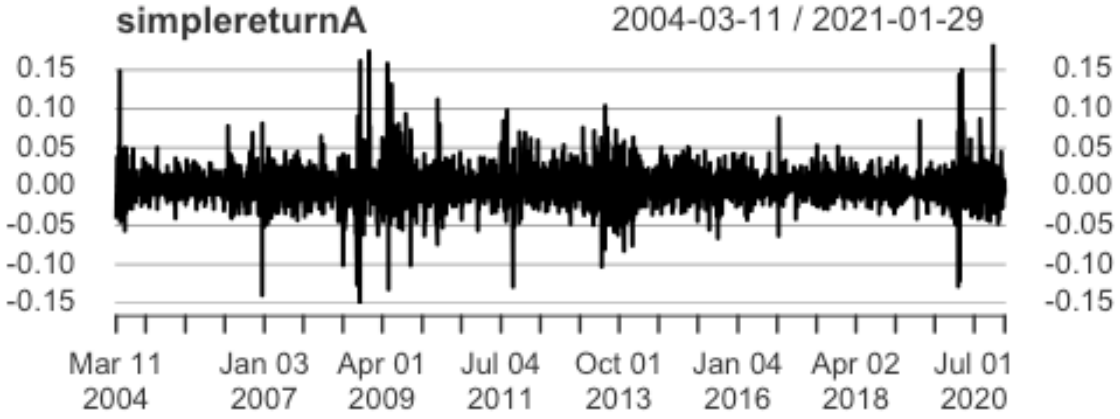
CAT return




```
#ploting for AOT return
par(mfrow=c(2,1))
plot(logreturnA,type='l')
plot(simplereturnA)
```

AOT return





(b)

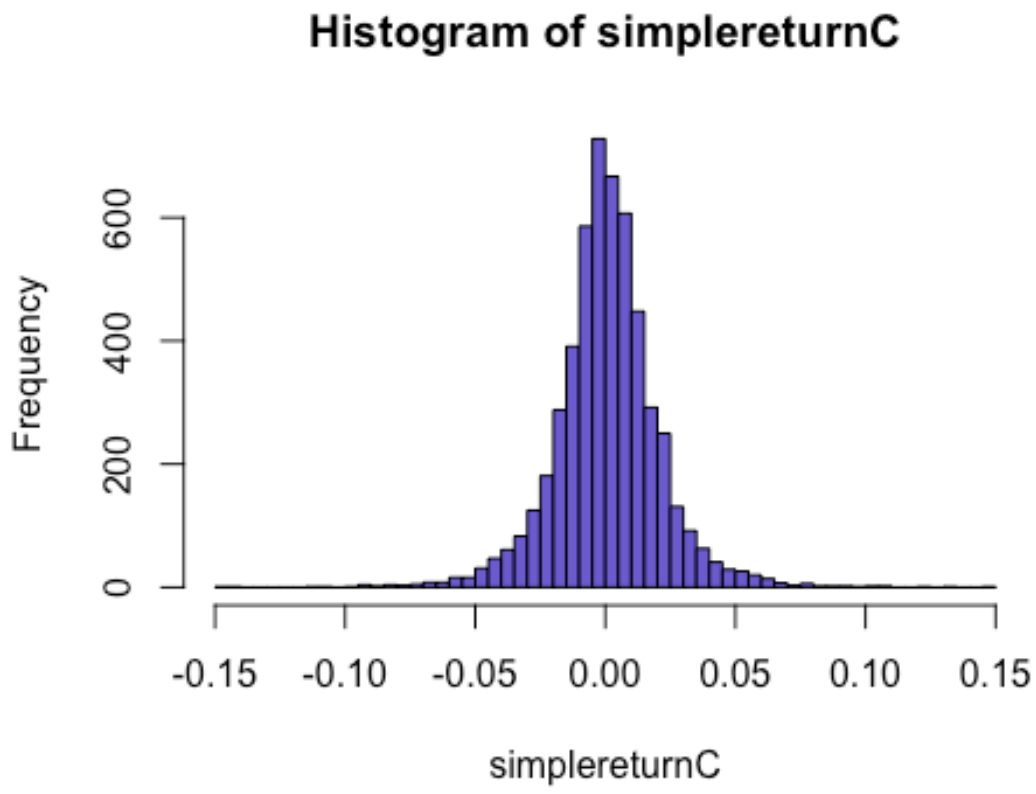
```
#answer for question b.
#calculate for simplereturn statistics
table.Stats(simplereturnC)

##                   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   - excess kurtosis

table.Stats(simplereturnA)
```

```
##                   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
```

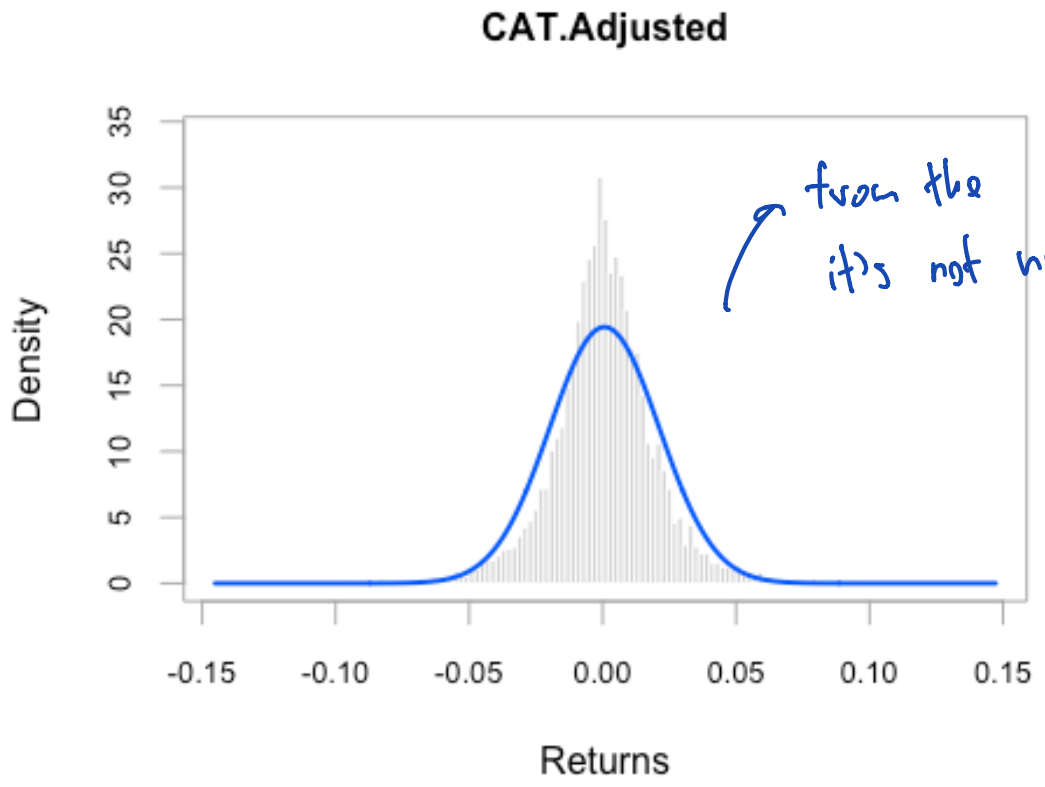
→ excess kurtosis

C.

```
#answer for question c.
#ploting the density function
par(mfrow=c(1,1))
hist(simplereturnC, breaks=100, col="slateblue")
```



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



from the graph it's not normally distributed

```
#test for normality
newsimplereturnC <- simplereturnC[2:nrow(simplereturnC),]
jarque.bera.test(newsimplereturnC)
```

H_0: normal

```
##
##  Jarque Bera Test
##
## data:  newsimplereturnC
## X-squared = 4569.9, df = 2, p-value < 2.2e-16
```

p-value $< \alpha = 0.05$
$\therefore$ reject H_0

D.

```
#answer for question d.
#calculate for logreturn statistics
table.Stats(logreturnC)

##                   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
```

→ excess kurtosis

```
table.Stats(logreturnA)

##                  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
```

→ excess kurtosis

(E)

```
#answer for question e.
# Ho: logreturnC = 0
newlogreturnC <- logreturnC[2:nrow(logreturnC),]
t.test(newlogreturnC)

## 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:  newlogreturnC
## 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
```

p-value > α = 0.05

∴ accept Ho

expected log return of CAT is = 0 #

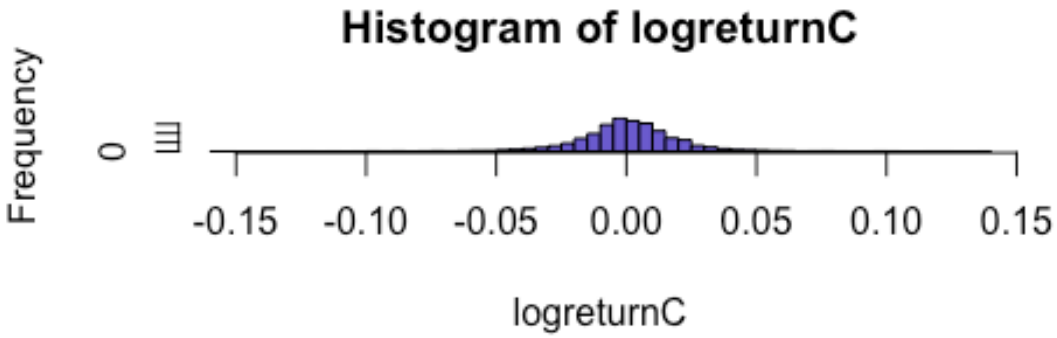
```
## sample estimates:
##    mean of x
## 0.0004879685

# Ho: logreturnA = 0
newlogreturnA <- logreturnA[2:nrow(logreturnA),]
t.test(newlogreturnA)

## 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:  newlogreturnA
## 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
```

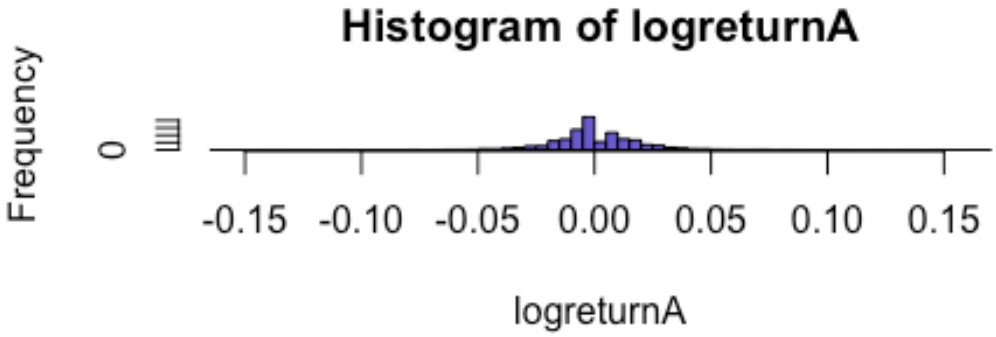
p-value < α = 0.05
∴ reject Ho

expected log return of CAT is ≠ 0 #

(F)

```
#answer for question f.
#ploting the density function
par(mfrow=c(2,1))
hist(logreturnC, breaks=100, col="slateblue")
hist(logreturnA, breaks=100, col="slateblue")
```





```
#answer for question g.
#construct the CI 95% using the information from t-test
t.test(newlogreturnC)

## 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:  newlogreturnC
## 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
```

H)

```
#answer for question h.
#Test Skewness = 0 CAT logreturn
TC=length(newlogreturnC)
SC=skewness(newlogreturnC)
tstC = SC/sqrt(6/TC)
tstC

## [1] -5.458812

pvC = 2*pnorm(tstC)
pvC

## [1] 4.793299e-08

#Test Skewness = 0 AOT logreturn
TA=length(newlogreturnA)
SA=skewness(newlogreturnA)
tstA = SA/sqrt(6/TA)
tstA

## [1] 4.596526

pvA = 2*(1-pnorm(tstA))
pvA

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

H_0 : Skewness = 0

p-value < α so, reject H_0

p-value < α so, reject H_0

I)

```
#answer for question i.
# Test excess kurtosis =0 CAT logreturn
KC = kurtosis(newlogreturnC)
tstC = KC/sqrt(24/TC)
tstC

## [1] 69.83078

pvC = 2*(1-pnorm(tstC))
pvC

## [1] 0

# Test excess kurtosis =0 AOT logreturn
KA = kurtosis(newlogreturnA)
tstA = KA/sqrt(24/TA)
tstA

## [1] 126.4855

pvA = 2*(1-pnorm(tstA))
pvA

## [1] 0
```

H_0 : excess kurtosis = 0

p-value < α so, reject H_0

p-value < α so, reject H_0