Tanapat6104640914.R

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```
#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'
```

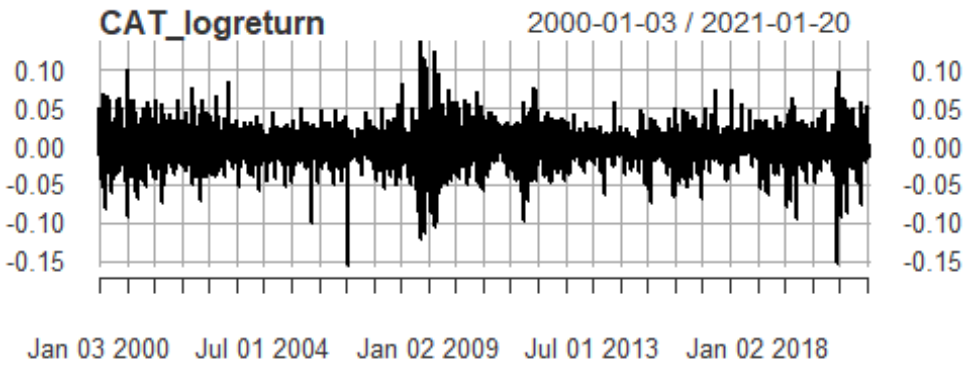
```
## The following object is masked from 'package:fBasics':
##
##     densityPlot
```

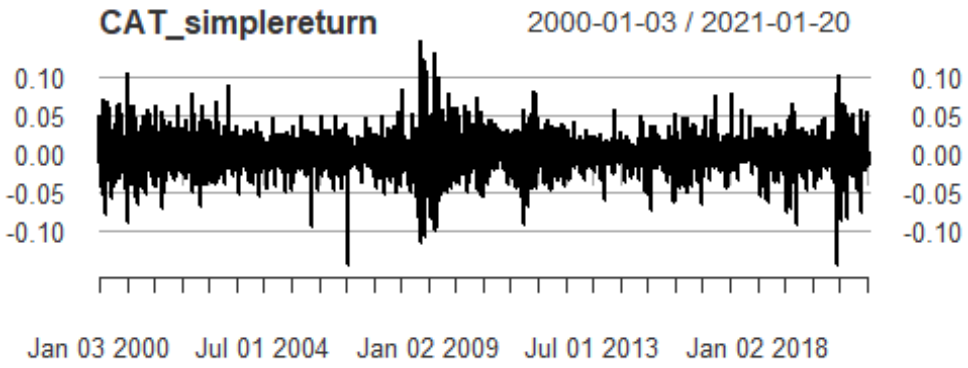
```
library(tseries)
library(forecast)

#CAT
getSymbols("CAT",from="2000-01-03",to="2021-01-21")
```

```
## '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"
```

```
da1=CAT
CAT_price=da1[,6]
CAT_logprice=log(CAT_price)
CAT_logreturn=diff(log(CAT_price))
CAT_simplereturn <-exp(CAT_logreturn)-1
par(mfrow=c(2,1))
plot(CAT_logreturn,type='l')
plot(CAT_simplereturn)
```

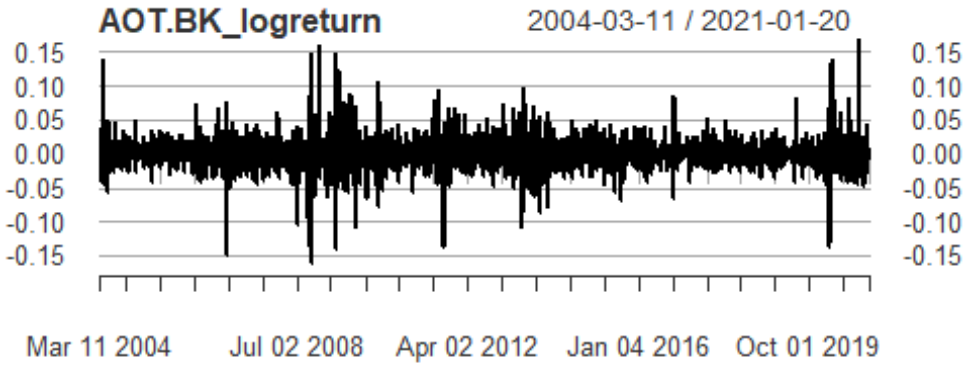


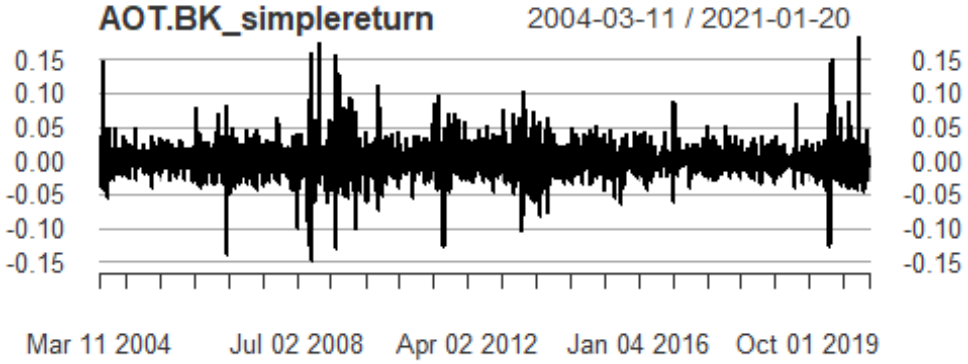



```
#AOT.BK
getSymbols("AOT.BK",from="2000-01-03",to="2021-01-21")

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

```
da2=AOT.BK
AOT.BK_price=da2[,6]
AOT.BK_logprice=log(AOT.BK_price)
AOT.BK_logreturn=diff(log(AOT.BK_price))
AOT.BK_simplereturn <-exp(AOT.BK_logreturn)-1
par(mfrow=c(2,1))
```

```
plot(AOT.BK_logreturn,type='l')
plot(AOT.BK_simplereturn)
```





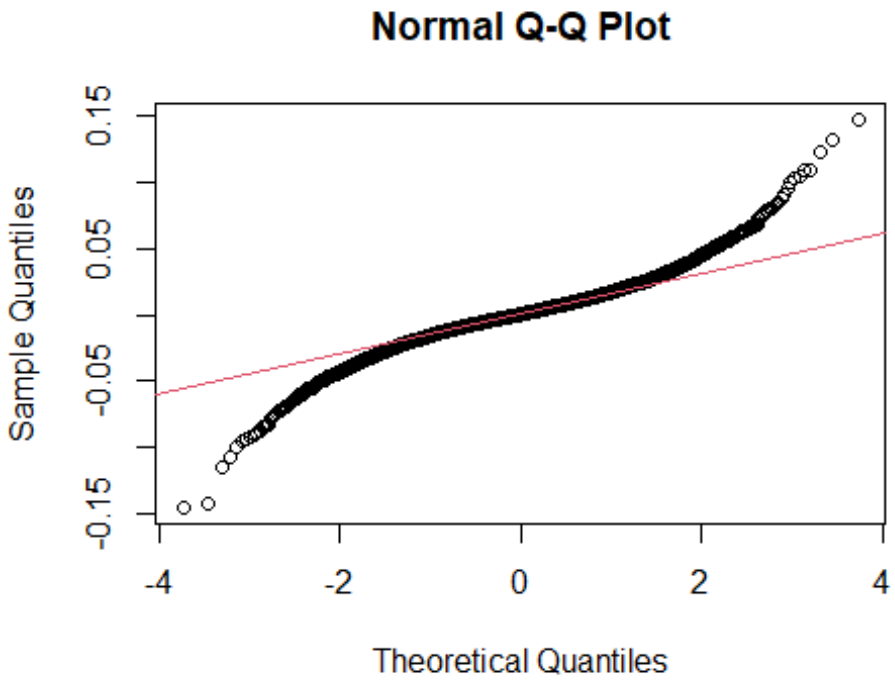

```
#2.1 CAT's  log return mean, variance, standard deviation, skewness, excess kurtosis, minimum and maximum
table.Stats(CAT_simplereturn)
```

```
##                  CAT.Adjusted
## Observations       5295.0000
## 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)       0.0002
## UCL Mean (0.95)       0.0013
## Variance              0.0004
## Stdev                 0.0205
## Skewness              0.0194
## Kurtosis              4.5517
```

```r
#2.2 AOT's mean, variance, standard deviation, skewness, excess kurtosis, minimum and maximum
table.Stats(AOT.BK_simplereturn)
```

```
##                 AOT.BK.Adjusted
## Observations          4151.0000
## NAs                      1.0000
## Minimum                 -0.1505
## Quartile 1              -0.0093
## Median                   0.0000
## Arithmetic Mean          0.0010
## Geometric Mean           0.0008
## 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                 0.5430
## Kurtosis                10.0670
```

```r
#3
CAT_newlogreturn <- CAT_logreturn[2:nrow(CAT_logreturn),]
CAT_newsimplereturn <- CAT_simplereturn[2:nrow(CAT_logreturn),]
par(mfrow=c(1,1))
qqnorm(CAT_newsimplereturn)
qqline(CAT_newsimplereturn, col = 2)
```




```
jarque.bera.test(CAT_newsimplereturn)

##
##  Jarque Bera Test
##
## data:  CAT_newsimplereturn
## X-squared = 4571.3, df = 2, p-value < 2.2e-16

#since the calculated p-value=2.2e-16 which is less than alpha=0.05. Thus,
CAT's simple return data is not normally distributed

#4.1 CAT's  log return mean, variance, standard deviation, skewness, excess
kurtosis, minimum and maximum
table.Stats(CAT_logreturn)

##                 CAT.Adjusted
## Observations       5295.0000
## 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)       0.0011
## Variance              0.0004
## Stdev                 0.0205
## Skewness             -0.1841
## Kurtosis              4.7026
```

```
#4.2 AOT's log return mean, variance, standard deviation, skewness, excess
kurtosis, minimum and maximum
table.Stats(AOT.BK_logreturn)
```

```
##                 AOT.BK.Adjusted
## Observations          4151.0000
## NAs                      1.0000
## Minimum                 -0.1632
## Quartile 1              -0.0093
## Median                   0.0000
## Arithmetic Mean          0.0008
## 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                 0.0005
## Stdev                    0.0212
## Skewness                 0.1735
## Kurtosis                 9.5949
```

```
#5.1 Test for AOT.BK's mean=0
AOT.BK_newlogreturn <- AOT.BK_logreturn[2:nrow(AOT.BK_logreturn),]
t.test(AOT.BK_newlogreturn)
```

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

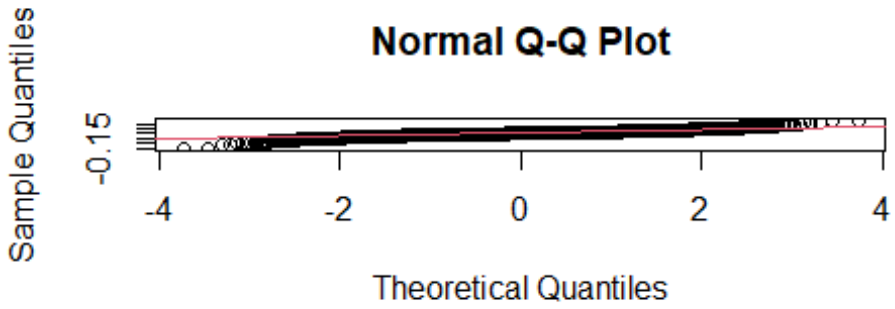
```
## Warning in cint * stderr: Recycling array of length 1 in vector-array
arithmetic is deprecated.
##   Use c() or as.vector() instead.
```

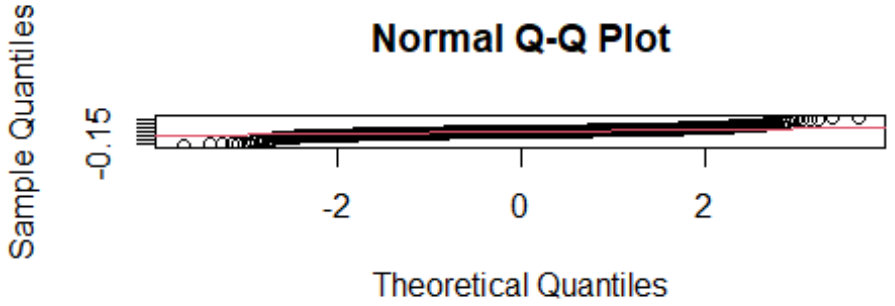
```
##
##  One Sample t-test
##
## data:  AOT.BK_newlogreturn
## t = 2.2911, df = 4150, p-value = 0.02201
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.0001089055 0.0014008190
## sample estimates:
##    mean of x
## 0.0007548622
```

```r
#5.2 Test for CAT's mean=0
t.test(CAT_newlogreturn)
```

```
## 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:  CAT_newlogreturn
## t = 1.7644, df = 5294, p-value = 0.07773
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -5.535425e-05  1.051714e-03
## sample estimates:
##    mean of x
## 0.0004981798
```

```r
#6
par(mfrow=c(2,1))
qqnorm(CAT_newlogreturn)
qqline(CAT_newlogreturn, col = 2)
qqnorm(AOT.BK_newlogreturn)
qqline(AOT.BK_newlogreturn, col = 2)
```






```
#7
table.Stats(CAT_newlogreturn)
```

```
##                 CAT.Adjusted
## Observations       5295.0000
## 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)       0.0011
## Variance              0.0004
## Stdev                 0.0205
## Skewness             -0.1841
## Kurtosis              4.7026
```

```
t.test(CAT_logreturn, conf.level=0.95)
```

```
## 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:  CAT_logreturn
## t = 1.7644, df = 5294, p-value = 0.07773
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -5.535425e-05  1.051714e-03
## sample estimates:
##    mean of x
## 0.0004981798
```

#8 Test Skewness = 0

Given H0 : m3 = 0

H1 : m3 ≠ 0

```
T1=length(CAT_newlogreturn)
CAT_s3=skewness(CAT_newlogreturn)
CAT_s3
```

```
## [1] -0.184087
```

```
tst = CAT_s3/sqrt(6/T1)
tst
```

```
## [1] -5.468655
```

```
pv1 = 2*pnorm(tst)
pv1
```

```
## [1] 4.534628e-08
```

Since the calculated $|s^*| = |-5.48655|$ is smaller than critical value of 1.96

Therefore, we can reject null hypothesis H0 ; m3 = 0 at 95% confidence interval, CAT log return skewness is not equal to 0

```
T2=length(AOT.BK_newlogreturn)
AOT.BK_s3=skewness(AOT.BK_newlogreturn)
AOT.BK_s3
```

```
## [1] 0.1734927
```

```
tst2 = AOT.BK_s3/sqrt(6/T2)
tst2
```

```
## [1] 4.56333
```

```
pv2 = 2*pnorm(tst2)
pv2
```

```
## [1] 1.999995
```

Since the calculated $|s^*|$ = 4.56333 is smaller than critical value of 1.96

Therefore, we can reject null hypothesis H0 ; m3 = 0 at 95% confidence interval, AOT.BK log return skewness is not equal to 0

```
#9 Test excess kurtosis = 0

Given H0 : k4 - 3 = 0

      H1 : k4 -3 ≠ 0
CAT_k4 = kurtosis(CAT_newlogreturn)
CAT_k4
```

```
## [1] 4.702555
```

```
tst3 = CAT_k4/sqrt(24/T1)
tst3
```

```
## [1] 69.84916
```

```
pv3 = 2*(1-pnorm(tst3))
pv3
```

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

```
AOT.BK_k4 = kurtosis(AOT.BK_newlogreturn)
AOT.BK_k4
```

```
## [1] 9.594879
```

```
tst4 = AOT.BK_k4/sqrt(24/T2)
tst4
```

```
## [1] 126.1857
```

```
pv4 = 2*(1-pnorm(tst4))
pv4
```

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

Both P-value = 0 in which is smaller than alpha = 0.05. Therefore, we can reject null hypothesis H0 : k4 -3 = 0, in such that both CAT and AOT.BK return kurtosis is not equal to 0