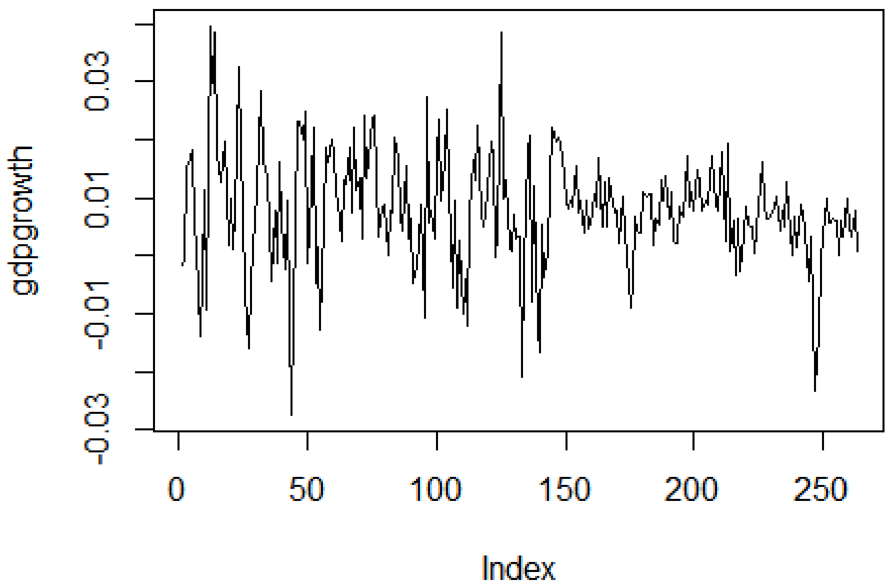
assignment3_achariyaporn.R

10.10

2021-03-01

```
cat(rep("\n",50))

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)
library(Matrix)


#1a plot GDP growth
da=read.table(file = "q-gdpmc1.txt",header = TRUE)
gdp=da[,4]
loggdp=log(gdp)
gdpgrowth=diff(log(gdp))
plot(gdpgrowth,type='l')
```




```
#1b Joint test
Box.test(loggdp, lag = 12,type = 'Ljung')
```

```
##
##  Box-Ljung test
##
## data:  loggdp
## X-squared = 2821.1, df = 12, p-value < 2.2e-16
```

Since p-value is very small and it is less than 0.05 (alpha at 95% confidence interval), so we can reject H0 with 95% confidence interval. It means that the variation of the past information can explain the variation of GDP.

```
#1c Test mean
t.test(gdpgrowth)
```

```
##
##  One Sample t-test
##
## data:  gdpgrowth
## t = 12.786, df = 262, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.006573382 0.008966545
## sample estimates:
```

```
##   mean of x
## 0.007769964
```

Since p-value is very small and it is less than 0.05(alpha at 95% confidence interval), so we can reject H0, it means that the mean of U.S. GDP growth rate is not equal to zero.

```
#2a Compute mean, s.d., skewness, excess kurtosis, min and max return series
da1=read.table(file = "d-amzn3dx.txt",header = TRUE)
amazon_return=da1[,2]
table.Stats(amazon_return)
```

```
##
## Observations    1259.0000
## NAs                0.0000
## Minimum           -0.1278
## Quartile 1        -0.0132
## Median            -0.0005
## Arithmetic Mean    0.0012
## Geometric Mean     0.0008
## Quartile 3         0.0146
## Maximum            0.2680
## SE Mean            0.0008
## LCL Mean (0.95)   -0.0004
## UCL Mean (0.95)    0.0028
## Variance           0.0008
## Stdev              0.0291
## Skewness           1.0331
## Kurtosis           9.3799
```

```
CRSP_return=da1[,3]
table.Stats(CRSP_return)
```

```
##
## Observations    1259.0000
## NAs                0.0000
## Minimum           -0.0898
## Quartile 1        -0.0063
## Median             0.0008
## Arithmetic Mean    0.0002
## Geometric Mean     0.0001
## Quartile 3         0.0074
## Maximum            0.1149
## SE Mean            0.0005
## LCL Mean (0.95)   -0.0007
## UCL Mean (0.95)    0.0011
## Variance           0.0003
## Stdev              0.0166
## Skewness          -0.1132
## Kurtosis           6.3137
```

```
CRSP_equalweighted_return=da1[,4]
table.Stats(CRSP_equalweighted_return)

##
## Observations    1259.0000
## NAs                0.0000
## Minimum           -0.0782
## Quartile 1        -0.0064
## Median             0.0012
## Arithmetic Mean    0.0005
## Geometric Mean     0.0004
## Quartile 3         0.0078
## Maximum            0.1074
## SE Mean            0.0004
## LCL Mean (0.95)   -0.0003
## UCL Mean (0.95)    0.0014
## Variance           0.0002
## Stdev              0.0154
## Skewness          -0.1684
## Kurtosis           5.2890

SP_return=da1[,5]
table.Stats(SP_return)

##
## Observations    1259.0000
## NAs                0.0000
## Minimum           -0.0904
## Quartile 1        -0.0063
## Median             0.0007
## Arithmetic Mean    0.0001
## Geometric Mean     0.0000
## Quartile 3         0.0070
## Maximum            0.1158
## SE Mean            0.0005
## LCL Mean (0.95)   -0.0008
## UCL Mean (0.95)    0.0010
## Variance           0.0003
## Stdev              0.0166
## Skewness          -0.0183
## Kurtosis           7.1705

#2b Transform simple to log return and compute mean, s.d., skewness, excess
kurtosis, min and max return series
logamazon_return=log(1+amazon_return)
table.Stats(logamazon_return)

##
## Observations    1259.0000
## NAs                0.0000
## Minimum           -0.1368
```

```
## Quartile 1        -0.0133
## Median            -0.0005
## Arithmetic Mean    0.0008
## Geometric Mean     0.0004
## Quartile 3         0.0145
## Maximum            0.2374
## SE Mean            0.0008
## LCL Mean (0.95)   -0.0008
## UCL Mean (0.95)    0.0024
## Variance           0.0008
## Stdev              0.0287
## Skewness           0.6279
## Kurtosis           7.2656
```

```
logCRSP_return=log(1+CRSP_return)
table.Stats(logCRSP_return)
```

```
##
## Observations    1259.0000
## NAs                0.0000
## Minimum           -0.0941
## Quartile 1        -0.0063
## Median             0.0008
## Arithmetic Mean    0.0001
## Geometric Mean    -0.0001
## Quartile 3         0.0073
## Maximum            0.1088
## SE Mean            0.0005
## LCL Mean (0.95)   -0.0009
## UCL Mean (0.95)    0.0010
## Variance           0.0003
## Stdev              0.0167
## Skewness          -0.3177
## Kurtosis           6.2095
```

```
logCRSP_equalweighted_return=log(1+CRSP_equalweighted_return)
table.Stats(logCRSP_equalweighted_return)
```

```
##
## Observations    1259.0000
## NAs                0.0000
## Minimum           -0.0815
## Quartile 1        -0.0064
## Median             0.0012
## Arithmetic Mean    0.0004
## Geometric Mean     0.0003
## Quartile 3         0.0077
## Maximum            0.1020
## SE Mean            0.0004
## LCL Mean (0.95)   -0.0005
## UCL Mean (0.95)    0.0013
```

```
## Variance           0.0002
## Stdev              0.0154
## Skewness          -0.3338
## Kurtosis           5.2061
```

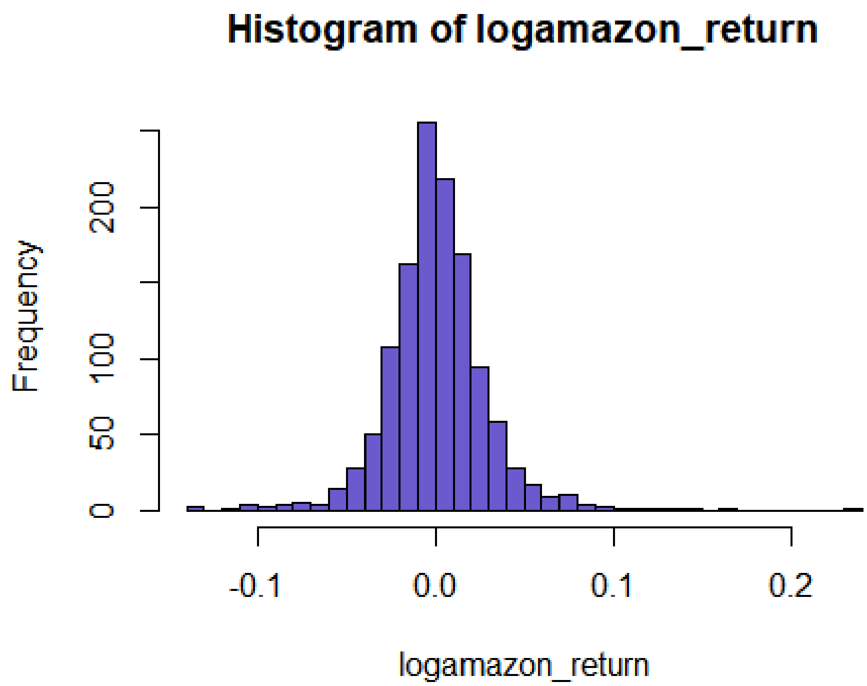
```
logSP_return=log(1+SP_return)
table.Stats(logSP_return)
```

```
##
## Observations    1259.0000
## NAs                0.0000
## Minimum           -0.0947
## Quartile 1        -0.0063
## Median             0.0007
## Arithmetic Mean    0.0000
## Geometric Mean    -0.0002
## Quartile 3         0.0070
## Maximum            0.1096
## SE Mean            0.0005
## LCL Mean (0.95)   -0.0009
## UCL Mean (0.95)    0.0009
## Variance           0.0003
## Stdev              0.0166
## Skewness          -0.2424
## Kurtosis           6.9679
```

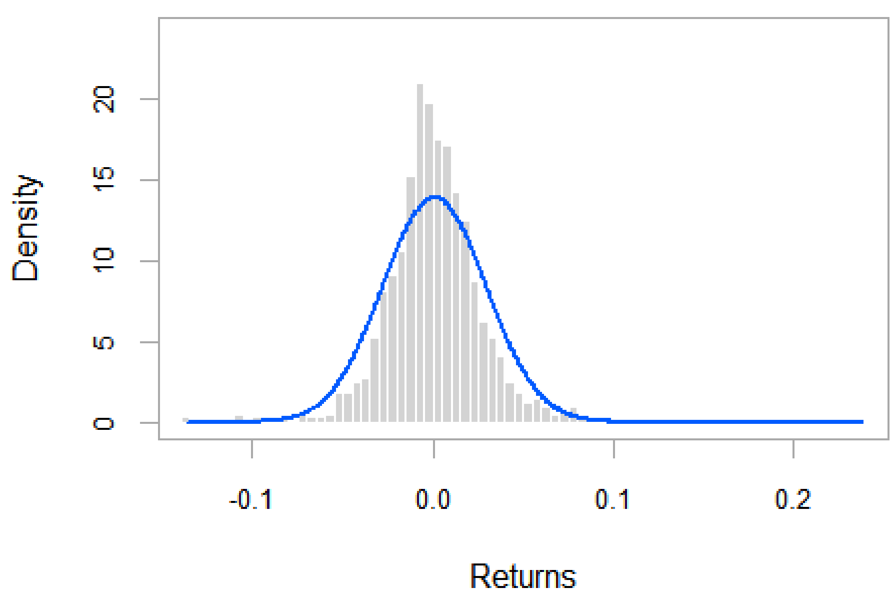
```
#2c test null hypothesis for the mean of log return of AMZN is zero
t.test(logamazon_return)
```

```
##
##  One Sample t-test
##
## data:  logamazon_return
## t = 0.97705, df = 1258, p-value = 0.3287
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -0.0007975567  0.0023801007
## sample estimates:
##   mean of x
## 0.000791272
```

```
#2d obtain histogram and sample density plot of daily log returns of Amazon
stock
hist(logamazon_return,breaks=40, col="slateblue")
```




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



```r
#3a Compute mean, s.d., skewness, excess kurtosis, min and max return series
da2=read.table(file = "m-abt3dx.txt",header = TRUE)
RET_return=da2[,2]
table.Stats(RET_return)
```

```
##
## Observations    492.0000
## NAs               0.0000
## Minimum          -0.2341
## Quartile 1       -0.0242
## Median            0.0141
## Arithmetic Mean   0.0141
## Geometric Mean    0.0120
## Quartile 3        0.0558
## Maximum           0.3823
## SE Mean           0.0029
## LCL Mean (0.95)   0.0083
## UCL Mean (0.95)   0.0198
## Variance          0.0042
## Stdev             0.0648
## Skewness          0.0974
## Kurtosis          2.4923
```

```r
CRSP2_return=da2[,3]
table.Stats(CRSP2_return)
```

```
##
## Observations    492.0000
## NAs               0.0000
## Minimum          -0.2254
## Quartile 1       -0.0172
## Median            0.0126
## Arithmetic Mean   0.0090
## Geometric Mean    0.0079
## Quartile 3        0.0395
## Maximum           0.1656
## SE Mean           0.0021
## LCL Mean (0.95)   0.0049
## UCL Mean (0.95)   0.0131
## Variance          0.0021
## Stdev             0.0463
## Skewness         -0.5570
## Kurtosis          2.0943
```

```r
CRSP_equalweighted2_return=da2[,4]
table.Stats(CRSP_equalweighted2_return)
```

```
##
## Observations    492.0000
## NAs               0.0000
## Minimum          -0.2722
```

```
## Quartile 1       -0.0207
## Median            0.0144
## Arithmetic Mean   0.0116
## Geometric Mean    0.0099
## Quartile 3        0.0445
## Maximum           0.2993
## SE Mean           0.0026
## LCL Mean (0.95)   0.0065
## UCL Mean (0.95)   0.0167
## Variance          0.0033
## Stdev             0.0573
## Skewness         -0.2006
## Kurtosis          3.3137
```

```
SP2_return=da2[,5]
table.Stats(SP2_return)
```

```
##
## Observations    492.0000
## NAs               0.0000
## Minimum          -0.2176
## Quartile 1       -0.0189
## Median            0.0091
## Arithmetic Mean   0.0064
## Geometric Mean    0.0054
## Quartile 3        0.0353
## Maximum           0.1630
## SE Mean           0.0020
## LCL Mean (0.95)   0.0024
## UCL Mean (0.95)   0.0104
## Variance          0.0020
## Stdev             0.0448
## Skewness         -0.4457
## Kurtosis          1.9097
```

```
#3b Transform simple to log return and compute mean, s.d., skewness, excess
kurtosis, min and max return series
logRET_return=log(1+RET_return)
table.Stats(logRET_return)
```

```
##
## Observations    492.0000
## NAs               0.0000
## Minimum          -0.2668
## Quartile 1       -0.0245
## Median            0.0140
## Arithmetic Mean   0.0119
## Geometric Mean    0.0098
## Quartile 3        0.0543
## Maximum           0.3238
## SE Mean           0.0029
```

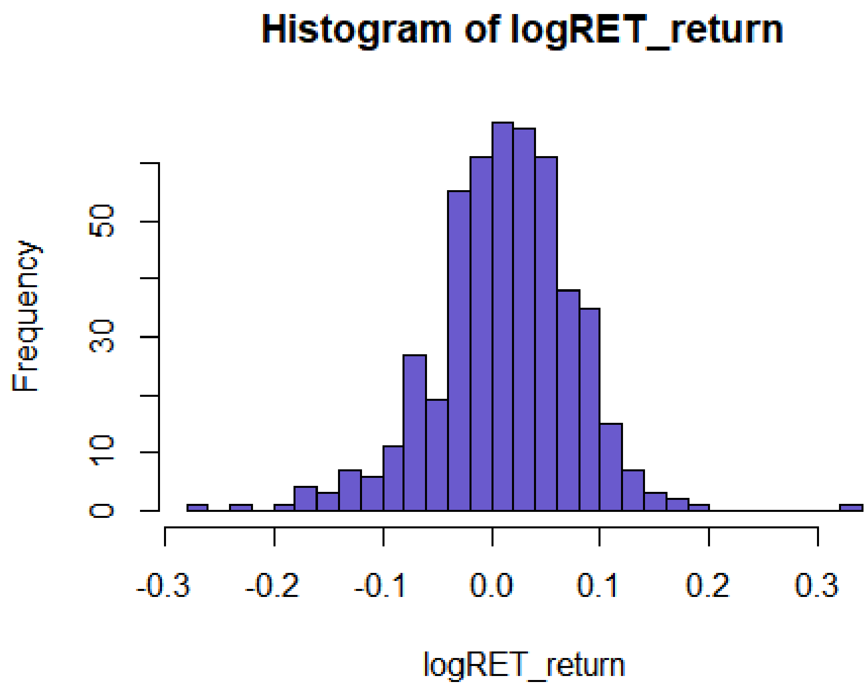
```
## LCL Mean (0.95)   0.0062
## UCL Mean (0.95)   0.0176
## Variance          0.0041
## Stdev             0.0643
## Skewness         -0.2980
## Kurtosis          2.0258

logCRSP2_return=log(1+CRSP2_return)
table.Stats(logCRSP2_return)

##
## Observations    492.0000
## NAs               0.0000
## Minimum          -0.2554
## Quartile 1       -0.0173
## Median            0.0125
## Arithmetic Mean   0.0079
## Geometric Mean    0.0068
## Quartile 3        0.0387
## Maximum           0.1532
## SE Mean           0.0021
## LCL Mean (0.95)   0.0038
## UCL Mean (0.95)   0.0120
## Variance          0.0022
## Stdev             0.0467
## Skewness         -0.8421
## Kurtosis          3.0278

logCRSP_equalweighted2_retuen=log(1+CRSP_equalweighted2_return)
table.Stats(logCRSP_equalweighted2_retuen)

##
## Observations    492.0000
## NAs               0.0000
## Minimum          -0.3178
## Quartile 1       -0.0209
## Median            0.0143
## Arithmetic Mean   0.0099
## Geometric Mean    0.0082
## Quartile 3        0.0435
## Maximum           0.2618
## SE Mean           0.0026
## LCL Mean (0.95)   0.0048
## UCL Mean (0.95)   0.0150
## Variance          0.0033
## Stdev             0.0575
## Skewness         -0.6643
## Kurtosis          4.0045

logSP2_return=log(1+SP2_return)
table.Stats(logSP2_return)
```

```
##
## Observations    492.0000
## NAs               0.0000
## Minimum          -0.2454
## Quartile 1       -0.0191
## Median            0.0090
## Arithmetic Mean   0.0054
## Geometric Mean    0.0043
## Quartile 3        0.0347
## Maximum           0.1510
## SE Mean           0.0020
## LCL Mean (0.95)   0.0014
## UCL Mean (0.95)   0.0094
## Variance          0.0020
## Stdev             0.0451
## Skewness         -0.7134
## Kurtosis          2.6821
```

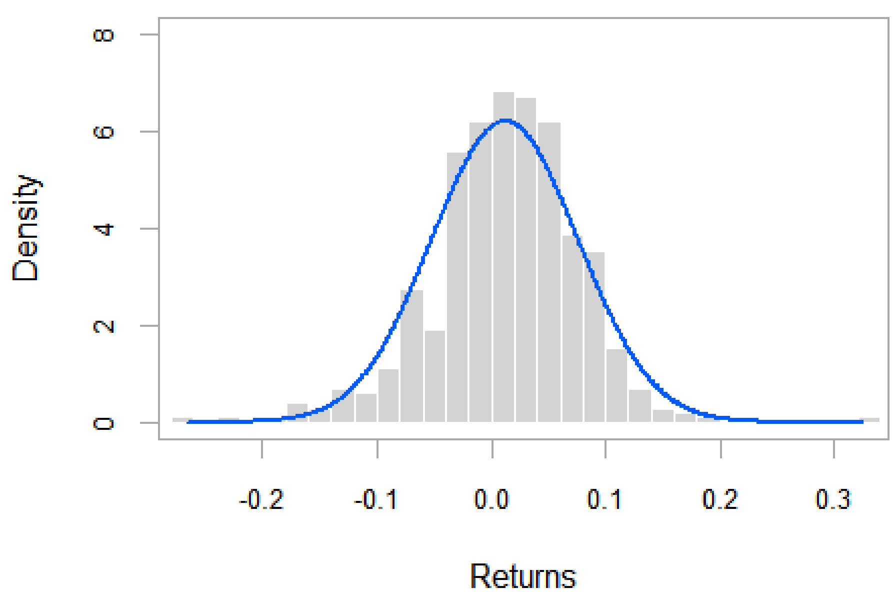
```
#3c Test null hypothesis for the mean of log return ABT is zero
t.test
```

```
## function (x, ...)
## UseMethod("t.test")
## <bytecode: 0x0000000013cfcf28>
## <environment: namespace:stats>
```

```
#3d obtain histogram and sample density plot of daily log returns of ABT
stock
hist(logRET_return,breaks = 40, col = "slateblue")
```




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



```
#4a test mean of stock return of value-weighted index
t.test(CRSP2_return)
```

```
##
##  One Sample t-test
##
## data:  CRSP2_return
## t = 4.3172, df = 491, p-value = 1.912e-05
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.004914667 0.013124406
## sample estimates:
##   mean of x
## 0.009019537
```

At 95% confidence level (alpha equals to 0.05), p-value that we get from the t-test is less than alpha, therefore, we can reject H0. This means that the mean of the return is not equal to zero.

```
#4b test skewness of stock return of value-weighted index
T=length(CRSP2_return)
s3=skewness(CRSP2_return)
tst = s3/sqrt(6/T)
tst
```

```
## [1] -5.044201
```

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

```
## [1] 4.55421e-07
```

Since p-value is less than alpha, 0.05, at 95% confidence interval so we can reject H0, the return is not symmetry.

```
#4c test exccess kurtosis of stock return of value-weighted index
k4 = kurtosis(CRSP2_return)
tst = k4/sqrt(24/T)
tst
```

```
## [1] 9.482548
```

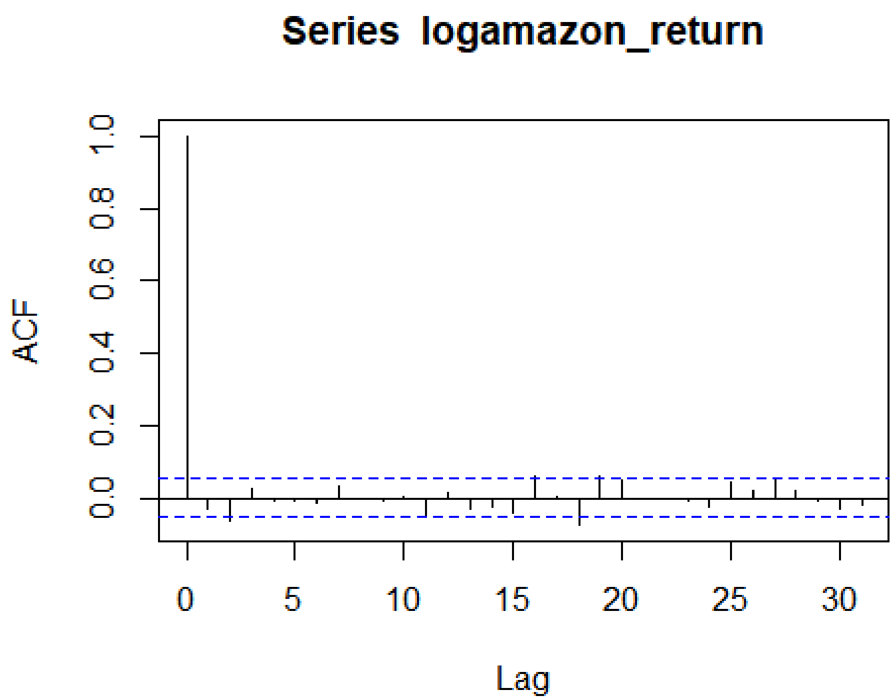
```
pv = 2*(1-pnorm(tst))
pv
```

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

Since the p-value is zero which is less than 0.05 (alpha at 95% confidence interval), so we can reject H0, the excess kurtosis is not equal to zero.

```
#5a i) test null hypothesis that log return is symmetric w.r.t its mean(for
AMZN stock)
```

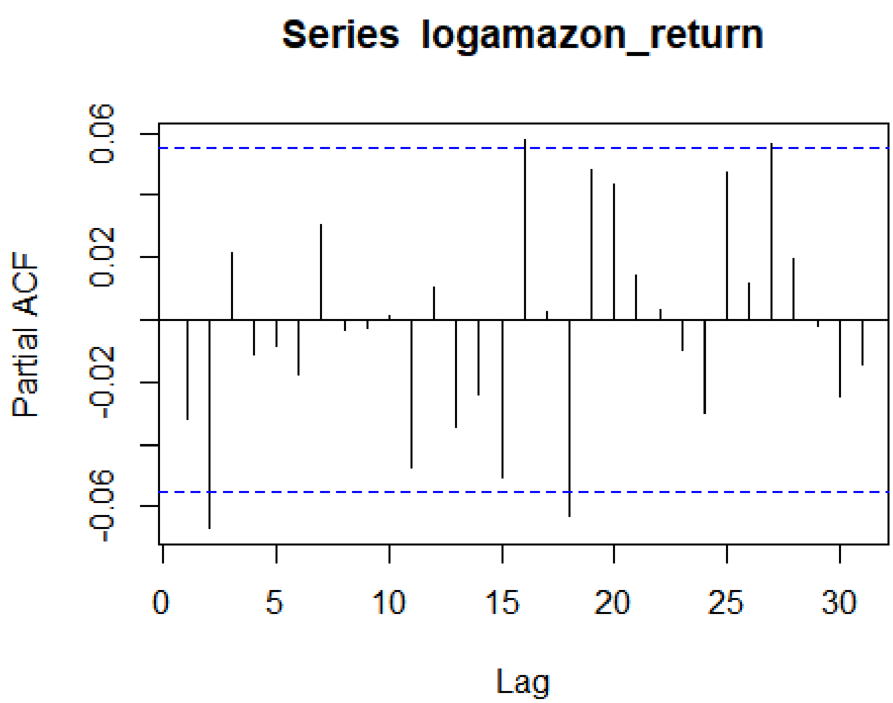
```r
T=length(logamazon_return)
s3=skewness(logamazon_return)
tst = s3/sqrt(6/T)
tst

## [1] 9.095459

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

## [1] 0

#5a ii) test the null hypothesis of the excess kurtosis of the returns is
zero
k4 = kurtosis(logamazon_return)
tst = k4/sqrt(24/T)
tst

## [1] 52.62331

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

## [1] 0

#5a iii) construct a 95% confidence interval for the expected daily log
return of AMZN
t.test(logamazon_return)

##
##  One Sample t-test
##
## data:  logamazon_return
## t = 0.97705, df = 1258, p-value = 0.3287
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -0.0007975567  0.0023801007
## sample estimates:
##   mean of x
## 0.000791272

#5b Compute ACF and PACF of daily log return of Amazon
m1=acf(logamazon_return)
```




```
names(m1)

## [1] "acf"    "type"   "n.used" "lag"    "series" "snames"

m1$acf

## , , 1
##
##                 [,1]
##  [1,]  1.0000000000
##  [2,] -0.0316614625
##  [3,] -0.0657963636
##  [4,]  0.0254218662
##  [5,] -0.0078449975
##  [6,] -0.0106049170
##  [7,] -0.0148006161
##  [8,]  0.0323683041
##  [9,] -0.0036167194
## [10,] -0.0071029841
## [11,]  0.0036460656
## [12,] -0.0470650529
## [13,]  0.0124225728
## [14,] -0.0292344042
## [15,] -0.0243312999
## [16,] -0.0427496969
## [17,]  0.0620802986
## [18,]  0.0061473042
```

```
## [19,] -0.0744147656
## [20,]  0.0568749860
## [21,]  0.0471836320
## [22,]  0.0003109035
## [23,] -0.0006986516
## [24,] -0.0062326764
## [25,] -0.0244831099
## [26,]  0.0430134379
## [27,]  0.0192213377
## [28,]  0.0464068477
## [29,]  0.0197592080
## [30,] -0.0055967072
## [31,] -0.0317808897
## [32,] -0.0189335815
```

```
m2=pacf(logamazon_return)
```




```
names(m2)

## [1] "acf"     "type"    "n.used" "lag"     "series" "snames"

m2$pacf

## NULL

Box.test(logamazon_return,lag = 12,type = 'Ljung')
```

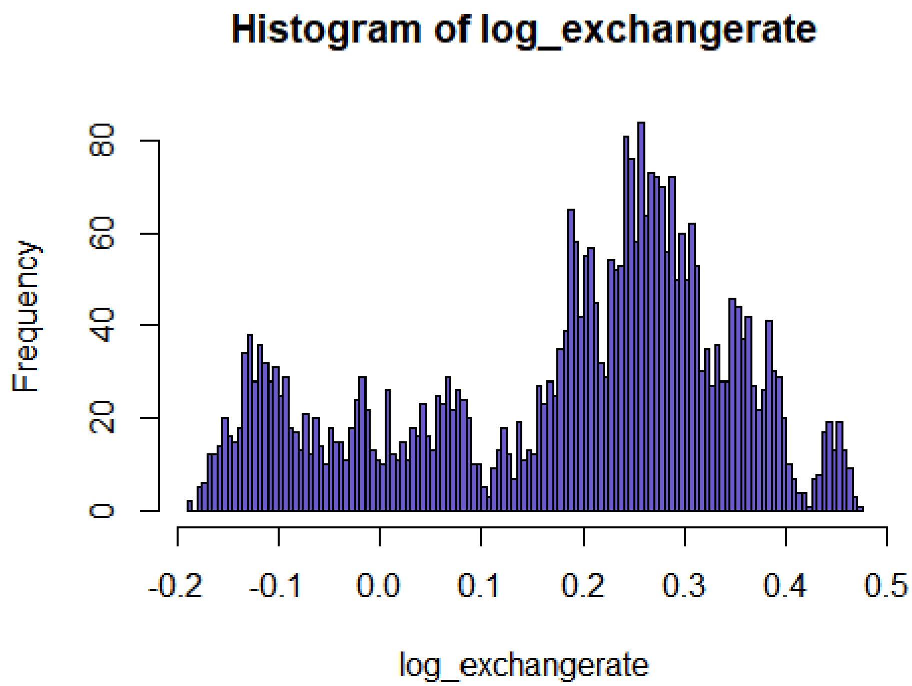
```
##
##  Box-Ljung test
##
## data:  logamazon_return
## X-squared = 12.488, df = 12, p-value = 0.4073
```

Since, p-value is greater than 0.05 (alpha at 95% confidence interval), we do not reject H0.

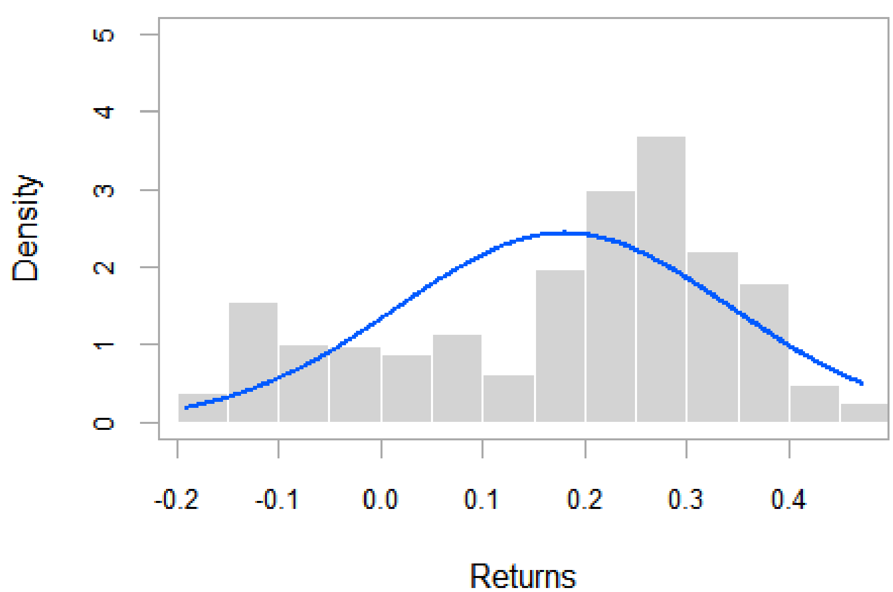
```
#6a Compute daily log return of the exchange rate
da3=read.table(file = "d-exuseu.txt",header = TRUE)
exchangerate=da3[,4]
log_exchangerate=log(exchangerate)


#6b Compute mean, s.d., skewness, excess kurtosis, min and max of log return
of exchange rate
table.Stats(log_exchangerate)
```

```
##
## Observations    3567.0000
## NAs                0.0000
## Minimum           -0.1900
## Quartile 1         0.0588
## Median             0.2290
## Arithmetic Mean    0.1796
## Geometric Mean     0.1673
## Quartile 3         0.2965
## Maximum            0.4706
## SE Mean            0.0027
## LCL Mean (0.95)    0.1742
## UCL Mean (0.95)    0.1849
## Variance           0.0269
## Stdev              0.1640
## Skewness          -0.5946
## Kurtosis          -0.7252
```

```
#6c obtain density plot
hist(log_exchangerate,breaks=100,col="slateblue")
```




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



```
#6d Test mean of the daily log return of exchange rate
t.test(log_exchangerate)

##
##  One Sample t-test
##
## data:  log_exchangerate
## t = 65.384, df = 3566, p-value < 2.2e-16
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.1741686 0.1849368
## sample estimates:
## mean of x
## 0.1795527
```