Assignment-3_Jidapa Chandhasrisawad.R

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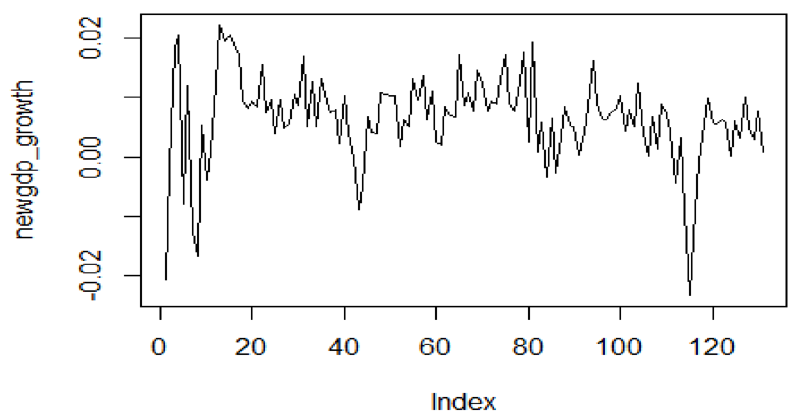
```r
#Assignment 3
setwd("D:/uni year 3/EE435")
#install.packages("quantmod")
#install.packages("fBasics")
#install.packages("sn")
#install.packages("PerformanceAnalytics")
#install.packages("car")
#install.packages("tseries")
#install.packages("forecast")
library(quantmod)

## 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)
#1 GDP
da = read.table(file = "q-gdpmc1.txt", header = TRUE)
gdp = da[,4]
log_gdp = log(gdp)
gdp_growth = diff(log_gdp)
#1a plot the graph from 1980 to 2012
new_gdp = da[133:264, 4]
```

```
newgdp_growth = diff(log(new_gdp))
plot(newgdp_growth, type = 'l')
```




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

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

Since p-value is less than 0.05, we reject H0: $\rho_1 = \rho_2 = \rho_3 = ... = \rho_{12} = 0$ with 95% confidence in terval meaning that the variation of the past information can explain the variation of GDP t oday.

```
#1c
t.test(gdp_growth)

##
##  One Sample t-test
##
## data:  gdp_growth
## 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 calculated p-value is less than 0.05, we need to reject the null hypothesis that true me an of the US GDP growth rate is equal to 0 with 95% confidence interval. Therefore, the tru e mean of GDP growth rate is not equal to zero.

```r
#2 Amazon
#2a
da2 = read.table("d-amzn3dx.txt", header = TRUE)
R_amzn = da2[,2]
R_vw = da2[,3]
R_ew = da2[,4]
R_sp = da2[,5]
```

```r
table.Stats(R_amzn)
```

```
##
## 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
```

```r
table.Stats(R_vw)
```

```
##
## 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
```

```r
table.Stats(R_ew)
```

```
##
## 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
```

```r
table.Stats(R_sp)
```

```
##
## 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
```

```r
#2b
#logreturn = ln(1+simple return)
```

```r
logreturn_amzn = log(1+R_amzn)
logreturn_vw = log(1+R_vw)
logreturn_ew = log(1+R_ew)
logreturn_sp = log(1+R_sp)
```

```r
table.Stats(logreturn_amzn)
```

```
##
## 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
```

```r
table.Stats(logreturn_vw)
```

```
##
## 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
```

```r
table.Stats(logreturn_ew)
```

```
##
## 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
```

```r
table.Stats(logreturn_sp)
```

```
##
## 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
```

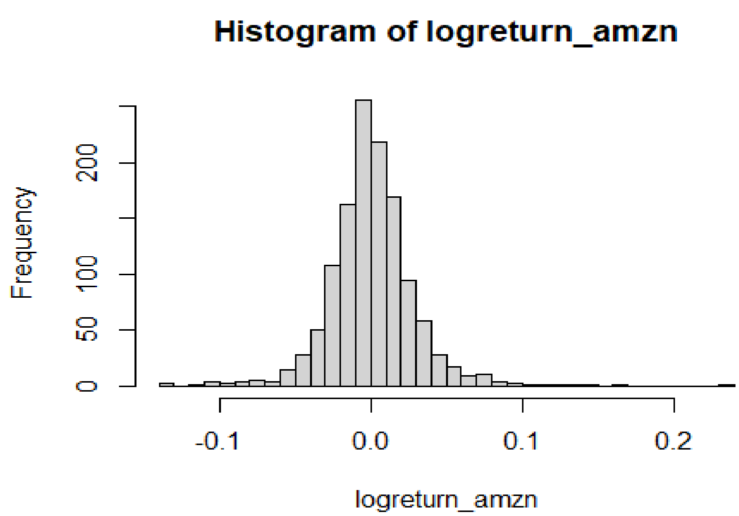
```r
#2c test mean of AMZN logreturn = 0
t.test(logreturn_amzn)
```

```
##
##  One Sample t-test
```

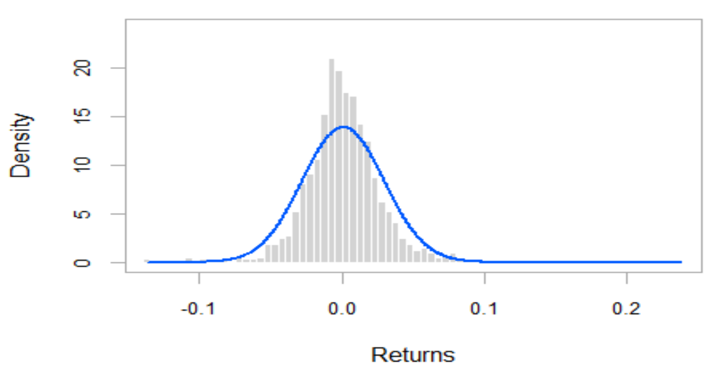
```
##
## data:  logreturn_amzn
## t = 0.97705, df = 1258, p-value = 0.3287
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -0.0007975567  0.0023801007
## sample estimates:
##   mean of x
## 0.000791272
```

Since the calculated p-value is larger than 0.05, we cannot reject the null hypothesis that th e true mean of Amazon log return is equal to zero. Therefore, it can be concluded that the tr ue mean of Amazon log return is equal to zero.

```
#2d histogram and sample density plot
hist(logreturn_amzn, nclass = 40)
```




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



```
#3
da3 = read.table(file = "m-abt3dx.txt", header = TRUE)
R_abt = da3[,2]
R_vw_m = da3[,3] #use _m to represent monthly data
R_ew_m =da3[,4]
R_sp_m = da3[,5]
```

```
table.Stats(R_abt)
```

```
##
## 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
```

```
table.Stats(R_vw_m)
```

```
##
## 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
```

```
table.Stats(R_ew_m)
```

```
##
## 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
```

```
table.Stats(R_sp_m)
```

```
##
## 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
logreturn_abt = log(1+R_abt)
logreturn_vw_m = log(1+R_vw_m)
logreturn_ew_m = log(1+R_ew_m)
```

```r
logreturn_sp_m = log(1+R_sp_m)
```

```r
table.Stats(logreturn_abt)
```

```
##
## 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
```

```r
table.Stats(logreturn_ew_m)
```

```
##
## 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
```

```r
table.Stats(logreturn_vw_m)
```

```
##
## 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
```

```r
table.Stats(logreturn_sp_m)
```

```
##
## 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
```

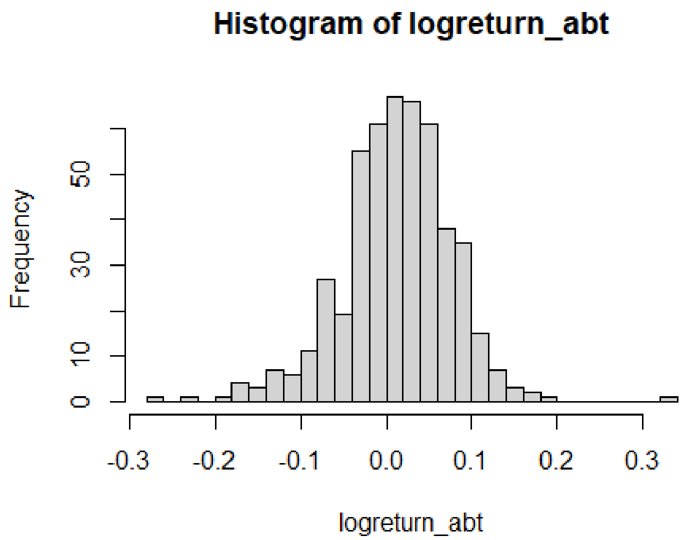
```r
#3c test mean of logreturn of abt = 0
t.test(logreturn_abt)
```

```
##
##  One Sample t-test
##
## data:  logreturn_abt
## t = 4.1143, df = 491, p-value = 4.555e-05
```

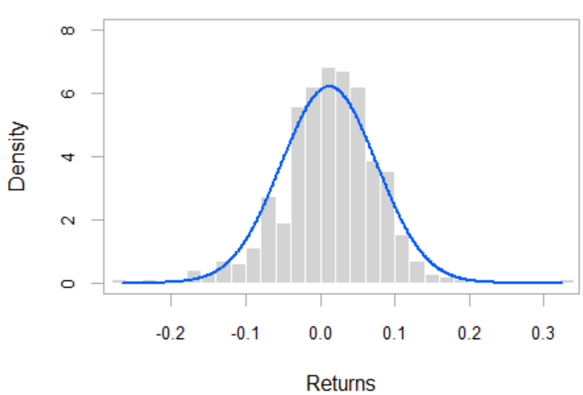
```
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.006229721 0.017618849
## sample estimates:
##  mean of x
## 0.01192429
```

Since the calculated p-value is less than 0.05, we reject H0: true mean of ABT log return = 0 with 95% confidence interval. Therefore, it can be concluded that the true mean of ABT log return is not equal to zero.

```
#3d histogram and sample density plot
hist(logreturn_abt, nclass = 40)
```




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



```r
#4 monthly stock return of VW
#4a mean of vw = 0
#H0: mean = 0
#H1: mean =/ 0
t.test(logreturn_vw_m)

##
##  One Sample t-test
##
## data:  logreturn_vw_m
## t = 3.7499, df = 491, p-value = 0.000198
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  0.003761858 0.012043156
## sample estimates:
##   mean of x
## 0.007902507
```

We reject H0 that the mean of CRSP value-weighted index (VW) is equal to zero with 95% confidence interval because the calculated p-value is less than 0.05. Hence, the true mean of VW index is not equal to zero.

```r
#4b test skewness(m3)
#H0: m3 = 0
#H1: m3 =/ 0
m3 = skewness(logreturn_vw_m)
tcal = m3/sqrt(6/length(logreturn_vw_m))
tcal

## [1] -7.625616

pvalue_m3 = 2*pnorm(tcal)
pvalue_m3

## [1] 2.428715e-14
```

We reject H0: m3 = 0 with 95% confidence interval because the calculated S* or tcal is large r than 1.96 which is the critical value. Thus, the skewness of the log return is not equal to ze ro.

```r
#4c
#H0: Kurtosis = 3 or Excess kurtosis = 0
#H1: Kurtosis =/ 3 or Excess kurtosis =/ 0
K = kurtosis(logreturn_vw_m)
tcal2 = K/sqrt(24/length(logreturn_vw_m))
tcal2

## [1] 13.70899

pvalue_K = 2*(1-pnorm(tcal2))
pvalue_K
```

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

We reject H0: Kurtosis = 3 with 95% confidence interval since the calculated K* or tcal2 is l arger than 1.96. Therefore, the kurtosis of the log return distribution is not equal to 3.

```
#5
#5ai
#H0: logreturn of AMZN is symmetry
#H1: logreturn of AMZN is not symmetry
m3_amzn = skewness(logreturn_amzn)
tcal_amzn = m3/sqrt(6/length(logreturn_amzn))
tcal_amzn

## [1] -12.19847
```

We reject H0 in this case as the calculated S* (tcal_amzn) is larger than 1.96 with 95% confi dence interval. Therefore, log return of Amazon is not symmetry.

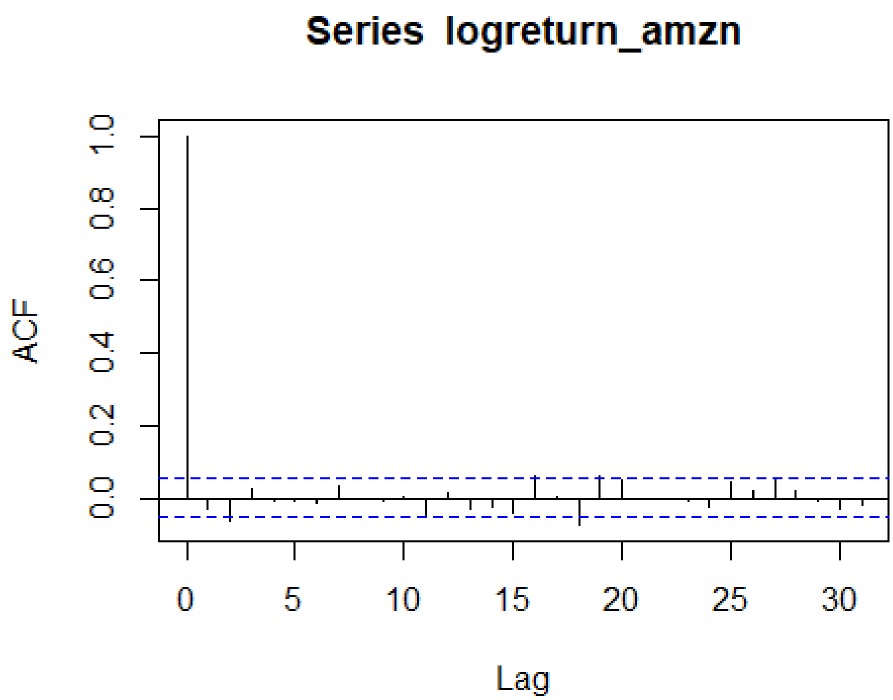
```
#5aii
#H0: excess kurtosis = 0
#H1: excess kurtosis =/ 0
K_amzn = kurtosis(logreturn_amzn)
K_amzn

## [1] 7.26559

tcal_Kamzn = K_amzn/sqrt(24/length(logreturn_amzn))
tcal_Kamzn

## [1] 52.62331
```

We reject H0 in this case with 95% confidence interval since S* (tcal_Kamzn) > 1.96. Theref ore, the excess kurtosis of Amazon log return is not equal to zero.

```
#5aiii 95 percent confidence interval
t.test(logreturn_amzn)

## 
##  One Sample t-test
## 
## data:  logreturn_amzn
## 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
```

95% CI is between -0.000798 and 0.00238.

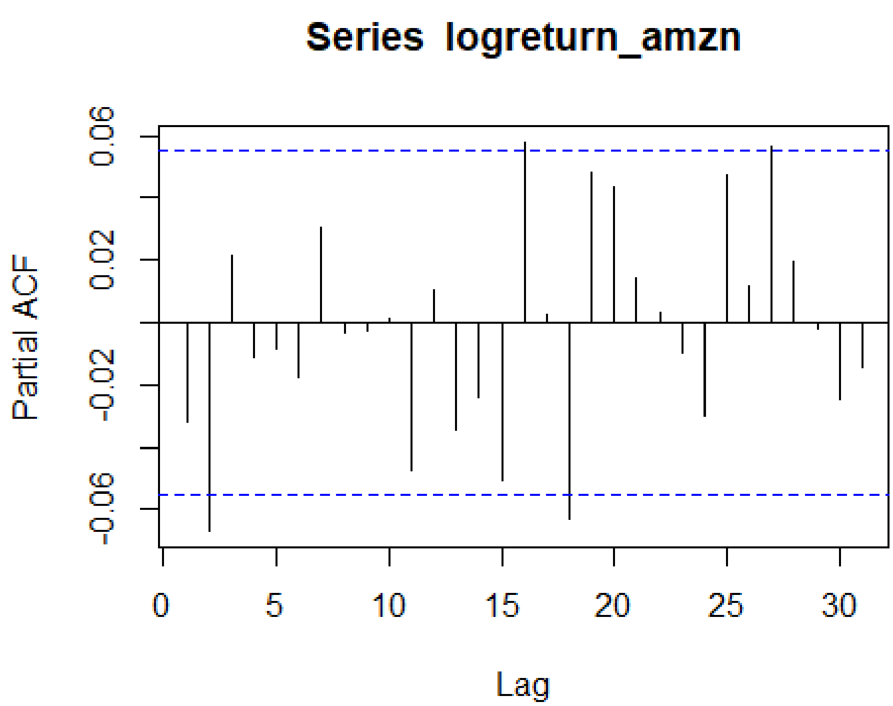
```
#5b
m1=acf(logreturn_amzn)
```




```
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(logreturn_amzn)
```




```
names(m2)

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

m2$acf

## , , 1
##
```

```
##               [,1]
##  [1,] -0.031661462
##  [2,] -0.066865841
##  [3,]  0.021198224
##  [4,] -0.010767266
##  [5,] -0.008175617
##  [6,] -0.017271554
##  [7,]  0.030726846
##  [8,] -0.003403192
##  [9,] -0.002629988
## [10,]  0.001032256
## [11,] -0.047363651
## [12,]  0.010284023
## [13,] -0.034370971
## [14,] -0.024008840
## [15,] -0.050490587
## [16,]  0.057915450
## [17,]  0.002614565
## [18,] -0.062793034
## [19,]  0.048259706
## [20,]  0.043316077
## [21,]  0.014313942
## [22,]  0.003269419
## [23,] -0.009825781
## [24,] -0.029795895
## [25,]  0.047586551
## [26,]  0.012023445
## [27,]  0.056509305
## [28,]  0.019236094
## [29,] -0.002035994
## [30,] -0.024437113
## [31,] -0.014212519
```

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

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

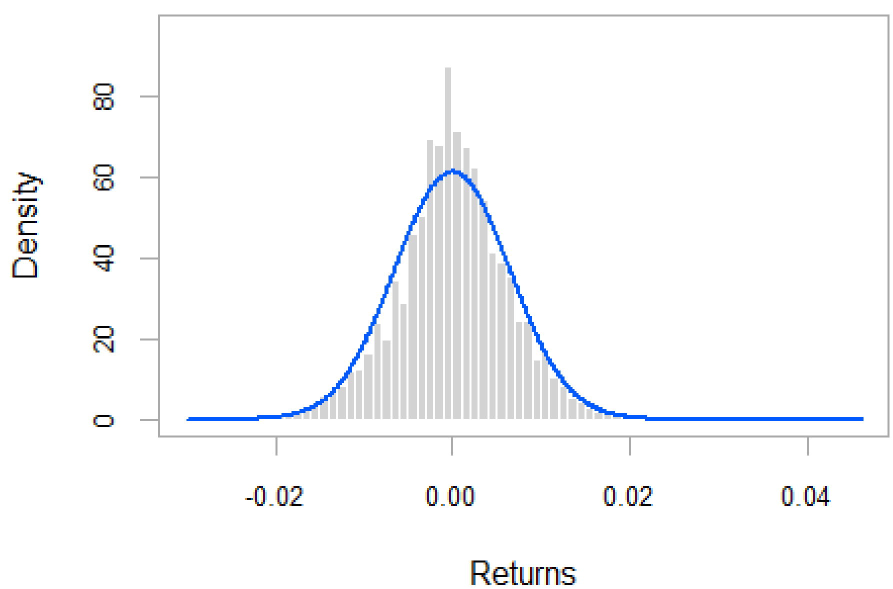
According to Ljung-Box test, we cannot reject H0: $\rho_1 = \rho_2 = \rho_3 = \ldots = \rho_{12} = 0$ with 95% CI since the p-value is larger than 0.05. Therefore, the past information could affect current log return of Amazon.

```
#6
da4 = read.table("d-exuseu.txt", header = TRUE)
#6a calculate daily log return of exchange rate
spotrate = da4[,4]
logreturn_ex = diff(log(spotrate))
```

```
#6b
table.Stats(logreturn_ex)
```

```
##
## Observations    3566.0000
## NAs                0.0000
## Minimum           -0.0300
## Quartile 1        -0.0036
## Median             0.0000
## Arithmetic Mean    0.0000
## Geometric Mean     0.0000
## Quartile 3         0.0038
## Maximum            0.0462
## SE Mean            0.0001
## LCL Mean (0.95)   -0.0002
## UCL Mean (0.95)    0.0002
## Variance           0.0000
## Stdev              0.0065
## Skewness           0.1168
## Kurtosis           2.0610
```

```
#6c density plot
chart.Histogram(logreturn_ex, methods = c("add.normal"))
```




```
#6d test mean = 0
t.test(logreturn_ex)
```

```
##
##  One Sample t-test
##
## data:  logreturn_ex
## t = 0.24489, df = 3565, p-value = 0.8066
## alternative hypothesis: true mean is not equal to 0
## 95 percent confidence interval:
##  -0.0001870737  0.0002404769
## sample estimates:
##    mean of x
## 2.670158e-05
```

Since the calculated p-value is larger than 0.05, we cannot reject H0: $\mu = 0$ with 95% confidence interval. Therefore, the true mean of log return of exchange rate is not equal to zero.