

Assignment3_6004641236.R

Admin

2021-03-01

```
#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)
library(fGarch)
library(Matrix)
library(tinytex)

da1=read.table("q-gdpmc1.txt", skip = 1, col.names = c("year", "month", "day", "gdp"))
dim(da1)

## [1] 264  4
head(da1)

##   year month day    gdp
## 1 1947     1   1 1770691
## 2 1947     4   1 1767976
## 3 1947     7   1 1766523
## 4 1947    10   1 1793310
## 5 1948     1   1 1821809
## 6 1948     4   1 1855345
tail(da1)

##   year month day    gdp
## 259 2011     7   1 13306922
## 260 2011    10   1 13441048
## 261 2012     1   1 13506429
## 262 2012     4   1 13548540

```

```
## 263 2012      7    1 13652519
## 264 2012     10    1 13665444
```

```
#cheack data
```

```
#Question1
```

```
GDP= da1[,4]
```

```
head(GDP)
```

```
## [1] 1770691 1767976 1766523 1793310 1821809 1855345
```

```
tail(GDP)
```

```
## [1] 13306922 13441048 13506429 13548540 13652519 13665444
```

```
list(GDP)
```

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

```
## [1] 1770691 1767976 1766523 1793310 1821809 1855345 1865320 1868184
## [9] 1842240 1835512 1856103 1838679 1912998 1971217 2048351 2084390
## [17] 2110731 2145746 2188503 2192210 2214268 2216709 2231561 2305276
## [25] 2348408 2366180 2351793 2314567 2303523 2306413 2332418 2379125
## [33] 2447657 2488149 2521394 2535472 2523902 2543752 2540555 2582070
## [41] 2597939 2591671 2616638 2589110 2519019 2534480 2593867 2654348
## [49] 2708036 2776430 2773119 2782827 2845268 2831971 2836599 2800224
## [57] 2816858 2869554 2915929 2975288 3028654 3062094 3090408 3097917
## [65] 3138407 3177733 3237567 3262180 3335397 3373705 3419548 3429028
## [73] 3513250 3560919 3633182 3720836 3812167 3824857 3850012 3881205
## [81] 3915396 3916211 3947455 3977573 4059545 4128472 4156717 4174727
## [89] 4240478 4252828 4279723 4259622 4252940 4260650 4298588 4253004
## [97] 4370283 4395075 4430159 4442470 4521907 4629147 4673511 4750488
## [105] 4872005 4928362 4902065 4948823 4905427 4917987 4869361 4850197
## [113] 4791203 4827818 4909135 4973263 5086318 5124570 5149673 5187069
## [121] 5247280 5351560 5447268 5446141 5464738 5679718 5735401 5811259
## [129] 5820977 5826441 5868323 5884469 5903424 5782434 5771687 5878439
## [137] 6000591 5952711 6025037 5949980 5852334 5884048 5861363 5865990
## [145] 5938947 6072433 6192178 6320176 6442760 6553996 6617690 6671565
## [153] 6734522 6791542 6897631 6949982 7016763 7044952 7112874 7147254
## [161] 7186881 7263307 7326301 7451658 7490203 7586401 7625570 7727392
## [169] 7799942 7858304 7920628 7937918 8020842 8052721 8052598 7982047
## [177] 7943380 7996993 8030679 8062160 8150654 8237259 8322253 8409834
## [185] 8425289 8479193 8523828 8636393 8720471 8839753 8896691 8995497
## [193] 9017565 9036950 9112901 9176437 9239297 9399025 9480781 9584272
## [201] 9657987 9801180 9924196 10000332 10094801 10185576 10319973 10498614
## [209] 10592145 10674942 10810680 11004834 11033569 11248802 11258255 11324964
## [217] 11287752 11361734 11330380 11370028 11467137 11528137 11586608 11590578
## [225] 11638917 11737522 11930678 12038591 12117924 12195893 12286667 12387233
## [233] 12514999 12570710 12670529 12735585 12896381 12948713 12950436 13038441
## [241] 13056121 13173553 13269826 13325962 13266834 13310467 13186925 12883531
## [249] 12710977 12700988 12746714 12873052 12947560 13019593 13103500 13181209
## [257] 13183780 13264662 13306922 13441048 13506429 13548540 13652519 13665444
```

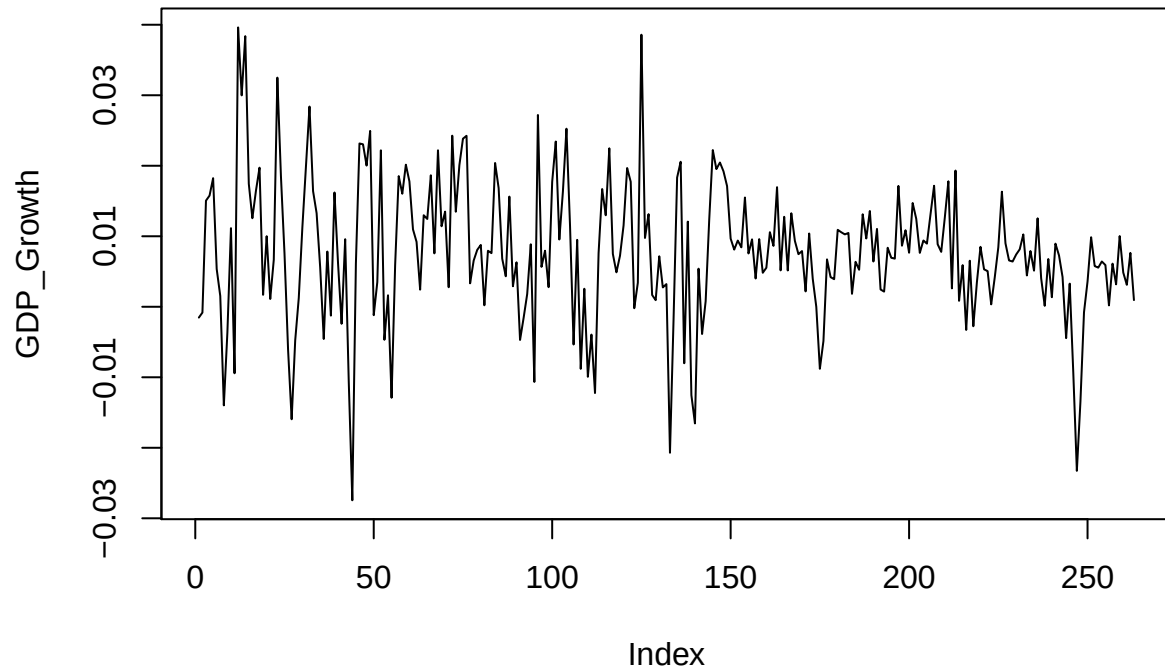
```
GDP_Growth=diff(log(GDP))
```

```
list(GDP_Growth)
```

```
## [[1]]
## [1] -1.534476e-03 -8.221816e-04 1.504987e-02 1.576689e-02 1.824070e-02
## [6] 5.361958e-03 1.534216e-03 -1.398461e-02 -3.658761e-03 1.115567e-02
## [11] -9.431750e-03 3.962427e-02 2.997947e-02 3.838396e-02 1.744117e-02
## [16] 1.255809e-02 1.645294e-02 1.973047e-02 1.692419e-03 1.001171e-02
## [21] 1.101789e-03 6.677677e-03 3.249907e-02 1.853724e-02 7.539189e-03
## [26] -6.098824e-03 -1.595539e-02 -4.782939e-03 1.253814e-03 1.121199e-02
## [31] 1.982728e-02 2.839847e-02 1.640782e-02 1.327286e-02 5.567890e-03
## [36] -4.573696e-03 7.834040e-03 -1.257595e-03 1.620884e-02 6.127036e-03
## [41] -2.415597e-03 9.587446e-03 -1.057610e-02 -2.744465e-02 6.118948e-03
## [46] 2.316132e-02 2.304924e-02 2.002460e-02 2.494228e-02 -1.193250e-03
## [51] 3.494638e-03 2.218995e-02 -4.684328e-03 1.632864e-03 -1.290639e-02
## [56] 5.922665e-03 1.853454e-02 1.603185e-02 2.015238e-02 1.777746e-02
## [61] 1.098070e-02 9.204125e-03 2.426829e-03 1.298540e-02 1.245270e-02
## [66] 1.865407e-02 7.573562e-03 2.219603e-02 1.141983e-02 1.349683e-02
## [71] 2.768460e-03 2.426470e-02 1.347712e-02 2.009019e-02 2.383953e-02
## [76] 2.424942e-02 3.323287e-03 6.555184e-03 8.069407e-03 8.770801e-03
## [81] 2.081310e-04 7.946463e-03 7.600767e-03 2.039906e-02 1.683646e-02
## [86] 6.818217e-03 4.323387e-03 1.562703e-02 2.908175e-03 6.304114e-03
## [91] -4.707864e-03 -1.569915e-03 1.811222e-03 8.864866e-03 -1.066104e-02
## [96] 2.720221e-02 5.656829e-03 7.950879e-03 2.775053e-03 1.772328e-02
## [101] 2.343881e-02 9.537991e-03 1.633674e-02 2.525821e-02 1.150112e-02
## [106] -5.350136e-03 9.493226e-03 -8.807627e-03 2.557157e-03 -9.936583e-03
## [111] -3.943394e-03 -1.223779e-02 7.613078e-03 1.670315e-02 1.297841e-02
## [116] 2.247803e-02 7.492429e-03 4.886598e-03 7.235580e-03 1.154105e-02
## [121] 1.967826e-02 1.772609e-02 -2.069141e-04 3.408895e-03 3.858540e-02
## [126] 9.756086e-03 1.313957e-02 1.670874e-03 9.382338e-04 7.162552e-03
## [131] 2.747604e-03 3.216014e-03 -2.070782e-02 -1.860289e-03 1.832684e-02
## [136] 2.056671e-02 -8.011218e-03 1.207687e-02 -1.253576e-02 -1.654730e-02
## [141] 5.404404e-03 -3.862790e-03 7.890954e-04 1.236058e-02 2.222750e-02
## [146] 1.952753e-02 2.046017e-02 1.920996e-02 1.711792e-02 9.671426e-03
## [151] 8.108099e-03 9.392370e-03 8.431180e-03 1.550000e-02 7.561050e-03
## [156] 9.562931e-03 4.009331e-03 9.595050e-03 4.821845e-03 5.529054e-03
## [161] 1.057795e-02 8.635515e-03 1.696581e-02 5.159342e-03 1.276140e-02
## [166] 5.149771e-03 1.326435e-02 9.344879e-03 7.454509e-03 7.899689e-03
## [171] 2.180529e-03 1.039238e-02 3.966643e-03 -1.527446e-05 -8.799877e-03
## [176] -4.856017e-03 6.726719e-03 4.203486e-03 3.912428e-03 1.091666e-02
## [181] 1.056947e-02 1.026537e-02 1.046872e-02 1.836043e-03 6.377502e-03
## [186] 5.250256e-03 1.311948e-02 9.688231e-03 1.358568e-02 6.420475e-03
## [191] 1.104471e-02 2.450223e-03 2.147386e-03 8.369374e-03 6.947901e-03
## [196] 6.826798e-03 1.714016e-02 8.660736e-03 1.085672e-02 7.661820e-03
## [201] 1.471755e-02 1.247303e-02 7.642477e-03 9.402246e-03 8.952063e-03
## [206] 1.310854e-02 1.716210e-02 8.869440e-03 7.786437e-03 1.263541e-02
## [211] 1.780010e-02 2.607722e-03 1.931928e-02 8.400033e-04 5.907855e-03
## [216] -3.291248e-03 6.532798e-03 -2.763429e-03 3.493157e-03 8.504522e-03
## [221] 5.305450e-03 5.059206e-03 3.425783e-04 4.161870e-03 8.436322e-03
## [226] 1.632235e-02 9.004340e-03 6.568272e-03 6.413577e-03 7.415435e-03
## [231] 8.151655e-03 1.026150e-02 4.441660e-03 7.909241e-03 5.121298e-03
## [236] 1.254669e-02 4.049672e-03 1.330546e-04 6.772539e-03 1.355072e-03
## [241] 8.954193e-03 7.281477e-03 4.221427e-03 -4.446926e-03 3.283482e-03
```

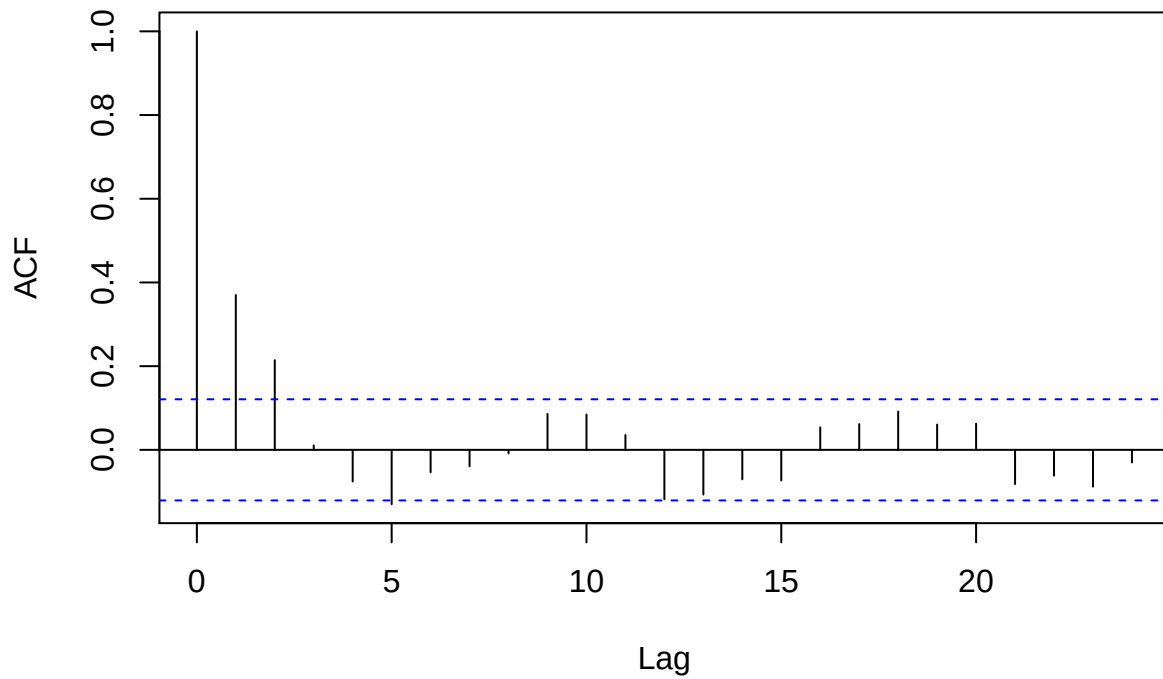
```
## [246] -9.324910e-03 -2.327598e-02 -1.348388e-02 -7.861651e-04 3.593727e-03  
## [251] 9.862621e-03 5.771219e-03 5.548023e-03 6.423993e-03 5.912885e-03  
## [256] 1.950314e-04 6.116221e-03 3.180844e-03 1.002896e-02 4.852486e-03  
## [261] 3.112998e-03 7.645254e-03 9.462639e-04
```

```
plot(GDP_Growth,type="l")
```



```
m1=acf(GDP_Growth)
```

Series GDP_Growth



```
names(m1)
```

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

```
m1$acf
```

```
## , , 1
```

```
##
```

```
##          [,1]
```

```
## [1,] 1.000000000
```

```
## [2,] 0.370000013
```

```
## [3,] 0.214242174
```

```
## [4,] 0.010736359
```

```
## [5,] -0.075552257
```

```
## [6,] -0.129944597
```

```
## [7,] -0.053754640
```

```
## [8,] -0.039425441
```

```
## [9,] -0.008702604
```

```
## [10,] 0.086105943
```

```
## [11,] 0.084571233
```

```
## [12,] 0.035641140
```

```
## [13,] -0.118107413
```

```
## [14,] -0.106798234
```

```
## [15,] -0.070360606
```

```
## [16,] -0.073192373
```

```
## [17,] 0.053870122
```

```
## [18,] 0.061631517
```

```
## [19,] 0.091689878
## [20,] 0.060492740
## [21,] 0.062664761
## [22,] -0.081733930
## [23,] -0.061613172
## [24,] -0.087952226
## [25,] -0.030142752

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

##
## Box-Ljung test
##
## data: GDP_Growth
## X-squared = 64.259, df = 12, p-value = 3.737e-09

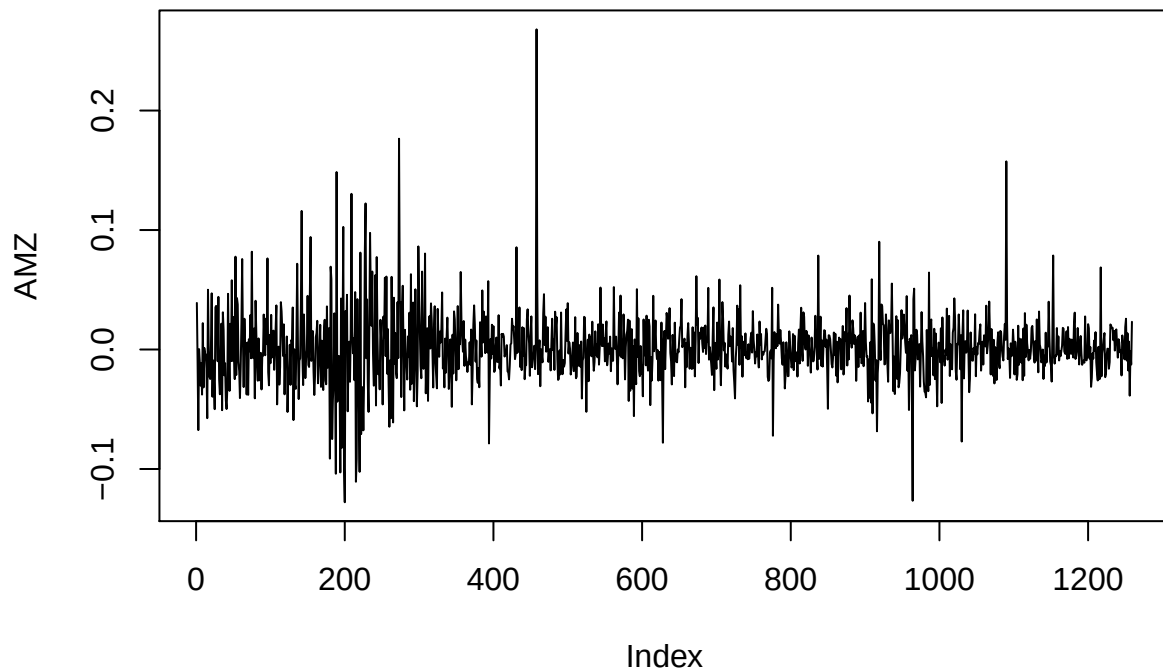
t.test(GDP_Growth)

##
## 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
```

#Question2

```
da2=read.table("d-amzn3dx.txt", skip = 1, col.names = c("date", "amzn","vwrtn","ewrtn","spartn"))

AMZ = da2[,2]
VWR = da2[,3]
EWR = da2[,4]
SPR = da2[,5]
plot(AMZ,type = "l")
```



```
head(AMZ)
```

```
## [1]  0.038968 -0.010805 -0.067430  0.000338 -0.010583 -0.030269
```

```
basicStats(AMZ)
```

```
##                               AMZ
## nobs                1259.000000
## NAs                   0.000000
## Minimum             -0.127820
## Maximum              0.267951
## 1. Quartile         -0.013195
## 3. Quartile          0.014571
## Mean                 0.001207
## Median              -0.000451
## Sum                  1.519912
## SE Mean              0.000820
## LCL Mean             -0.000401
## UCL Mean              0.002816
## Variance             0.000846
## Stdev                0.029087
## Skewness             1.031884
## Kurtosis             9.360219
```

```
basicStats(VWR)
```

```
##                               VWR
## nobs                1259.000000
```



```
## NAs          0.000000
## Minimum      -0.089763
## Maximum       0.114895
## 1. Quartile  -0.006328
## 3. Quartile   0.007376
## Mean          0.000210
## Median        0.000818
## Sum           0.264749
## SE Mean       0.000469
## LCL Mean      -0.000710
## UCL Mean       0.001130
## Variance      0.000277
## Stdev         0.016641
## Skewness      -0.113083
## Kurtosis      6.298940
```

```
basicStats(EWR)
```

```
##              EWR
## nobs          1259.000000
## NAs           0.000000
## Minimum       -0.078240
## Maximum        0.107422
## 1. Quartile   -0.006365
## 3. Quartile    0.007780
## Mean          0.000517
## Median         0.001210
## Sum           0.651089
## SE Mean       0.000434
## LCL Mean      -0.000334
## UCL Mean       0.001368
## Variance      0.000237
## Stdev         0.015395
## Skewness      -0.168185
## Kurtosis      5.275824
```

```
basicStats(SPR)
```

```
##              SPR
## nobs          1259.000000
## NAs           0.000000
## Minimum       -0.090350
## Maximum        0.115800
## 1. Quartile   -0.006301
## 3. Quartile    0.006978
## Mean          0.000114
## Median         0.000685
## Sum           0.143876
## SE Mean       0.000467
## LCL Mean      -0.000802
## UCL Mean       0.001031
## Variance      0.000275
## Stdev         0.016573
## Skewness      -0.018307
## Kurtosis      7.154386
```

```
logreturn_AMZ = log(AMZ+1)
logreturn_VWR = log(VWR+1)
logreturn_EWR = log(EWR+1)
logreturn_SPR = log(SCR+1)
```

```
basicStats(logreturn_AMZ)
```

```
##          logreturn_AMZ
## nobs          1259.000000
## NAs              0.000000
## Minimum         -0.136759
## Maximum          0.237402
## 1. Quartile     -0.013283
## 3. Quartile      0.014466
## Mean            0.000791
## Median          -0.000451
## Sum              0.996211
## SE Mean          0.000810
## LCL Mean        -0.000798
## UCL Mean         0.002380
## Variance         0.000826
## Stdev            0.028736
## Skewness         0.627148
## Kurtosis         7.249289
```

```
basicStats(logreturn_VWR)
```

```
##          logreturn_VWR
## nobs          1259.000000
## NAs              0.000000
## Minimum         -0.094050
## Maximum          0.108760
## 1. Quartile     -0.006348
## 3. Quartile      0.007348
## Mean            0.000072
## Median           0.000818
## Sum              0.090160
## SE Mean          0.000470
## LCL Mean        -0.000850
## UCL Mean         0.000993
## Variance         0.000278
## Stdev            0.016673
## Skewness        -0.317276
## Kurtosis         6.194861
```

```
basicStats(logreturn_EWR)
```

```
##          logreturn_EWR
## nobs          1259.000000
## NAs              0.000000
## Minimum         -0.081470
## Maximum          0.102035
## 1. Quartile     -0.006385
## 3. Quartile      0.007749
```

```
## Mean          0.000398
## Median        0.001209
## Sum           0.501599
## SE Mean       0.000435
## LCL Mean      -0.000454
## UCL Mean      0.001251
## Variance      0.000238
## Stdev         0.015420
## Skewness      -0.333442
## Kurtosis      5.193084
```

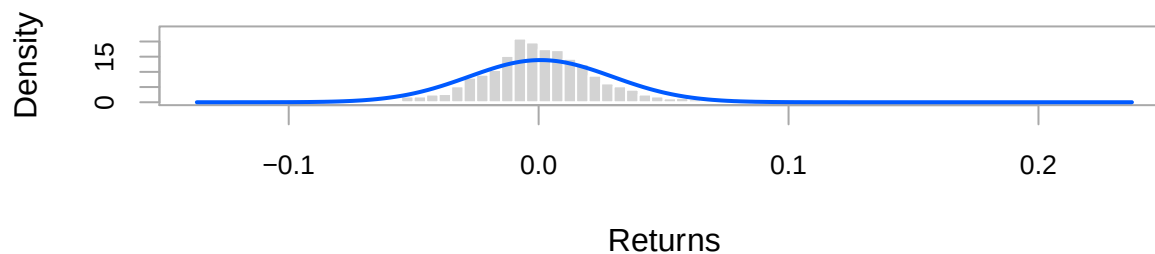
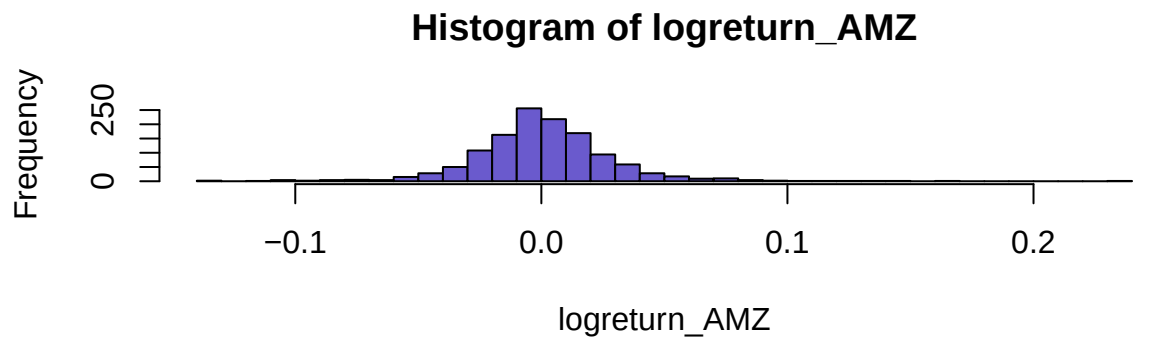
```
basicStats(logreturn_SPR)
```

```
##          logreturn_SPR
## nobs      1259.000000
## NAs        0.000000
## Minimum    -0.094695
## Maximum     0.109572
## 1. Quartile -0.006320
## 3. Quartile  0.006954
## Mean       -0.000023
## Median      0.000685
## Sum        -0.029133
## SE Mean     0.000468
## LCL Mean    -0.000941
## UCL Mean     0.000894
## Variance    0.000275
## Stdev       0.016594
## Skewness    -0.242090
## Kurtosis    6.952089
```

```
t.test(logreturn_AMZ)
```

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

```
par(mfrow=c(2,1))
hist(logreturn_AMZ, breaks = 40, col="slateblue")
chart.Histogram(logreturn_AMZ, methods = c("add.normal"))
```



#Question3

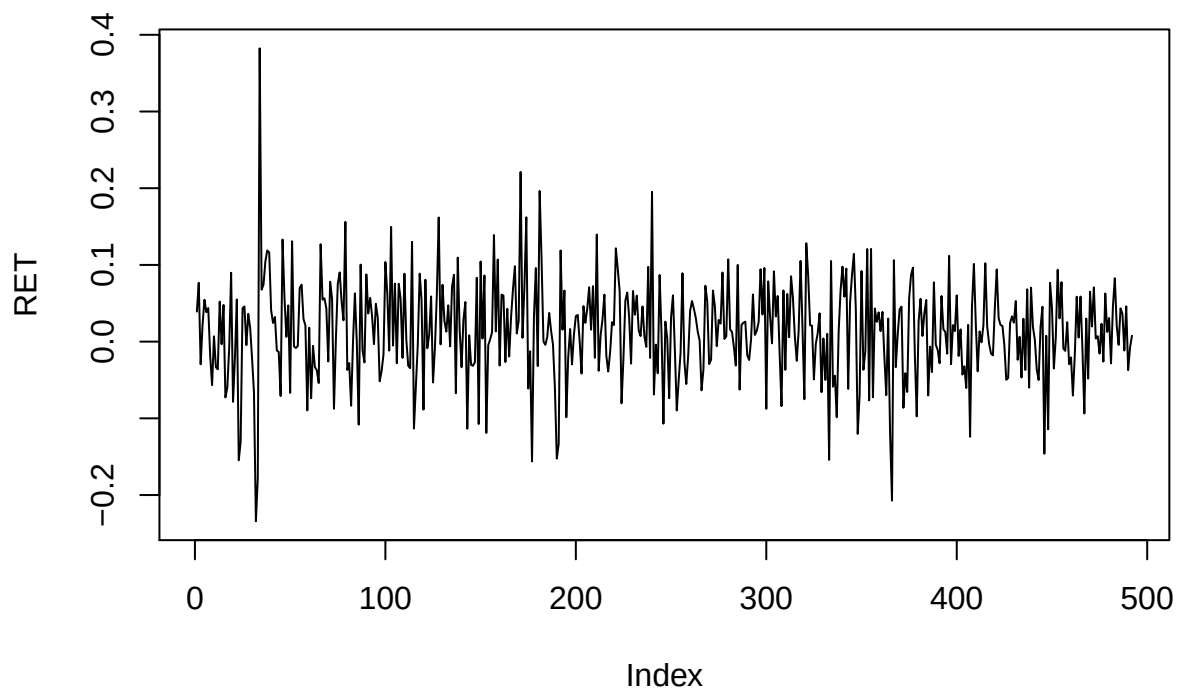
```
da3=read.table("m-abt3dx.txt", skip = 1, col.names = c("date", "RET", "vwretd", "ewretd", "sprtrn"))
dim(da3)
```

```
## [1] 492 5
```

```
head(da3)
```

```
##      date      RET    vwretd    ewretd    sprtrn
## 1 19720131 0.039147 0.028383 0.103892 0.018121
## 2 19720229 0.076779 0.031349 0.041809 0.025303
## 3 19720330 -0.029565 0.008722 -0.000951 0.005912
## 4 19720428 0.021864 0.005505 0.001231 0.004384
## 5 19720531 0.054577 0.016375 -0.018121 0.017275
## 6 19720630 0.038397 -0.020896 -0.033775 -0.021821
```

```
RET = da3[,2]
vwretd = da3[,3]
ewretd = da3[,4]
sprtrn = da3[,5]
plot(RET, type = "l")
```



```
head(RET)
```

```
## [1]  0.039147  0.076779 -0.029565  0.021864  0.054577  0.038397
```

```
basicStats(RET)
```

```
##                RET
## nobs          492.000000
## NAs           0.000000
## Minimum      -0.234146
## Maximum       0.382326
## 1. Quartile  -0.024230
## 3. Quartile   0.055840
## Mean         0.014073
## Median       0.014083
## Sum          6.923863
## SE Mean      0.002921
## LCL Mean     0.008333
## UCL Mean     0.019812
## Variance     0.004198
## Stdev        0.064795
## Skewness     0.097058
## Kurtosis     2.469971
```

```
basicStats(vwretd)
```

```
##                vwretd
## nobs          492.000000
```

```
## NAs          0.000000
## Minimum      -0.225363
## Maximum       0.165585
## 1. Quartile  -0.017196
## 3. Quartile   0.039484
## Mean          0.009020
## Median        0.012626
## Sum           4.437612
## SE Mean       0.002089
## LCL Mean      0.004915
## UCL Mean      0.013124
## Variance      0.002147
## Stdev         0.046341
## Skewness      -0.555341
## Kurtosis      2.073657
```

```
basicStats(ewretd)
```

```
##              ewretd
## nobs          492.000000
## NAs           0.000000
## Minimum       -0.272248
## Maximum        0.299260
## 1. Quartile   -0.020694
## 3. Quartile    0.044462
## Mean          0.011583
## Median        0.014379
## Sum           5.699074
## SE Mean       0.002583
## LCL Mean      0.006508
## UCL Mean      0.016659
## Variance      0.003283
## Stdev         0.057299
## Skewness      -0.200025
## Kurtosis      3.288104
```

```
basicStats(sprtrn)
```

```
##              sprtrn
## nobs          492.000000
## NAs           0.000000
## Minimum       -0.217630
## Maximum        0.163047
## 1. Quartile   -0.018948
## 3. Quartile    0.035349
## Mean          0.006386
## Median        0.009091
## Sum           3.142113
## SE Mean       0.002019
## LCL Mean      0.002419
## UCL Mean      0.010354
## Variance      0.002006
## Stdev         0.044788
## Skewness      -0.444303
## Kurtosis      1.889777
```

```
logreturn_RET = log(RET+1)
logreturn_vwretd = log(vwretd+1)
logreturn_ewretd = log(ewretd+1)
logreturn_sprtrn = log(sprtrn+1)
```

```
basicStats(logreturn_RET)
```

```
##          logreturn_RET
## nobs          492.000000
## NAs            0.000000
## Minimum       -0.266764
## Maximum        0.323768
## 1. Quartile   -0.024528
## 3. Quartile    0.054337
## Mean          0.011924
## Median        0.013985
## Sum           5.866748
## SE Mean       0.002898
## LCL Mean      0.006230
## UCL Mean      0.017619
## Variance      0.004133
## Stdev         0.064287
## Skewness      -0.297125
## Kurtosis      2.005416
```

```
basicStats(logreturn_vwretd)
```

```
##          logreturn_vwretd
## nobs          492.000000
## NAs            0.000000
## Minimum       -0.255361
## Maximum        0.153223
## 1. Quartile   -0.017345
## 3. Quartile    0.038724
## Mean          0.007903
## Median        0.012547
## Sum           3.888033
## SE Mean       0.002107
## LCL Mean      0.003762
## UCL Mean      0.012043
## Variance      0.002185
## Stdev         0.046745
## Skewness      -0.839542
## Kurtosis      3.003331
```

```
basicStats(logreturn_ewretd)
```

```
##          logreturn_ewretd
## nobs          492.000000
## NAs            0.000000
## Minimum       -0.317795
## Maximum        0.261795
## 1. Quartile   -0.020911
## 3. Quartile    0.043501
```

```
## Mean          0.009887
## Median        0.014277
## Sum           4.864341
## SE Mean       0.002592
## LCL Mean      0.004794
## UCL Mean      0.014979
## Variance      0.003305
## Stdev         0.057491
## Skewness      -0.662276
## Kurtosis      3.976081
```

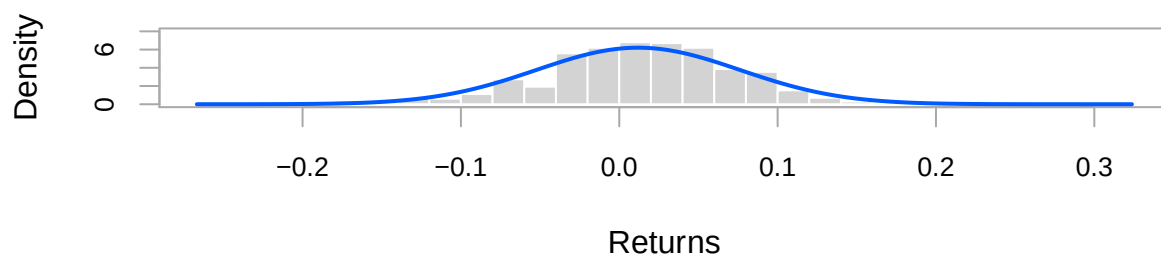
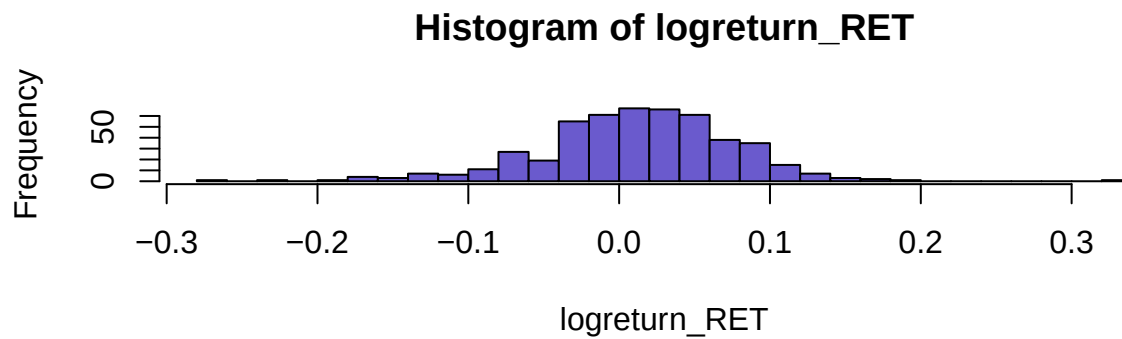
```
basicStats(logreturn_sprtrn)
```

```
##          logreturn_sprtrn
## nobs          492.000000
## NAs           0.000000
## Minimum       -0.245428
## Maximum        0.151043
## 1. Quartile   -0.019130
## 3. Quartile    0.034738
## Mean          0.005360
## Median        0.009050
## Sum           2.636920
## SE Mean       0.002035
## LCL Mean      0.001361
## UCL Mean      0.009359
## Variance      0.002038
## Stdev         0.045145
## Skewness      -0.711215
## Kurtosis      2.659018
```

```
t.test(logreturn_RET)
```

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

```
par(mfrow=c(2,1))
hist(logreturn_RET, breaks = 40, col="slateblue")
chart.Histogram(logreturn_RET, methods = c("add.normal"))
```

#Question4

#H0: $\mu = 0$

#Ha: $\mu \neq 0$

`t.test(vwretd)`

##

One Sample t-test

##

data: vwretd

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

#H0 is rejected at 0.05 level of significance, $\mu \neq 0$

#H0: $M3 = 0$

#Ha: $M3 \neq 0$

`T_vw=length(vwretd)`

`T_vw`

```

## [1] 492
S_vw= skewness(vwretd)
S_vw

## [1] -0.5570388
tstS_vw = S_vw/sqrt(6/T_vw)
tstS_vw

## [1] -5.044201
pvS_vw = 2*(pnorm(tstS_vw))
pvS_vw

## [1] 4.55421e-07
#H0 is rejected at 0.05 level of significant M3 != 0

#H0: k = 3
#Ha: k!= 3

k_vw = kurtosis(vwretd)
k_vw

## [1] 2.094344
tstK_vw = k_vw/sqrt(24/T_vw)
tstK_vw

## [1] 9.482548
pv_vw = 2*(1-pnorm(tstK_vw))
pv_vw

## [1] 0
#H0 is rejected at 0.05 level of significance, k !=3

#Question 5

#H0: u = 0
#Ha: u!= 0

t.test(logreturn_AMZ)

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

```

```
#H0 is rejected at 0.05 level of significance, u!= 0
```

```
#H0: M3 = 0
```

```
#Ha: M3!= 0
```

```
T_am=length(logreturn_AMZ)
```

```
T_am
```

```
## [1] 1259
```

```
S_am= skewness(logreturn_AMZ)
```

```
S_am
```

```
## [1] 0.6278955
```

```
tstS_am = S_am/sqrt(6/T_am)
```

```
tstS_am
```

```
## [1] 9.095459
```

```
pvS_am = 2*(pnorm(tstS_am))
```

```
pvS_am
```

```
## [1] 2
```

```
#H0 is accepted at 0.05 level of significant M3 != 0
```

```
#H0: k = 3
```

```
#Ha: k!= 3
```

```
k_am = kurtosis(logreturn_AMZ)
```

```
k_am
```

```
## [1] 7.26559
```

```
tstK_am = k_am/sqrt(24/T_am)
```

```
tstK_am
```

```
## [1] 52.62331
```

```
pv_am = 2*(1-pnorm(tstK_am))
```

```
pv_am
```

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

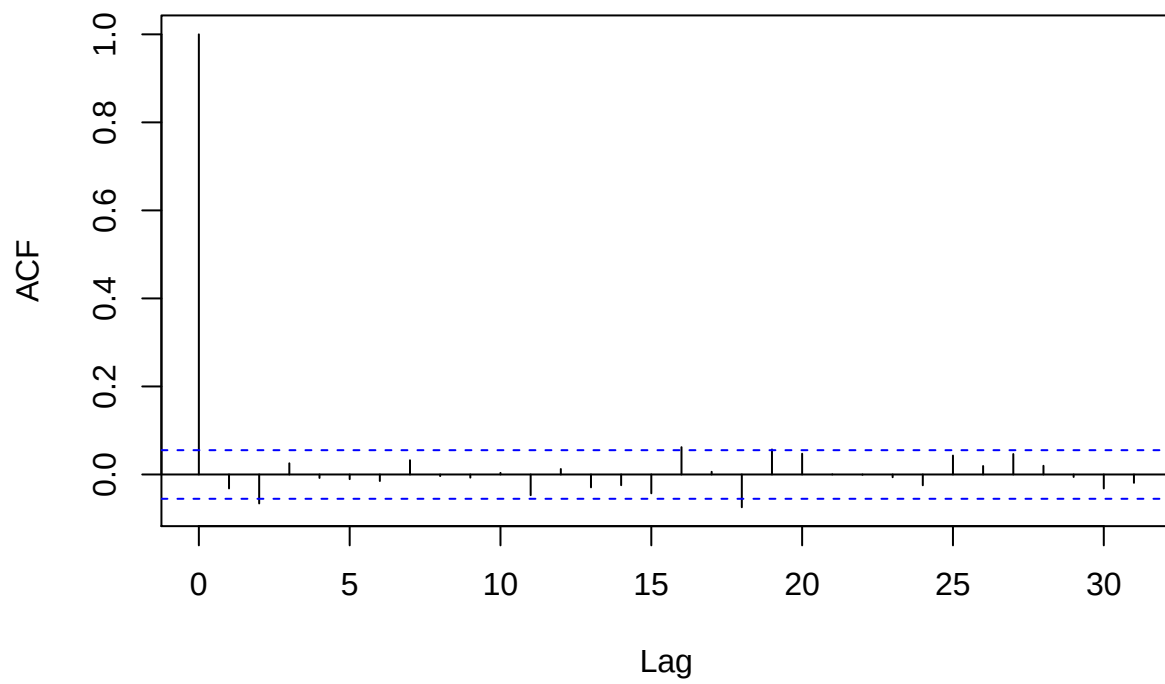
```
#H0 is rejected at 0.05 level of significant, k !=3
```

```
#95 percent confidence interval:
```

```
#-0.0007975567 0.0023801007
```

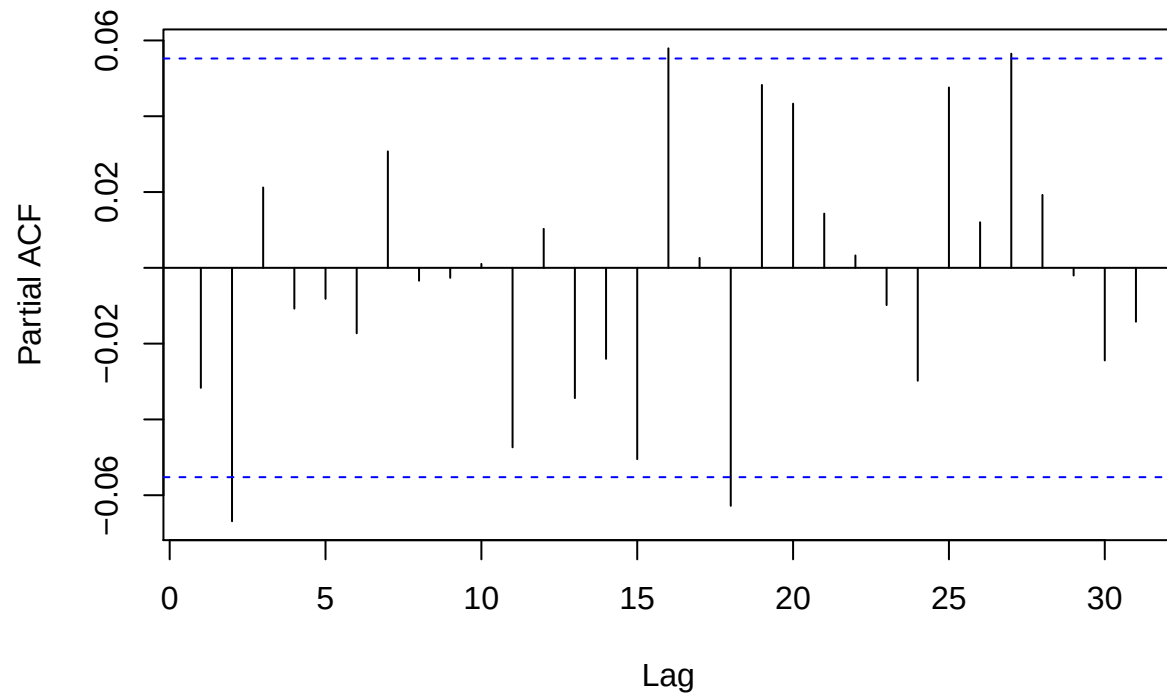
```
m1_am=acf(logreturn_AMZ)
```

Series logreturn_AMZ



```
m2_am=pacf(logreturn_AMZ)
```

Series logreturn_AMZ



```
names(m1_am)
```

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

```
names(m2_am)
```

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

```
m1_am$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_am$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
```

```

#H0:  $p_1 = \dots = p_{12} = 0$ 
#Ha:  $p_i \neq 0$ 

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

##
## Box-Ljung test
##
## data: logreturn_AMZ
## X-squared = 12.488, df = 12, p-value = 0.4073
#H0 is not rejected at 0.05 level of significant,  $p_1 = \dots = p_{12} = 0$ 

#Question 6

da4=read.table("d-exuseu.txt", skip = 1, col.names = c("Year", "Month", "Day", "Value"))

dim(da4)

## [1] 3567 4

head(da4)

## Year Month Day Value
## 1 1999 1 4 1.1812
## 2 1999 1 5 1.1760
## 3 1999 1 6 1.1636
## 4 1999 1 7 1.1672
## 5 1999 1 8 1.1554
## 6 1999 1 11 1.1534

value = da4[,4]
head(value)

## [1] 1.1812 1.1760 1.1636 1.1672 1.1554 1.1534

logreturn_vu = diff(log(value))

logreturn_vu

## [1] -4.412021e-03 -1.060020e-02 3.089071e-03 -1.016111e-02 -1.732502e-03
## [6] 1.213067e-03 1.290563e-02 -7.696584e-04 -8.419294e-03 1.637861e-03
## [11] -3.019196e-03 1.727713e-04 4.317976e-04 -1.382409e-03 9.506115e-04
## [16] -8.326876e-03 -7.518832e-03 -2.108408e-03 -5.998077e-03 2.209360e-03
## [21] 9.705740e-04 -2.914553e-03 -2.036390e-03 1.151513e-03 3.540450e-04
## [26] 2.739607e-03 -2.474155e-03 -1.859642e-03 -8.277382e-03 3.657616e-03
## [31] -6.235247e-04 -1.327493e-02 -3.437051e-03 -3.994558e-03 -1.912134e-03
## [36] 8.711489e-03 -6.617438e-03 -9.503864e-03 3.666029e-03 -3.941524e-03
## [41] -5.895374e-03 1.753820e-03 5.151331e-03 -2.388390e-03 8.060866e-03
## [46] -2.649250e-03 3.658314e-04 -5.487972e-04 -1.373312e-03 9.119990e-03
## [51] -2.272212e-03 -6.115111e-03 -7.326679e-04 2.748134e-04 2.747379e-04
## [56] -4.588848e-03 -1.184431e-02 -2.516428e-03 1.491981e-03 7.056668e-03
## [61] -2.408524e-03 0.000000e+00 -7.073745e-03 1.225415e-02 -4.994923e-03
## [66] 4.718081e-03 -4.532638e-03 5.178484e-03 -5.734915e-03 -9.276868e-05
## [71] -5.768531e-03 -2.709649e-03 -7.513183e-03 2.071759e-03 -1.694756e-03
## [76] -1.320132e-03 3.391111e-03 -4.146255e-03 5.555831e-03 -3.103694e-03

```

```

## [81] -2.357713e-03 -2.552589e-03 6.624084e-04 2.079003e-03 1.229081e-02
## [86] 5.115576e-03 1.855288e-04 5.563798e-04 -6.230550e-03 -5.050043e-03
## [91] -3.757284e-03 2.256064e-03 2.063597e-03 0.000000e+00 -2.909025e-03
## [96] -1.034272e-03 -4.998360e-03 1.511573e-03 -5.665723e-04 -1.101730e-02
## [101] -3.060739e-03 -1.629836e-03 2.587324e-03 -8.843660e-03 -1.931248e-04
## [106] -2.707670e-03 -3.006354e-03 1.369752e-02 1.148985e-03 2.580400e-03
## [111] 3.715528e-03 -9.554821e-03 3.839509e-04 -1.177733e-02 3.005771e-03
## [116] 3.768667e-03 -4.349724e-03 0.000000e+00 -6.783275e-04 5.413780e-03
## [121] 7.300705e-03 -7.204296e-03 -3.476585e-03 -2.615394e-03 -7.203380e-03
## [126] 7.812500e-04 4.879715e-04 -2.442242e-03 -2.546275e-03 -1.177394e-03
## [131] -4.624854e-03 3.642633e-03 3.825222e-03 4.893565e-04 -1.664790e-03
## [136] 0.000000e+00 2.104524e-02 1.012135e-02 -1.616354e-03 -1.142531e-03
## [141] 1.456428e-02 -2.255852e-03 1.598421e-03 7.021515e-03 -2.335031e-03
## [146] -3.090614e-03 1.780611e-03 8.020187e-03 2.504756e-03 -2.133285e-03
## [151] -7.081655e-03 5.408947e-03 -8.593365e-03 -2.253945e-03 -6.413906e-03
## [156] -1.041420e-03 -3.035767e-03 -1.902045e-03 1.305106e-02 1.033009e-03
## [161] -9.525229e-03 -4.463657e-03 -4.292466e-03 -1.913693e-03 1.818095e-03
## [166] -1.435064e-03 1.293654e-02 9.450456e-05 1.006073e-02 -7.889587e-03
## [171] -2.265648e-03 8.502197e-04 -4.448027e-03 -1.346404e-02 -1.922892e-04
## [176] 7.689351e-04 -2.212284e-03 3.172622e-03 -1.825432e-03 8.650935e-04
## [181] 4.983717e-03 3.816799e-03 -8.128182e-03 4.884833e-03 -3.349766e-03
## [186] 7.449891e-03 9.847632e-03 2.822734e-03 7.022172e-03 -1.400495e-03
## [191] -9.347542e-04 1.028182e-03 1.586931e-03 -8.524243e-03 1.001553e-02
## [196] 1.953943e-03 3.803873e-03 8.115880e-03 -2.206897e-03 -2.765488e-03
## [201] -6.296900e-03 3.986470e-03 -1.210105e-02 -1.124438e-03 -8.284740e-03
## [206] -4.358131e-03 -1.235096e-03 -9.507059e-05 -2.284410e-03 1.142857e-03
## [211] -2.000858e-03 -4.301082e-03 -3.838776e-03 -3.564036e-03 3.660185e-03
## [216] 3.359412e-03 -1.166222e-02 0.000000e+00 -2.908809e-04 8.785960e-03
## [221] -1.024164e-02 1.552645e-03 1.356589e-03 -6.411524e-03 -8.318294e-03
## [226] -3.839910e-03 -3.656673e-03 -2.279825e-03 -1.787843e-03 -3.585304e-03
## [231] -6.986377e-04 2.328899e-02 -2.930548e-03 4.002934e-03 -9.988332e-03
## [236] -2.952901e-04 -3.747909e-03 -5.250916e-03 -9.933939e-05 1.018047e-02
## [241] -7.997278e-03 -2.183190e-03 2.678706e-03 -1.288852e-03 8.102011e-03
## [246] -3.351408e-03 7.895776e-04 -6.731366e-03 -2.287079e-03 -2.092781e-03
## [251] 4.578489e-03 8.405488e-03 1.505111e-02 2.518893e-03 -1.064911e-03
## [256] -2.910081e-03 -4.088393e-03 6.804731e-03 -3.980008e-03 -1.070508e-03
## [261] -1.392316e-02 -6.913922e-04 -5.930026e-04 1.777954e-03 -3.262001e-03
## [266] -8.052134e-03 2.193421e-03 -2.992222e-03 -1.216034e-02 -1.271958e-02
## [271] -8.195882e-04 -2.668310e-03 3.795071e-03 1.210903e-02 -1.292836e-02
## [276] 2.353785e-03 8.042802e-03 5.258912e-03 -4.954760e-03 -1.826299e-03
## [281] -6.520655e-03 5.199584e-03 8.131735e-04 2.131440e-03 -1.318927e-03
## [286] 2.109571e-02 -4.283515e-03 -8.622472e-03 -1.706145e-02 -9.674839e-03
## [291] -2.692628e-03 5.893622e-03 -8.385576e-03 -1.039663e-04 -1.560793e-03
## [296] -4.487823e-03 1.672241e-03 1.121507e-02 -2.584916e-03 -1.139483e-03
## [301] -4.146797e-04 5.377469e-03 1.442853e-03 -1.649145e-03 1.649145e-03
## [306] -7.211663e-04 -9.839031e-03 8.601535e-03 3.399437e-03 -8.157410e-03
## [311] -3.219277e-03 -9.405441e-03 7.322974e-03 -2.086812e-03 -1.463364e-03
## [316] 2.924590e-03 6.134670e-03 -6.969394e-03 1.043297e-03 -2.085723e-04
## [321] 3.128422e-04 -4.179298e-03 -2.830932e-03 4.191121e-03 -1.464895e-03
## [326] -7.673344e-03 -1.146144e-02 7.468659e-04 3.199147e-04 1.810919e-03
## [331] -1.404021e-02 -5.194255e-03 -1.464507e-02 6.603566e-04 3.404913e-03
## [336] -5.718071e-03 -1.971220e-02 1.797955e-03 5.151187e-03 -3.351394e-04
## [341] 8.123341e-03 8.167816e-03 -8.389496e-03 6.519000e-03 6.367351e-03
## [346] -9.345349e-03 -1.468815e-02 3.468923e-03 -6.704660e-04 1.001009e-02

```



```

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## [396] -8.749522e-03 -9.151165e-03  2.160761e-03 -4.109447e-03 -9.910236e-03
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## [416]  6.779687e-03 -4.431642e-04 -2.440920e-03 -4.007129e-03 -4.695369e-03
## [421] -5.167970e-03  1.287019e-02 -1.309549e-02 -1.979812e-02  4.357305e-03
## [426] -8.733680e-03 -4.627496e-03 -3.252035e-03  5.105604e-03 -2.665587e-03
## [431] -5.235919e-03 -5.732686e-03 -1.056524e-03 -6.126315e-03  1.128097e-02
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## [446] -5.758710e-04  2.303882e-04  3.793762e-03 -8.180240e-03 -8.831105e-03
## [451] -9.263125e-03  2.118146e-03 -1.372965e-02  1.786034e-03 -7.140307e-04
## [456] -4.294924e-03  0.000000e+00 -1.130227e-02  1.209117e-04  1.619032e-02
## [461]  3.088255e-03  6.383755e-03  1.148226e-02  1.164280e-03  2.324501e-03
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## [471] -2.089137e-03 -3.958096e-03 -3.499971e-04 -4.443932e-03 -1.877054e-03
## [476] -3.529000e-03 -3.305008e-03 -4.146680e-03 -4.879510e-03  1.397961e-02
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## [486] -8.032172e-03  8.257498e-03  1.575867e-03 -5.978922e-03 -7.609782e-03
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## [496] -3.028436e-03  1.737237e-02  5.943881e-03  1.286682e-02  6.694766e-03
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## [546] -5.475348e-03  2.580369e-03 -4.196488e-03  7.545136e-04  3.656704e-03
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## [601] -1.368613e-03 -1.205595e-02 -6.838624e-03 -3.261885e-03  8.164694e-04
## [606] -3.503858e-03  3.387260e-03 -1.420962e-02 -3.548826e-04 -3.550086e-04
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## [631] 2.598631e-03 -1.270273e-02 1.128613e-02 1.062637e-03 9.747009e-03
## [636] 6.639125e-03 -9.799425e-03 -3.517617e-04 2.576717e-03 0.000000e+00
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## [646] 5.128509e-03 -3.644236e-03 -1.827110e-03 1.142922e-04 2.285453e-04
## [651] 4.673705e-03 2.271954e-03 3.398281e-03 -4.647217e-03 -3.072199e-03
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## [771] -5.793759e-03 4.406315e-03 5.783356e-04 -6.263795e-03 2.208404e-03
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## [811] -1.140576e-04 -4.687598e-03 -1.720480e-03 6.885472e-04 1.015817e-02
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## [2871] -8.084401e-05 -8.362135e-03 -4.903573e-03 -1.065618e-03 -1.612205e-02
## [2876] -3.255836e-03 3.005763e-03 4.159740e-03 5.464494e-03 -2.811313e-03
## [2881] 1.642478e-02 4.064385e-03 -3.245436e-04 3.402466e-03 -4.044489e-04
## [2886] 2.020611e-03 -6.642928e-03 5.688051e-04 -1.788764e-03 3.574334e-03
## [2891] -1.298280e-03 -1.052942e-02 8.497477e-03 1.397720e-02 9.025260e-03
## [2896] 5.471211e-03 -4.120450e-03 7.042004e-03 -3.475242e-03 -5.235614e-03
## [2901] 1.154528e-02 2.826413e-03 1.076118e-02 2.014568e-03 3.400050e-03
## [2906] -4.484312e-03 -6.764400e-03 6.609409e-03 -2.250069e-03 8.431036e-03
## [2911] 0.000000e+00 1.154690e-03 5.064856e-03 3.826579e-04 8.002177e-03
## [2916] 4.921829e-03 -6.137080e-03 -7.600228e-05 9.455799e-03 -3.091659e-03
## [2921] -1.108760e-02 -1.508069e-02 -2.561616e-03 -7.724456e-03 5.545806e-03
## [2926] 4.042294e-03 -1.397407e-03 -2.722784e-03 -1.175378e-02 -1.893492e-03
## [2931] 9.471940e-04 -1.816244e-03 5.124376e-03 3.767370e-03 -6.208027e-03
## [2936] 1.417881e-03 8.543376e-03 8.581348e-04 4.745429e-03 -1.265246e-02
## [2941] 3.143418e-04 -1.494005e-03 1.808248e-03 1.241185e-02 9.573884e-03
## [2946] -4.611483e-04 5.443338e-03 -2.526317e-03 2.143952e-03 4.731028e-03
## [2951] 1.877812e-02 -3.067831e-03 9.843480e-03 -7.420875e-05 7.982894e-03
## [2956] 4.041003e-03 -2.716695e-03 1.118637e-02 -4.810154e-03 1.060979e-02
## [2961] 6.484640e-03 -2.154785e-04 1.436575e-04 -5.545767e-03 8.486207e-03
## [2966] 7.277949e-03 -4.846076e-03 -1.429797e-03 -1.086146e-02 8.784619e-03
## [2971] 1.719075e-03 -4.950328e-03 5.880261e-03 -8.112324e-03 -6.145856e-03
## [2976] 1.017435e-02 -2.515905e-03 -4.319344e-04 9.887592e-03 -8.559202e-04
## [2981] 1.487385e-02 -1.351898e-02 -7.582297e-03 -4.461723e-03 -9.930136e-03
## [2986] -2.041710e-03 -6.223707e-03 -7.223974e-03 2.807330e-03 4.636964e-03
## [2991] 2.640072e-03 -3.080762e-03 -1.659297e-02 -2.842399e-03 -8.047274e-03
## [2996] -1.146775e-02 -4.286596e-03 8.630949e-03 5.990085e-03 1.045319e-02
## [3001] -6.906416e-03 3.609298e-03 -6.098268e-03 -2.722325e-03 2.722325e-03
## [3006] 1.103988e-02 4.480287e-04 -6.666442e-03 -7.543790e-03 -3.869357e-03
## [3011] -2.359299e-03 5.332318e-04 -3.203664e-03 9.163804e-04 3.428967e-03
## [3016] -1.827319e-03 4.637910e-03 6.502367e-03 7.657695e-03 -4.873121e-03
## [3021] -1.019762e-02 -1.099332e-02 -6.391766e-03 7.725289e-05 2.546003e-03
## [3026] 6.757820e-03 2.255109e-02 -2.697439e-03 5.312992e-03 7.139169e-03
## [3031] -3.860722e-03 1.021323e-02 5.287521e-03 -6.594131e-04 3.219672e-03
## [3036] 0.000000e+00 -5.935170e-03 7.905758e-03 5.671093e-03 -1.015523e-03
## [3041] -9.113175e-03 -5.139889e-03 -1.989610e-03 9.543458e-03 7.305936e-05
## [3046] -3.732850e-03 -8.616616e-03 -3.408168e-03 1.483240e-03 3.919978e-03

```

```

## [3051] 4.786636e-03 4.471329e-03 -8.780274e-04 7.075415e-03 2.613242e-03
## [3056] -2.685930e-03 2.613432e-03 1.448961e-03 4.045956e-03 5.608298e-03
## [3061] 2.577875e-03 -5.007332e-04 -4.589796e-03 -4.313754e-04 -5.986530e-03
## [3066] 2.961681e-03 7.974467e-03 -5.010199e-04 -3.298676e-03 7.085883e-03
## [3071] 8.522174e-03 3.036189e-03 1.972109e-03 -6.211200e-03 5.366487e-03
## [3076] -3.951459e-03 -2.832061e-03 -9.931192e-04 3.547987e-04 6.223940e-03
## [3081] 2.253681e-03 4.220003e-04 6.326667e-04 7.212159e-03 -3.214538e-03
## [3086] 1.044432e-02 1.176837e-03 6.918261e-05 1.520808e-03 -8.983795e-04
## [3091] -1.452936e-03 -1.619356e-02 7.571014e-03 1.345747e-02 4.948804e-03
## [3096] -2.746311e-03 2.129049e-03 3.356053e-03 2.322088e-03 8.558672e-03
## [3101] 2.431941e-03 3.300666e-03 3.361910e-04 -1.076209e-03 -1.874928e-02
## [3106] -6.052704e-03 -1.347430e-02 3.977813e-03 -6.217926e-03 -2.807216e-03
## [3111] -6.203756e-03 5.500719e-03 -4.511180e-03 8.091513e-03 -1.121862e-03
## [3116] -5.769382e-03 -1.114000e-02 6.542943e-03 -3.544968e-04 -9.932601e-04
## [3121] 1.402666e-02 6.210117e-03 3.818521e-03 -3.465364e-04 1.226333e-02
## [3126] 1.094991e-03 3.754911e-03 -6.014645e-03 -3.639989e-03 -1.169604e-02
## [3131] 2.088191e-04 7.281333e-03 -1.756510e-02 -4.651827e-03 1.200815e-02
## [3136] -4.189067e-04 5.501598e-03 2.777585e-04 -1.659179e-02 1.622289e-03
## [3141] 6.532987e-03 6.003508e-03 4.167251e-03 6.562837e-03 -1.033378e-03
## [3146] -2.622681e-03 -9.792085e-03 1.394798e-03 -6.853174e-03 -1.534412e-02
## [3151] -1.426127e-03 1.085849e-02 1.058238e-03 -1.834992e-03 -8.085724e-03
## [3156] 8.085724e-03 2.257974e-03 1.288533e-02 -4.175656e-04 -6.266755e-04
## [3161] 9.566134e-03 -8.452316e-03 -4.882141e-03 5.925220e-03 -1.301173e-02
## [3166] 2.110151e-03 6.164211e-03 -1.137733e-02 0.000000e+00 5.845293e-03
## [3171] 7.021732e-05 -3.446460e-03 2.603527e-03 6.322667e-04 1.484813e-02
## [3176] -2.147336e-03 1.039609e-03 -8.067925e-03 6.126446e-03 -1.667130e-03
## [3181] 3.262193e-03 -2.011585e-03 -1.528734e-03 5.755312e-03 3.244403e-03
## [3186] -5.182254e-03 -2.011027e-03 -8.574768e-03 -5.616809e-03 -1.446731e-02
## [3191] 4.205730e-03 -7.927197e-03 -2.035344e-02 -2.270980e-03 3.294896e-03
## [3196] 2.190581e-03 1.073719e-02 -5.426734e-03 -1.072259e-02 4.463476e-03
## [3201] 1.969294e-03 -2.046446e-02 5.340467e-03 -1.479618e-04 6.636703e-03
## [3206] 1.615628e-03 8.068361e-04 -1.402858e-02 -1.257031e-02 9.783632e-04
## [3211] 2.554280e-03 5.984458e-03 7.726636e-03 1.067403e-02 1.077863e-02
## [3216] -5.447626e-03 9.495921e-03 -6.586828e-03 -3.710579e-03 4.073622e-03
## [3221] -7.505409e-03 1.459456e-02 4.243847e-03 -1.508458e-03 -5.261463e-03
## [3226] 2.384976e-02 -5.646528e-04 -1.543910e-02 -1.962196e-02 9.243488e-03
## [3231] -4.283595e-03 1.236139e-03 -1.236139e-03 2.978679e-03 -1.380541e-02
## [3236] 2.941609e-04 1.836548e-03 -7.440456e-03 -1.405898e-03 1.258001e-03
## [3241] -7.395629e-05 2.957924e-04 -1.850139e-03 -1.139804e-02 -7.747021e-03
## [3246] 6.772545e-03 6.747386e-04 8.210227e-03 2.524129e-03 -7.516874e-03
## [3251] 5.735797e-03 -4.914381e-03 -8.214166e-04 -4.642464e-03 3.296871e-03
## [3256] -1.355647e-02 -7.153215e-03 -9.360922e-03 3.155669e-03 9.217298e-04
## [3261] -6.143922e-04 4.522293e-03 -2.756932e-03 3.833621e-04 -3.833621e-04
## [3266] 2.603969e-03 -1.138474e-02 2.009430e-03 1.620058e-03 6.760416e-03
## [3271] -1.008050e-02 -1.143403e-02 -4.704784e-03 1.727659e-03 2.898893e-03
## [3276] -7.538908e-03 1.035141e-02 -1.066677e-02 4.562985e-03 6.649741e-03
## [3281] 8.695032e-03 8.499131e-04 6.696711e-03 -2.381045e-03 -2.001386e-03
## [3286] 1.331822e-02 3.036747e-03 -5.244169e-03 -5.348424e-03 9.606661e-03
## [3291] -9.109543e-04 -4.643559e-03 1.829548e-03 8.644931e-03 6.793222e-04
## [3296] 3.314504e-03 -8.306950e-03 1.818320e-03 -4.704106e-03 -4.726339e-03
## [3301] 1.755927e-03 2.970412e-03 8.029130e-03 -3.018185e-04 4.292337e-03
## [3306] 1.157982e-02 -3.944485e-03 3.127097e-03 -6.937479e-03 -2.923650e-03
## [3311] -8.898332e-03 1.816256e-03 -8.504227e-03 2.665348e-03 8.104570e-03
## [3316] -1.122755e-02 2.514383e-03 -2.438096e-03 -6.428430e-03 3.448940e-03

```

```

## [3321] 7.697915e-03 5.376153e-03 -1.511488e-03 -2.423142e-03 3.032141e-04
## [3326] 5.216023e-03 4.888882e-03 6.000600e-04 -2.703110e-03 -2.635048e-03
## [3331] 5.188177e-03 -6.751941e-04 9.001576e-04 -1.594713e-02 -4.734640e-03
## [3336] 1.911827e-03 -1.528117e-04 -1.452877e-03 2.751033e-03 5.099916e-03
## [3341] -6.780203e-03 -1.147272e-03 4.276448e-03 -7.620499e-05 7.617887e-04
## [3346] 6.073508e-03 -6.301984e-03 5.923468e-03 2.271265e-04 1.664020e-03
## [3351] 1.208459e-03 -1.435208e-03 -2.268002e-04 -5.458694e-03 -5.322992e-04
## [3356] -4.268625e-03 -2.983592e-03 -2.838840e-03 -4.697918e-03 3.859067e-04
## [3361] -1.699105e-03 -6.981102e-03 -6.089963e-03 -3.058946e-03 -1.651009e-03
## [3366] 9.437673e-04 3.766187e-03 -2.666250e-03 -1.312064e-02 1.113232e-03
## [3371] -5.179088e-03 -2.399425e-03 -6.668566e-03 -3.310593e-03 4.519052e-03
## [3376] 6.020488e-03 -4.652664e-03 7.848831e-03 2.629169e-03 -6.866294e-03
## [3381] 1.760987e-03 -2.161644e-03 9.492354e-03 9.522299e-04 1.980905e-03
## [3386] -4.363182e-03 9.022618e-03 8.663123e-04 -9.253101e-03 -3.262905e-03
## [3391] -5.194817e-03 -7.214140e-04 -1.123235e-03 -1.928486e-03 1.872490e-02
## [3396] -6.652963e-03 2.856691e-03 -1.887754e-02 -8.189124e-03 1.301766e-03
## [3401] -3.583941e-03 -8.979959e-04 -3.682040e-03 2.701487e-03 2.857261e-03
## [3406] -2.693769e-03 2.204532e-03 -3.262909e-04 -6.630401e-03 -4.114893e-03
## [3411] -5.291893e-03 5.786575e-03 1.212533e-02 7.302264e-03 -9.748249e-03
## [3416] 5.292095e-03 -1.300073e-03 -1.227110e-02 1.964283e-02 2.579398e-03
## [3421] 0.000000e+00 -4.680070e-03 -6.979981e-03 1.627605e-03 3.328330e-03
## [3426] -8.107670e-04 -3.331034e-03 5.518599e-03 -3.323743e-03 2.271069e-03
## [3431] 1.039703e-02 0.000000e+00 8.860565e-03 -3.981531e-03 -1.517148e-03
## [3436] 3.987564e-03 -2.071549e-03 -3.275417e-03 6.460641e-03 -9.545021e-04
## [3441] 2.940127e-03 1.823299e-03 1.337444e-02 -7.815248e-05 4.911716e-03
## [3446] 2.795901e-03 1.395025e-03 1.765610e-02 -1.294400e-03 -5.654049e-03
## [3451] 1.072140e-03 -8.995563e-03 3.238495e-03 -6.255088e-03 2.784871e-03
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## [3461] -3.248263e-03 7.101535e-03 4.451274e-03 -1.411244e-02 9.315324e-04
## [3466] 3.098856e-03 1.391358e-03 3.089280e-04 6.618973e-03 7.413386e-03
## [3471] -2.058006e-03 -6.429906e-03 3.143572e-03 -7.067710e-03 -1.929236e-03
## [3476] 9.264979e-04 -1.544640e-03 -2.476398e-03 5.640347e-03 -1.619309e-03
## [3481] -1.621935e-03 -6.903266e-03 -4.524542e-03 2.186817e-03 -4.613528e-03
## [3486] -1.490255e-03 -1.964251e-03 7.864417e-05 1.885607e-03 3.369513e-03
## [3491] -5.333764e-03 7.131412e-03 6.245121e-04 1.560671e-04 1.109614e-02
## [3496] 5.400193e-04 -2.007258e-03 -1.314620e-03 2.318752e-03 4.390871e-03
## [3501] 4.295144e-03 1.147359e-03 -3.058338e-04 -8.370177e-03 -2.006948e-03
## [3506] -9.276439e-04 4.783591e-03 3.534387e-03 2.986791e-03 4.349326e-03
## [3511] 2.661295e-03 4.167778e-03 2.718624e-03 -2.718624e-03 -4.395611e-03
## [3516] 9.869046e-04 3.711141e-03 0.000000e+00 -6.049607e-04 -2.575174e-03
## [3521] 6.823093e-04 -6.462672e-03 -4.817075e-03 3.977669e-03 -2.369398e-03
## [3526] 7.649354e-04 1.079941e-02 1.001024e-02 1.197515e-03 -2.021640e-03
## [3531] -2.777050e-03 3.825818e-03 -3.976148e-03 7.516819e-05 3.006163e-04
## [3536] 5.246209e-03 5.813537e-03 2.229240e-04 1.855770e-03 5.915427e-03
## [3541] 1.473405e-03 7.919091e-03 -1.212403e-02 3.100091e-03 -3.026168e-03
## [3546] -1.085109e-02 -1.196351e-03 3.584769e-03 2.680168e-03 -1.487099e-04
## [3551] -8.513232e-03 2.097693e-03 1.869229e-03 -2.767702e-03 -1.099657e-02
## [3556] -2.882065e-03 4.556155e-04 -8.998764e-03 3.822927e-03 -1.909637e-03
## [3561] -6.982036e-03 6.157636e-04 1.768211e-03 -2.229998e-03 8.279716e-03
## [3566] -8.125763e-03

```

```
basicStats(logreturn_vu)
```

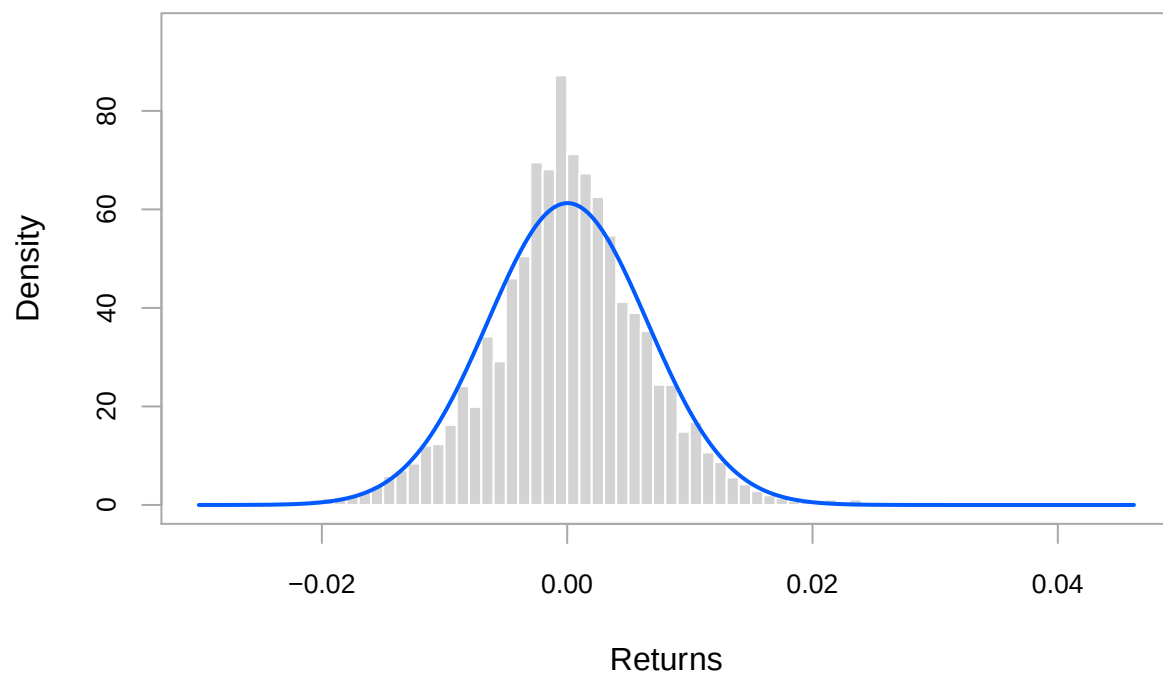
```

##          logreturn_vu
## nobs          3566.000000

```

```
## NAs          0.000000
## Minimum      -0.030031
## Maximum       0.046208
## 1. Quartile  -0.003585
## 3. Quartile   0.003767
## Mean         0.000027
## Median        0.000000
## Sum          0.095218
## SE Mean       0.000109
## LCL Mean      -0.000187
## UCL Mean       0.000240
## Variance      0.000042
## Stdev         0.006511
## Skewness      0.116750
## Kurtosis      2.058184
```

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



```
#H0: u = 0
#Ha: u != 0
```

```
t.test(logreturn_vu)
```

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

```
## 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
```

```
#H0 is rejected at 0.05 level of significant, u = 0
```