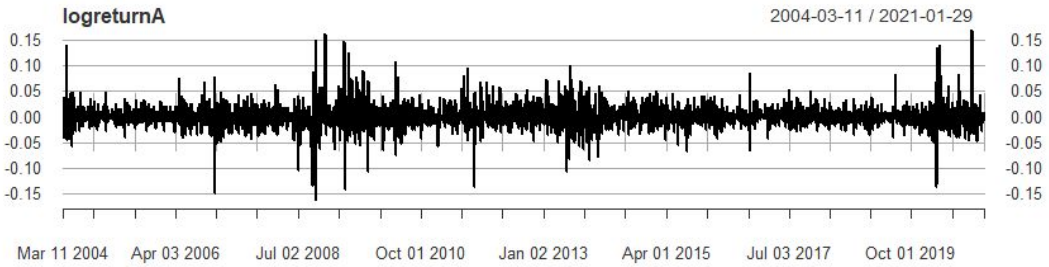
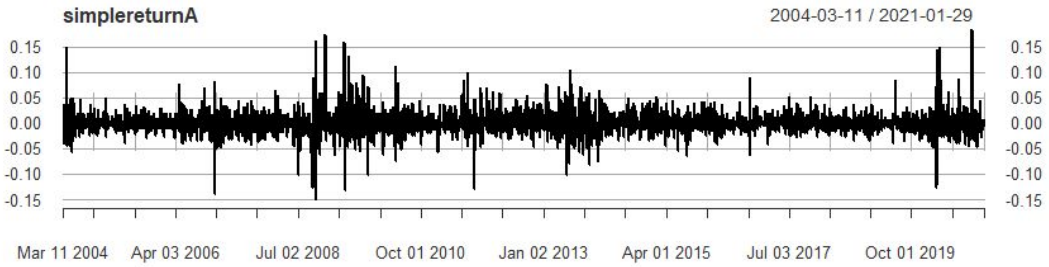
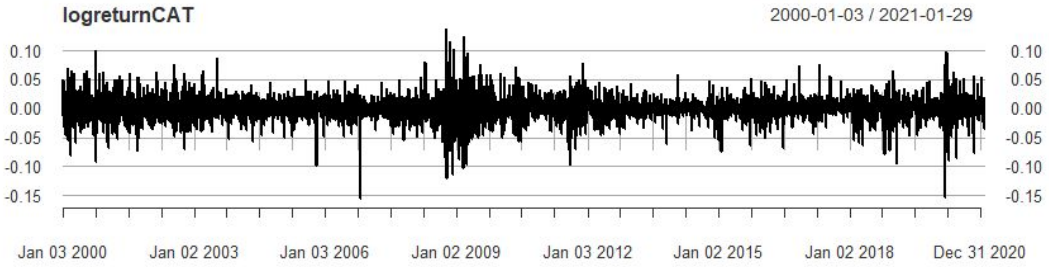
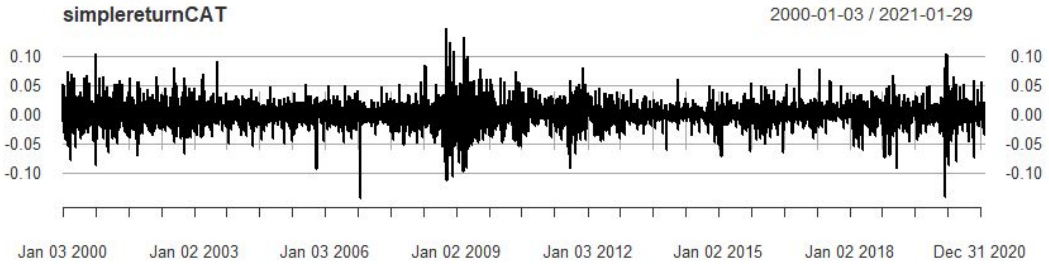
1a) AOT


logreturnA
2004-03-11 / 2021-01-29
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
Mar 11 2004
Apr 03 2006
Jul 02 2008
Oct 01 2010
Jan 02 2013
Apr 01 2015
Jul 03 2017
Oct 01 2019


simplereturnA
2004-03-11 / 2021-01-29
0.15
0.10
0.05
0.00
-0.05
-0.10
-0.15
Mar 11 2004
Apr 03 2006
Jul 02 2008
Oct 01 2010
Jan 02 2013
Apr 01 2015
Jul 03 2017
Oct 01 2019


logreturnCAT
2000-01-03 / 2021-01-29
0.10
0.05
0.00
-0.05
-0.10
-0.15
Jan 03 2000
Jan 02 2003
Jan 03 2006
Jan 02 2009
Jan 03 2012
Jan 02 2015
Jan 02 2018
Dec 31 2020


simplereturnCAT
2000-01-03 / 2021-01-29
0.10
0.05
0.00
-0.05
-0.10
Jan 03 2000
Jan 02 2003
Jan 03 2006
Jan 02 2009
Jan 03 2012
Jan 02 2015
Jan 02 2018
Dec 31 2020

1b) AOT on the left and CAT on the right

AOT: mean = 0.1%, S.D.= 0.0213, Skewness = 0.5443, kurtosis(excess) = 10.0827, Min = -15.05%, Max = 18.34%.

CAT mean = 0.07%, S.D.= 0.0205, Skewness = 0.0197, kurtosis(excess) = 4.548, Min = -14.52%, Max = 14.72%.

```
> table.Stats(simplereturnA)
                  AOT.BK.Adjusted
Observations           4158.0000
NAs                       1.0000
Minimum                  -0.1505
Quartile 1               -0.0093
Median                    0.0000
Arithmetic Mean           0.0010
Geometric Mean            0.0007
Quartile 3                0.0103
Maximum                   0.1834
SE Mean                   0.0003
LCL Mean (0.95)           0.0003
UCL Mean (0.95)           0.0016
Variance                  0.0005
Stdev                     0.0213
Skewness                  0.5443
Kurtosis                 10.0827
```

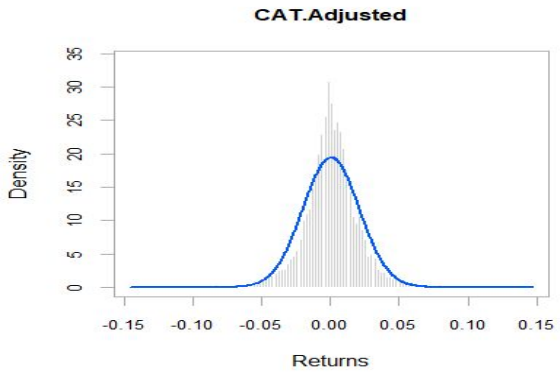
```
> table.Stats(simplereturnCAT)
                  CAT.Adjusted
Observations           5302.0000
NAs                       1.0000
Minimum                  -0.1452
Quartile 1               -0.0095
Median                    0.0005
Arithmetic Mean           0.0007
Geometric Mean            0.0005
Quartile 3                0.0110
Maximum                   0.1472
SE Mean                   0.0003
LCL Mean (0.95)           0.0001
UCL Mean (0.95)           0.0013
Variance                  0.0004
Stdev                     0.0205
Skewness                  0.0197
Kurtosis                  4.5480
```

1c) Since p-value for simple returns of CAT is too close to zero compared with alpha of 0.05, we cannot accept the null hypothesis and thus conclude that the simple returns of CAT are not normally distributed at 95% confidence interval.

```
> jarque.bera.test(newsimplereturnCAT)

        Jarque Bera Test

data:  newsimplereturnCAT
X-squared = 4569.9, df = 2, p-value < 2.2e-16
```



1d) AOT.BK sample mean = 0.07%, S.D. = 0.0212, Skewness = 0.1746, excess kurtosis = 9.6096, Min = -16.32% Max = 16.84%

CAT sample mean = 0.05%, S.D. = 0.0205 Skewness = -0.1836, excess kurtosis = 4.6982, Min = -15.69% Max = 13.73%

C:/Users/user/Desktop/Arm/EE435 R/

	CAT.Adjusted
Observations	5302.0000
NAs	1.0000
Minimum	-0.1569
Quartile 1	-0.0095
Median	0.0005
Arithmetic Mean	0.0005
Geometric Mean	0.0003
Quartile 3	0.0110
Maximum	0.1373
SE Mean	0.0003
LCL Mean (0.95)	-0.0001
UCL Mean (0.95)	0.0010
Variance	0.0004
Stdev	0.0205
Skewness	-0.1836
Kurtosis	4.6982

C:/Users/user/Desktop/Arm/EE435 R/

	AOT.BK.Adjusted
Observations	4158.0000
NAs	1.0000
Minimum	-0.1632
Quartile 1	-0.0093
Median	0.0000
Arithmetic Mean	0.0007
Geometric Mean	0.0005
Quartile 3	0.0102
Maximum	0.1684
SE Mean	0.0003
LCL Mean (0.95)	0.0001
UCL Mean (0.95)	0.0014
Variance	0.0004
Stdev	0.0212
Skewness	0.1746
Kurtosis	9.6096

1e) As p-value of CAT log return is higher than alpha of 0.05, then we cannot reject null hypothesis which can be concluded that the mean of returns is equal to zero.

```
> t.test(newlogreturnCAT)

        One Sample t-test

data:  newlogreturnCAT
t = 1.7296, df = 5301, p-value = 0.08377
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 -6.513168e-05  1.041069e-03
sample estimates:
   mean of x
0.0004879685
```

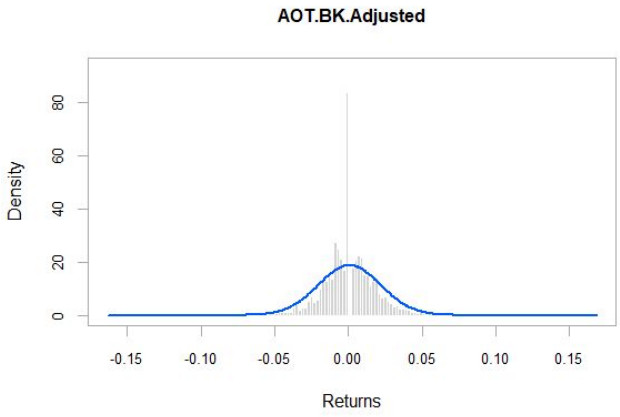
As p-value of AOT log return is lower than alpha of 0.05, then we do not accept null hypothesis which can be concluded that the mean of returns is not equal to zero.

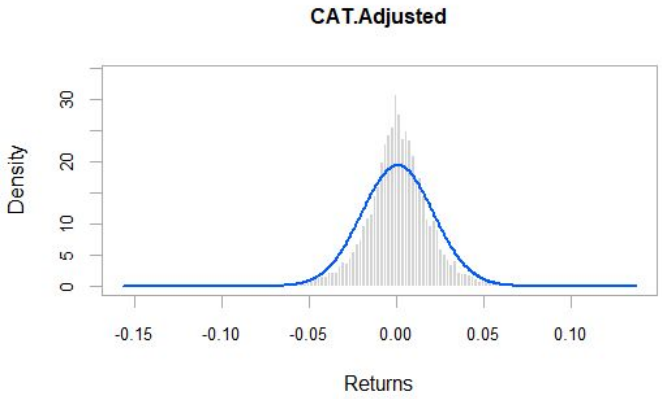
```
> t.test(newlogreturnA)

        One Sample t-test

data:  newlogreturnA
t = 2.2696, df = 4157, p-value = 0.02328
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 0.0001016629 0.0013915769
sample estimates:
   mean of x
0.0007466199
```

1f)





1g) Using the test form 1e), 95 percent confidence interval is -6.513168e-05 to 1.041069e-03

1h)

```
#Test Skewness
T=length(newlogreturnCAT)
m3=skewness(newlogreturnCAT)
m3
tst = m3/sqrt(6/T)
tst
pv = 2*pnorm(tst)
pv

t=length(newlogreturnA)
m4=skewness(newlogreturnA)
m4
tst = m3/sqrt(6/t)
tst
pv = 2*pnorm(tst)
pv
```

```
> T=length(newlogreturnCAT)
> m3=skewness(newlogreturnCAT)
> m3
[1] -0.1836344
> tst = m3/sqrt(6/T)
> tst
[1] -5.458812
> pv = 2*pnorm(tst)
> pv
[1] 4.793299e-08
>
> t=length(newlogreturnA)
> m4=skewness(newlogreturnA)
> m4
[1] 0.1746076
> tst = m3/sqrt(6/t)
> tst
[1] -4.834155
> pv = 2*pnorm(tst)
> pv
[1] 1.337125e-06
```

Since both p-values are less than alpha of 0.05, the null hypothesis is rejected. The skewness of both stock returns are not equal to zero.

1i)

```
#
K1 = kurtosis(newlogreturnCAT)
tst = K1/sqrt(24/T)
tst
pv = 2*(1-pnorm(tst))
pv


K = kurtosis(newlogreturnA)
tst = K/sqrt(24/t)
tst
pv = 2*(1-pnorm(tst))
pv
```

```
> K1 = kurtosis(newlogreturnCAT)
> tst = K1/sqrt(24/T)
> tst
[1] 69.83078
> pv = 2*(1-pnorm(tst))
> pv
[1] 0
>
>
> K = kurtosis(newlogreturnA)
> tst = K/sqrt(24/t)
> tst
[1] 126.4855
> pv = 2*(1-pnorm(tst))
> pv
[1] 0
```

p-v of both are zero and thus lower than alpha of 0.05 which we reject the null hypothesis. We could say that the excess kurtosis are not equal to zero or the kurtosis of both are not equal to 3.