

## Assignment 2

**DUE DATE:** Thursday 11<sup>th</sup>, February 2021.

I pledge to the Honor Code and to obey all rules for taking and performing homework assignments as specified by the course instructor.

Full name Hongvichny Hor Student ID. 6004820012

All data are downloadable from yahoo finance

**You should submit your answer with (i) the code file with the name (assignment1\_yourname.r) and (ii) the report in .pdf file. You can upload your files on the BE-moodle**

**1.(90 points)** Consider the stock price of Caterpillar (CAT) stock, Airports of Thailand Public Company Limited (AOT.BK) from January 3, 2000 to January 31, 2021. The data are downloadable from yahoo finance.

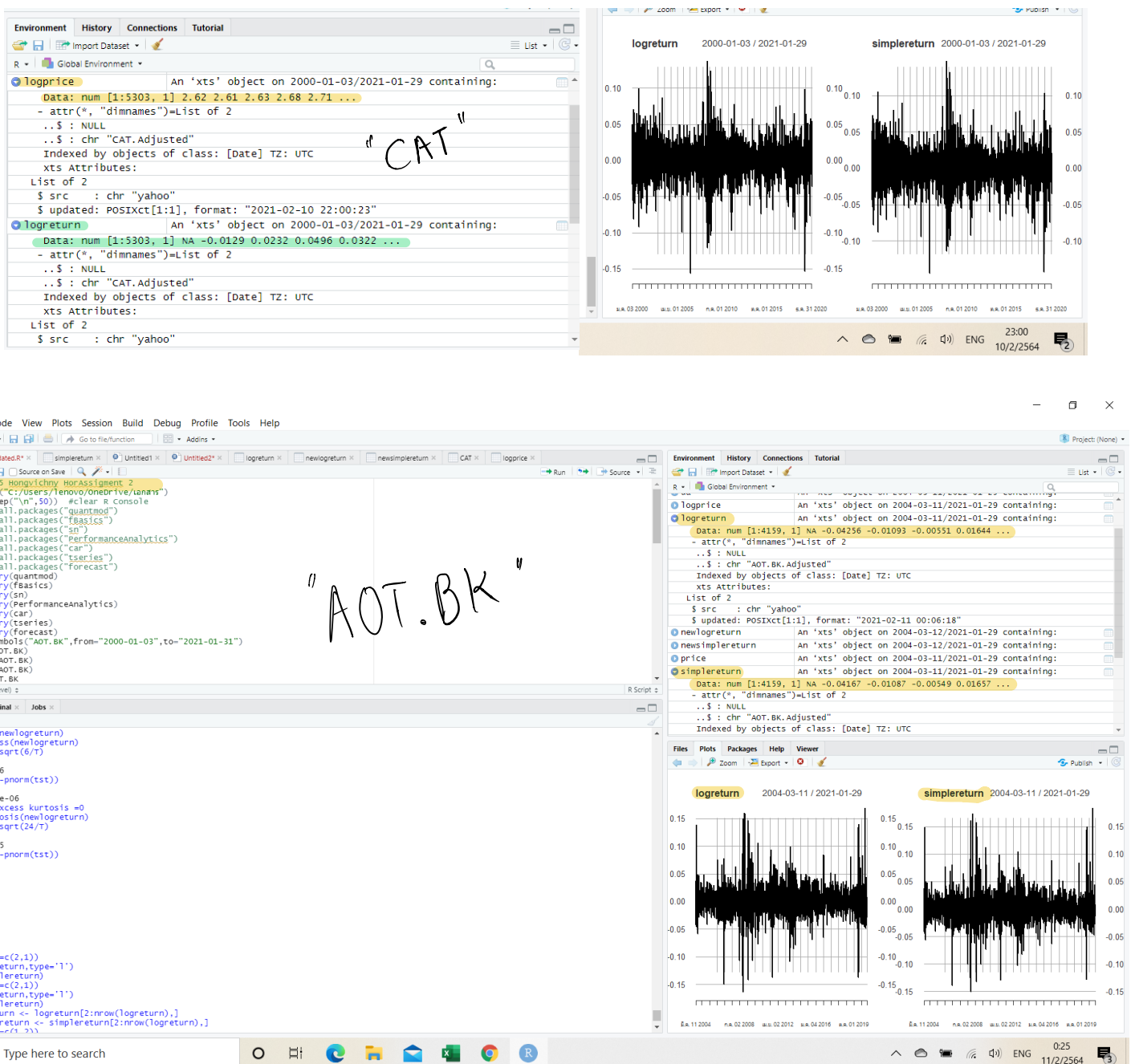
- (a) Calculate the log returns and the simple returns, then plot these two series on the same figure.
- (b) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each simple return series.
- (c) Obtain the empirical density function of the simple returns of Caterpillar stock. Are the daily simple returns normally distributed? Perform a normality test to justify your answer.
- (d) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each log return series.
- (e) Test the null hypothesis that the mean of the log returns of Caterpillar stock is zero. Do the same test for AOT stock.
- (f) Obtain the empirical density plot of the daily log returns of Caterpillar stock and AOT stock.
- (g) Construct a 95% confidence interval for the daily log returns of CAT stock.

(h) Test  $H_0 : m_3 = 0$  versus  $H_a : m_3 \neq 0$ , where  $m_3$  denotes the skewness of the return.

(i) Test  $H_0 : K = 3$  versus  $H_a : K \neq 3$ , where  $K$  denotes the kurtosis. (Excess kurtosis = 0.)

## Answer

(a) Calculate the log returns and the simple returns, then plot these two series on the same figure.



(b) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each simple return series.

(d) Compute the sample mean, standard deviation, skewness, excess kurtosis, minimum, and maximum of each log return series.

```

1 #E643 Assignment 2 Hongluichy Hor
2 setwd("C:/Users/lenovo/OneDrive/lanans")
3 cat(rep("n",90)) #clear R console
4 #install.packages("quantmod")
5 #install.packages("fBasics")
6 #install.packages("gg")
7 #install.packages("performanceAnalytics")
8 #install.packages("car")
9 #install.packages("tseries")
10 #install.packages("forecast")
11 library(quantmod)
12 library(fBasics)
13 library(gg)
14 library(performanceAnalytics)
15 library(car)
16 library(tseries)
17 library(forecast)
18 getSymbols("CAT",from="2000-01-03",to="2021-01-31")
19 dim(CAT)
20 head(CAT)
21 ts11(CAT)
22 da= CAT
23
24

```

Console output:

```

In readlines(con, warn = FALSE) :
cannot open file 'C:/Users/lenovo/OneDrive/?????/Lecture_2_updated.R': Invalid argument
> pv = 2*(1-prnorm(tst))
Error in prnorm(tst) : object 'tst' not found
> pv
Error: object 'pv' not found
Error in readlines(con, warn = FALSE) : cannot open the connection
In addition: warning message:
In readlines(con, warn = FALSE) :
cannot open file 'C:/Users/lenovo/OneDrive/?????/Lecture_2_updated.R': Invalid argument
> table.stats(logreturn)
CAT Adjusted
Observations 3902.0000
NAS 1.0000
Minimum -0.1689
Quartile 1 -0.0095
Median 0.0005
Arithmetic Mean 0.0005
Geometric Mean 0.0003
Quartile 3 0.0110
Maximum 0.1679
SE Mean 0.0003
LCL Mean (0.95) -0.0001
UCL Mean (0.95) 0.0010
Variance 0.0004
SD 0.0200
Skewness -0.1836
Kurtosis 4.6982
> view(logprice)
> getwd()
[1] "C:/Users/lenovo/OneDrive/lanans"
>

```

*"CAT"*

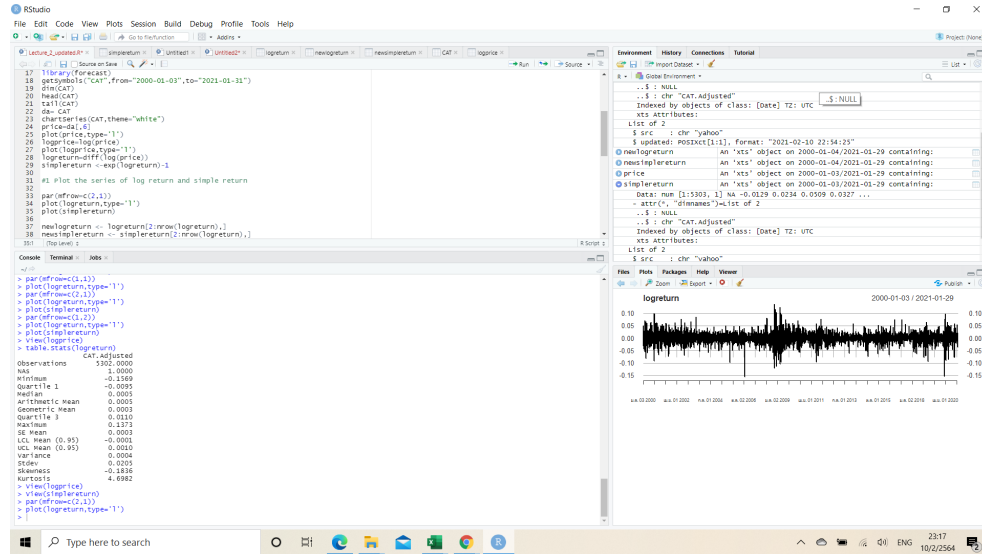
```

> logprice=log(price)
> plot(logprice,type='l')
> logreturn=diff(log(price))
> simplereturn <-exp(logreturn)-1
> par(mfrow=c(2,1))
> plot(logreturn,type='l')
> plot(simplereturn)
> newlogreturn <- logreturn[2:nrow(logreturn),]
> newsimplereturn <- simplereturn[2:nrow(logreturn),]
> #2 Histogram and sample statistics
> par(mfrow=c(1,1))
> hist(logreturn, breaks=100, col="slateblue")
> chart.Histogram(logreturn,methods = c("add.normal"))
> table.stats(logreturn)
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
> |

```

*"AOT"*

(c) Obtain the empirical density function of the simple returns of Caterpillar stock. Are the daily simple returns normally distributed? Perform a normality test to justify your answer.



Yes, It's normally distribution.

(e) Test the null hypothesis that the mean of the log returns of Caterpillar stock is zero. Do the same test for AOT stock.

```
> # use qqnorm function
> par(mfrow=c(1,1))
> qqnorm(newlogreturn)
> qqline(newlogreturn, col = 2)
> jarque.bera.test(newlogreturn)

Jarque Bera Test

data: newlogreturn
X-squared = 16020, df = 2, p-value < 2.2e-16

> #P-value<0.05 we reject the null hypothesis. It means the return(r_t)
> #4 Test mean = 0
> t.test(newlogreturn)

One Sample t-test

data: newlogreturn
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

warning messages:
1: In tstat + c(-cint, cint) :
  Recycling array of length 1 in array-vector arithmetic is deprecated.
  Use c() or as.vector() instead.
2: In cint * stderr :
  Recycling array of length 1 in vector-array arithmetic is deprecated.
```

"CAT"

```
63:1 (Top Level) R Script
Console Terminal Jobs
~/
> #
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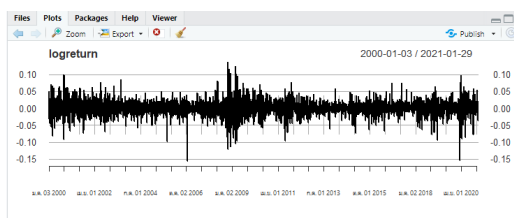
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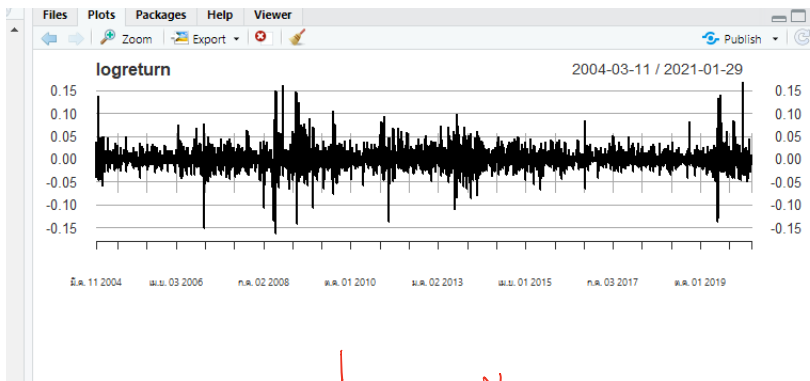
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```

"AOT.BK"

(f) Obtain the empirical density plot of the daily log returns of Caterpillar stock and AOT stock.



→ CAT



(g) Construct a 95% confidence interval for the daily log returns of CAT stock.

```

RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help
Lecture_2_updated.R* | simpretum | Untitled1 | Untitled2 | logreturn | newlogreturn | newsimpretum | CAT | logprice
44 table.stats(logreturn)
45
46 #3 qq-plots and tests for normality
47 #
48 # use qqnorm function
49 par(mfrow=c(1,1))
50 qqnorm(newlogreturn)
51 qqline(newlogreturn, col = 2)
52 jarque.bera.test(newlogreturn)
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54 #p-value<0.05 we reject the null hypothesis. It means the return(r_t)
55 #4 Test mean = 0
56 t.test(newlogreturn)
57 #H0: the mean of the log return= 0
58 #H1: the mean of the log return !=0
59 #5 Test skewness = 0
60 T=length(newlogreturn)
61 s3=skewness(newlogreturn)
62 tst = s3/sqrt(6/T)
63 tst
64 pv = 2*pnorm(tst)
65 pv
6126 (Top Level) >

Console Terminal Jobs
~/
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One Sample t-test

data: newlogreturn
t = 1.7296, df = 5301, p-value = 0.08377
alternative hypothesis: true mean is not equal to 0
95 percent confidence interval:
 -6.53168e-05  1.04106e-03
sample estimates:
mean of x
0.0004879685

```

(h) Test  $H_0 : m_3 = 0$  versus  $H_a : m_3 \neq 0$ , where  $m_3$  denotes the skewness of the return.

The left screenshot shows the R script for hypothesis testing. The code includes comments and function calls for normality tests, skewness tests, and t-tests. The right screenshot shows the console output, which includes the results of the t-test and warnings about deprecated array arithmetic.

```

# RStudio
File Edit Code View Plots Session Build Debug Profile Tools Help

# Lecture_2_updated.R
44 table.Stats(logreturn)
45 #
46 #3 QQ-plots and tests for normality
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> #5 Test Skewness = 0
> T=length(newlogreturn)
> s3=skewness(newlogreturn)
> tst = s3/sqrt(6/T)
> tst
[1] 4.596526
> pv = 2*(1-pnorm(tst))
> pv
[1] 4.29594e-06
> #6 Test excess kurtosis = 0
> k4 = kurtosis(newlogreturn)
> tst = k4/sqrt(24/T)
> tst
[1] 126.4855
> pv = 2*(1-pnorm(tst))
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[1] 0
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one sample t-test

data: newlogreturn
t = 1.7296, df = 5301, p-value = 0.08377
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 -6.513168e-05 1.041069e-03
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(i) Test  $H_0 : K = 3$  versus  $H_a : K \neq 3$ , where K denotes the kurtosis. (Excess kurtosis = 0.)

The screenshot shows the R script for hypothesis testing. The code includes comments and function calls for normality tests, skewness tests, and t-tests. The right screenshot shows the console output, which includes the results of the t-test and warnings about deprecated array arithmetic.

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File Edit Code View Plots Session Build Debug Profile Tools Help

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 mean of x
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```

RStudio

File Edit View Plots Session Build Debug Profile Tools Help

Go to file/function Addins

Source on Save

1. Lecture\_2\_logreturn.R x logreturn x logreturn x logreturn x CAT x logprice x

54 #p-value<0.05 we reject the null hypothesis. It means the return(r\_t)  
55 #4 Test mean = 0  
56 t.test(newlogreturn)  
57 #H0: the mean of the log return= 3  
58 #H1: the mean of the log return !=3  
59 #3 Test Skewness = 0  
60 T=length(newlogreturn)  
61 s3=skewness(newlogreturn)  
62 tst = s3/sqrt(6/T)  
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71 pv = 2\*(1-pnorm(tst))  
72 pv  
73  
74  
75

73x1 (Top Level) z

Console Terminal Jobs

~/

```
> #H0: the mean of the log return= 3
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> tst
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alternative hypothesis: true mean is not equal to 0
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 0.000016625 0.001393769
sample estimates:
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```

Type here to search

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