```
R version 4.3.2 (2023-10-31 ucrt) -- "Eye Holes"
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Platform: x86_64-w64-mingw32/x64 (64-bit)

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  Natural language support but running in an English locale

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Type 'demo()' for some demos, 'help()' for on-line help, or
'help.start()' for an HTML browser interface to help.
Type 'q()' to quit R.

> library(readxl)
> library(lubridate)

Attaching package: ‘lubridate’

The following objects are masked from ‘package:base’:

    date, intersect, setdiff, union

> library(moments)
> library(car)
Loading required package: carData
> library(lmtest)
Loading required package: zoo

Attaching package: ‘zoo’

The following objects are masked from ‘package:base’:

    as.Date, as.Date.numeric

> library(sandwich)
> library(urca)
> library(tidyverse)
── Attaching core tidyverse packages ──────────────────────────────────────── tidyverse 2.0.0 ──
✔ dplyr   1.1.3     ✔ readr   2.1.4
✔ forcats 1.0.0     ✔ stringr 1.5.0
✔ ggplot2 3.4.4     ✔ tibble  3.2.1
✔ purrr   1.0.2     ✔ tidyr   1.3.0
── Conflicts ────────────────────────────────────────────────────── tidyverse_conflicts() ──
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
✖ dplyr::recode() masks car::recode()
✖ purrr::some()   masks car::some()
ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to become e
rrors
> library(Metrics)
> ################################################
> #set your working directory where you data is saved
> setwd("C:/Users/saive/Desktop/Acads/MBA737/Assignment 2")
>
> ##Read the data
> Data= read_excel("ABC.xlsx")
-/
  /
   -
    >
> ##Check the data
> head(Data) #Date contacts security ABC price, returns, sensex returns,
# A tibble: 6 × 7
  Date                Price      ABC   Sensex DividendAnnounced Sentiment     Nifty
```

```
  <dttm>              <dbl>    <dbl>    <dbl>             <dbl>     <dbl>     <dbl>
1 2000-01-03 00:00:00  718.  0.0799   0.0738                0    0.0489  0.0958
2 2000-01-04 00:00:00  713. -0.00731  0.0216                0   -0.0550  0.00971
3 2000-01-05 00:00:00  730   0.0240  -0.0244                0    0.0191 -0.0322
4 2000-01-06 00:00:00  788.  0.0799   0.0120                0    0.0804  0.0112
5 2000-01-07 00:00:00  851.  0.0800  -0.00130               0    0.0940 -0.000397
6 2000-01-10 00:00:00  920.  0.0800   0.0192                1    0.0152  0.0302
> #dividend announcement, sentiment, and Nifty returns
> dim(Data)
[1] 5153    7
> class(Data$Date) ##Date object seems to be in date/time
[1] "POSIXct" "POSIXt"
> Data$Date=as.Date(Data$Date) ##Converting date/time to date object
> class(Data$Date)
[1] "Date"
> Data=na.omit(Data)
>
> ################################################
> #Visualaze the data: Returns on ABC and Nifty
> plot(Data$Date, Data$ABC, xlab="Data", ylab="", main="ABC Returns",
+      type="l")
> ###Compute cummulative returns
> Data$Cum_Ret= Data$Price/Data$Price[1]-1
>
> plot(Data$Date, Data$Cum_Ret, xlab="Data", ylab="", main="Cummulative Returns",
+      type="l")
> ##############Market or Nifty Returns
> plot(Data$Date, Data$Nifty, xlab="Data", ylab="", main="Market Returns",
+      type="l")
> #Cummulative market returns
> Data$Cum_Ret_Nifty= cumsum(Data$Nifty)
>
> ###Plot cummulative returns
> plot(Data$Date, Data$Cum_Ret_Nifty, xlab="Data", ylab="",
+      main="Cummulative Market Returns",
+      type="l")
> ###Basic properties of Data
> ###Summmarizing the data
> summary(Data$ABC)
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-0.9273627 -0.0090724  0.0001761  0.0003167  0.0100360  0.1108470
> summary(Data$Nifty)
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-0.1458446 -0.0096267  0.0005979  0.0004322  0.0107338  0.1597033
> summary(Data$Sensex)
      Min.    1st Qu.     Median       Mean    3rd Qu.       Max.
-0.1315258 -0.0061911  0.0009185  0.0005075  0.0075565  0.1733933
>
> ##########Plot ABC vs Nifty
> plot(density(Data$ABC), main="Density-Graph",
+      xlab="Data", col="red", lwd=2, lty=1, xlim=c(-0.6, 0.6))
>
>
> lines(density(Data$Nifty), col="blue", lwd=2)
> legend("topleft", c("ABC", "Nifty"),fill= c("red", "blue"))
>
> ################################################################
> ##Normality and Staionerity of the data
>
> ####Symmetry
> skewness(Data$ABC)  #Large Negative skewness in ABC returns
[1] -11.99669
> skewness(Data$Nifty) #Moderate Negative skewness in ABC returns
[1] -0.1775945
>
> agostino.test(Data$ABC)  #Negative skewness is statistically signifcant

        D'Agostino skewness test

data:  Data$ABC
```

```
skew = -11.997, z = -81.159, p-value < 2.2e-16
alternative hypothesis: data have a skewness

> agostino.test(Data$Nifty) #Negative skewness is statistically signifcant but small in magnitude

        D'Agostino skewness test

data:  Data$Nifty
skew = -0.17759, z = -5.17203, p-value = 2.316e-07
alternative hypothesis: data have a skewness

> ##Kurtosis (fat tails and excess peakedness)
> kurtosis(Data$ABC) ##very large kurtosis indicating fat tails and excess peaked ness
[1] 415.1945
> kurtosis(Data$Nifty) ##Moderately large kurtosis indicating fat tails and excess peaked ness
[1] 7.319551
>
>
> ####The test compares kurtosis with normal distribution kurtosis (3)
> anscombe.test(Data$ABC) ##very large and statistically signifcant kurtosis

        Anscombe-Glynn kurtosis test

data:  Data$ABC
kurt = 415.195, z = 50.333, p-value < 2.2e-16
alternative hypothesis: kurtosis is not equal to 3

> #indicating fat tails and excess peaked ness
> anscombe.test(Data$Nifty) ## statistically signifcant kurtosis

        Anscombe-Glynn kurtosis test

data:  Data$Nifty
kurt = 7.3196, z = 22.5579, p-value < 2.2e-16
alternative hypothesis: kurtosis is not equal to 3

> #indicating fat tails and excess peaked ness
> ########################Testing the normality
>
>
> ####Overall test of data normality
> jarque.test(Data$ABC)  ##excessive deviation from normality due to

        Jarque-Bera Normality Test

data:  Data$ABC
JB = 36603480, p-value < 2.2e-16
alternative hypothesis: greater

> ##large negative skewness and kurtosis
> jarque.test(Data$Nifty)  ##excessive deviation from normality due to

        Jarque-Bera Normality Test

data:  Data$Nifty
JB = 4033.2, p-value < 2.2e-16
alternative hypothesis: greater

> ##large negative skewness and kurtosis
>
>
> #####
> ##Stationerity of the data
> ###Stationarity is an important requirement of regression or any mathematical time
> #series model; it indicates whether the mean and variance of the process are
> ##constant or changing with time
> #stationarity is more imp that normality. Even if the data is not normal
> #the sampling distribution may be normal due to central limit theorem
>
> ##ADF Test: H0 Null: Non stationarity
```

```
> summary(ur.df(Data$ABC)) ##Null rejected; Data Stationary

###############################################
# Augmented Dickey-Fuller Test Unit Root Test #
###############################################

Test regression none


Call:
lm(formula = z.diff ~ z.lag.1 - 1 + z.diff.lag)

Residuals:
     Min       1Q   Median       3Q      Max
-0.92671 -0.00912  0.00013  0.00999  0.11103

Coefficients:
           Estimate Std. Error t value Pr(>|t|)
z.lag.1    -1.02004    0.01970 -51.786   <2e-16 ***
z.diff.lag  0.02003    0.01392   1.439     0.15
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.02488 on 5149 degrees of freedom
Multiple R-squared:  0.5002,    Adjusted R-squared:    0.5
F-statistic:  2577 on 2 and 5149 DF,  p-value: < 2.2e-16


Value of test-statistic is: -51.7863

Critical values for test statistics:
      1pct  5pct 10pct
tau1 -2.58 -1.95 -1.62

> summary(ur.df(Data$Nifty))##Null rejected; Data Stationary

###############################################
# Augmented Dickey-Fuller Test Unit Root Test #
###############################################

Test regression none


Call:
lm(formula = z.diff ~ z.lag.1 - 1 + z.diff.lag)

Residuals:
      Min        1Q    Median        3Q       Max
-0.147411 -0.009582  0.000652  0.010714  0.158660

Coefficients:
            Estimate Std. Error t value Pr(>|t|)
z.lag.1    -0.980741   0.019405  -50.54   <2e-16 ***
z.diff.lag  0.008194   0.013896    0.59    0.555
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.01779 on 5149 degrees of freedom
Multiple R-squared:  0.4864,    Adjusted R-squared:  0.4862
F-statistic:  2439 on 2 and 5149 DF,  p-value: < 2.2e-16


Value of test-statistic is: -50.5395

Critical values for test statistics:
      1pct  5pct 10pct
tau1 -2.58 -1.95 -1.62

>
> ##PP test: H0: Null of Non stationarity
```

```
> summary(ur.pp(Data$ABC)) ##Null rejected: Data Stationary

###################################
# Phillips-Perron Unit Root Test #
###################################

Test regression with intercept


Call:
lm(formula = y ~ y.l1)

Residuals:
     Min       1Q   Median       3Q      Max
-0.92767 -0.00938 -0.00013  0.00971  0.11054

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.0003014  0.0003467   0.869    0.385
y.l1        -0.0003372  0.0139211  -0.024    0.981

Residual standard error: 0.02488 on 5150 degrees of freedom
Multiple R-squared:  1.139e-07, Adjusted R-squared:  -0.0001941
F-statistic: 0.0005867 on 1 and 5150 DF,  p-value: 0.9807


Value of test-statistic, type: Z-alpha  is: -4925.525

         aux. Z statistics
Z-tau-mu            0.8703

> summary(ur.pp(Data$Nifty)) ##Null rejected: Data Stationary

###################################
# Phillips-Perron Unit Root Test #
###################################

Test regression with intercept


Call:
lm(formula = y ~ y.l1)

Residuals:
      Min        1Q    Median        3Q       Max
-0.147539 -0.009986  0.000217  0.010282  0.158352

Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.0004020  0.0002478   1.622   0.1048
y.l1        0.0270940  0.0138908   1.951   0.0512 .
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.01778 on 5150 degrees of freedom
Multiple R-squared:  0.0007382, Adjusted R-squared:  0.0005442
F-statistic: 3.804 on 1 and 5150 DF,  p-value: 0.05117


Value of test-statistic, type: Z-alpha  is: -5013.452

         aux. Z statistics
Z-tau-mu            1.6221

>
>
> ###KPSS test H0: test of  stationarity
> summary(ur.kpss(Data$ABC)) #Fail to reject null: Data Staionary

#######################
```

```
# KPSS Unit Root Test #
#######################

Test is of type: mu with 10 lags.

Value of test-statistic is: 0.0887

Critical value for a significance level of:
                10pct  5pct 2.5pct  1pct
critical values 0.347 0.463  0.574 0.739

> summary(ur.kpss(Data$Nifty)) #Fail to reject null: Data Staionary

#######################
# KPSS Unit Root Test #
#######################

Test is of type: mu with 10 lags.

Value of test-statistic is: 0.1303

Critical value for a significance level of:
                10pct  5pct 2.5pct  1pct
critical values 0.347 0.463  0.574 0.739

>
> ####
>
>
```