FA542-Homework3

I will get different result of serial correlations, if i use different lag. So this is first version(exist serial correlations.) of my homework 3.

   (i)   Download daily price data for January 1, 1987 through December 31, 2021 of Microsoft stock from Yahoo Finance. You may use the quantmod package in R for this purpose.

```
library(quantmod)
library(fBasics)
library(fGarch)
getSymbols('MSFT',src='yahoo',from='1987-01-01',to='2021-12-31')

## [1] "MSFT"

Mreturn = monthlyReturn(MSFT,type="log")
```

   (ii) Is there any evidence of serial correlations in the monthly log returns. Use autocorrelations and 5% significance level to answer the question. If yes, remove the serial correlations.

```
Box.test(Mreturn,lag=12,type="Ljung-Box")

##
##  Box-Ljung test
##
## data:  Mreturn
## X-squared = 20.282, df = 12, p-value = 0.06193

print("the p-value = 0.06193, fail to reject NULL hypothesis no correlations.")

## [1] "the p-value = 0.06193, fail to reject NULL hypothesis no correlations."

print("removing the sample mean from the data.")

## [1] "removing the sample mean from the data."
```

(iii) Is there any evidence of ARCH effects in the monthly log returns? Use the residual series if there are serial correlations in part (ii). Use Ljung–Box statistics for the squared returns (or residuals) with 6 and 12 lags of autocorrelations and 5% significance level to answer the question.

```
#Because we don't have serial correlation in (ii)
#Here we use the residuals of the mean equation to test for ARCH effects.
#reject H0, ARCH effects exist
at = Mreturn - mean(Mreturn)
Box.test(at^2,lag=6,type="Ljung-Box")

##
##   Box-Ljung test
##
## data:  at^2
## X-squared = 54.52, df = 6, p-value = 5.794e-10

Box.test(at^2,lag=12,type="Ljung-Box")

##
##   Box-Ljung test
##
## data:  at^2
## X-squared = 137, df = 12, p-value < 2.2e-16
```

(iv) Identify an ARCH model for the data and fit the identified model. Write down the fitted model and justify your choice of parameters.

```
library(fGarch)
# Fit an ARCH model to the residuals
pacf(at^2,lag=12) #by inspection consider ARCH(9) model
```

Series at^2
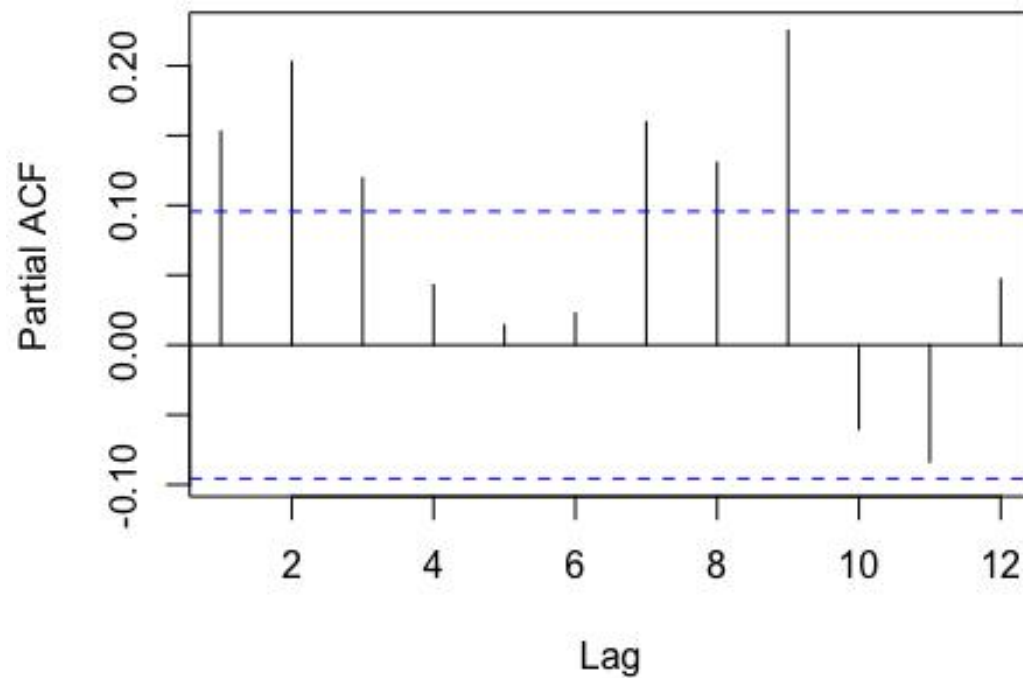

```
ARCH = garchFit(formula=~garch(9,0), data=Mreturn, trace=FALSE)
print("I choose 9 becauese, when it is 10, PACF drop blow 0")

## [1] "I choose 9 becauese, when it is 10, PACF drop blow 0"
```