FA542-homework3

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I will get different result of serial correlations, if i use different lag. So this is second 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(tseries)
getSymbols('MSFT',src='yahoo',from='1987-01-01',to='2021-12-31')

M_sreturn = 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(M_sreturn,lag=9,type="Ljung-Box")

##
##   Box-Ljung test
##
## data:   M_sreturn
## X-squared = 17.217, df = 9, p-value = 0.04542

#there exist serial correlations.
best = 0
```

```
for (p in 0:5){ # Loop through different choices for AR and MA lengths (p and
q)
  for (q in 0:5){
    tmp = arima(M_sreturn, order=c(p,1,q))
    if (BIC(tmp) < best){ # Use BIC to evaluate performance. Other options avai
lable
      mdl = tmp
      best = BIC(tmp) # Choose the model with the best BIC
    }
  }
}
# Fit a linear model to remove the serial correlations
#From previous part we can choose MA(1)model and take out the residuals
mdl = arima(M_sreturn, order=c(0,0,1))
```

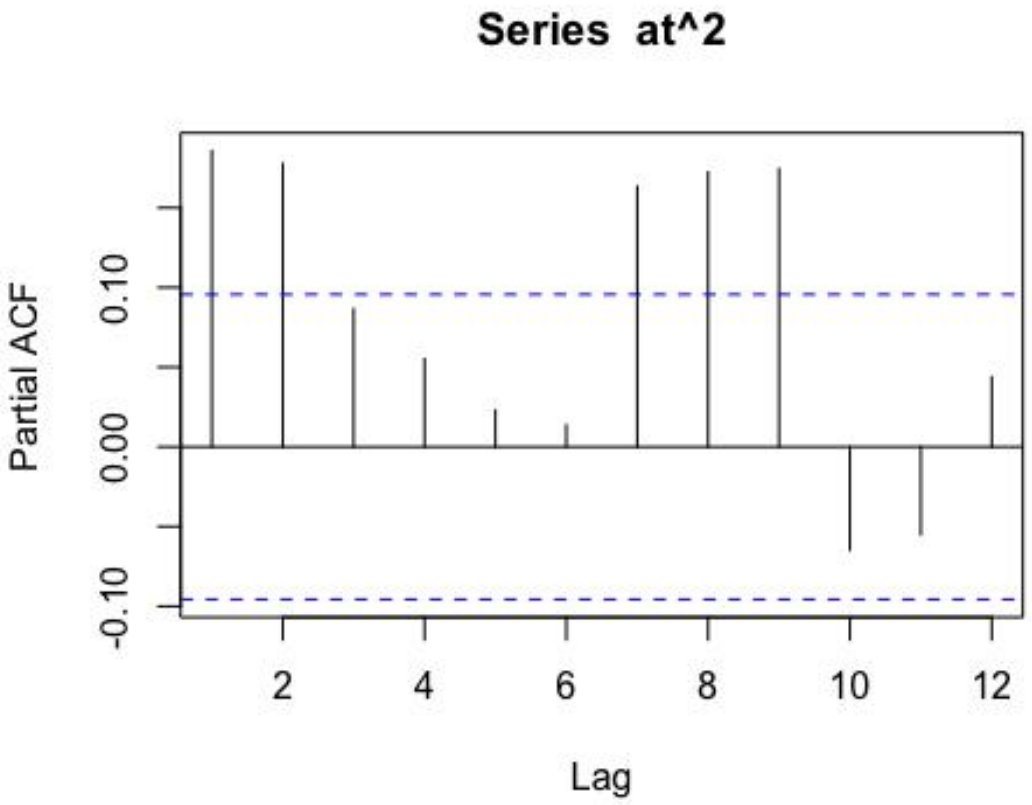
(iii) Is there any evidence of ARCH effects in the monthly log returns? Use the residual series if there are serial correlations in part (ii). Use Ljung–Box statistics for the squared returns (or residuals) with 6 and 12 lags of autocorrelations and 5% significance level to answer the question.

```
# Test for ARCH effects in the residuals
at = mdl$residuals
Box.test(at^2,lag=6,type="Ljung-Box") #ARCH effects exist

##
##  Box-Ljung test
##
## data:  at^2
## X-squared = 53.034, df = 6, p-value = 1.155e-09

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

```
##
##   Box-Ljung test
##
## data:   at^2
## X-squared = 134.27, 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
```




```
ARCH = garchFit(formula=~garch(9,0), data=M_sreturn, 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"
```