# Problem 5

Nidhi

2022-11-16

### Problem 5: Computational Finance - Modelling Stock prices

1. Estimate the parameters of the models $\theta = (\alpha, \beta, \sigma)$ using the method of moments type plug-in estimator discussed in the class.
2. Estimate the parameters using the `lm` built-in function of `R`. Note that `lm` using the OLS method.
3. Fill-up the following table

| Parameters | Method of Moments | OLS |
|---|---|---|
| $\alpha$ | | |
| $\beta$ | | |
| $\sigma$ | | |

4. If the current value of Nifty is 18000 and it goes up to 18200. The current value of TCS is Rs. 3200/-. How much you can expect TCS price to go up?

```
library(quantmod)
```

```
## Loading required package: xts
```

```
## Loading required package: zoo
```

```
##
## Attaching package: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
## Loading required package: TTR
```

```
## Registered S3 method overwritten by 'quantmod':
##   method            from
##   as.zoo.data.frame zoo
```

```
getSymbols('TCS.NS')
```

```
## [1] "TCS.NS"
```

```
getSymbols('^NSEI')
```

```
## [1] "^NSEI"
```

```
TCS_rt <- diff(log(TCS.NS$TCS.NS.Adjusted))
Nifty_rt <- diff(log(NSEI$NSEI.Adjusted))

retrn <- cbind.xts(TCS_rt, Nifty_rt)
retrn <- na.omit(data.frame(retrn))

names(retrn) = c('TCS', 'Nifty50')

covariance <- cov(retrn[,'Nifty50'], retrn[, 'TCS'])
nifty.var <- var(retrn[, 'Nifty50'])
beta <- covariance/nifty.var

tcs.mean <- mean(retrn[,'TCS'])
nifty.mean <- mean(retrn[, 'Nifty50'])
alpha <- tcs.mean - beta*nifty.mean

sigma = sqrt((sum((retrn[,'TCS']-alpha-beta*retrn[,'Nifty50'])^2))/length(retrn[,'TCS']))

fit <- summary(lm(TCS ~ Nifty50, data = retrn))

ols.alpha <- fit$coefficients[1]
ols.beta <- fit$coefficients[2]
ols.sigma <- fit$sigma

TCS_return = alpha + beta*log(18200/18000)
TCS_new = 3200*exp(TCS_return)
```

| Parameters | Method of Moments | OLS |
|---|---|---|
| $\alpha$ | 0.0004616524 | 0.0004616524 |
| $\beta$ | 0.7436617 | 0.7436617 |
| $\sigma$ | 0.01618042 | 0.01618481 |