

STATS 4310 - Tuan Pham - Finance Application

Tuan Pham

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Part1:

Part 1a:

Stock pick:

Underlying Stock	Ticker	Beta	PE Ratio	Growth Estimate(5yrs)
Microsoft	MSFT	N/A	32.91	14.30%
Lockheed Martin	LMT	0.62	16.41	10.69%
Enphase Energy	ENPH	1.51	23.91	27.60%

Part 1b:

```
# Quantitative Financial Modelling Framework
library(quantmod)

# Set the time frame of desired observation
start<- as.Date("2019-01-01")
end<-as.Date("2023-10-26")

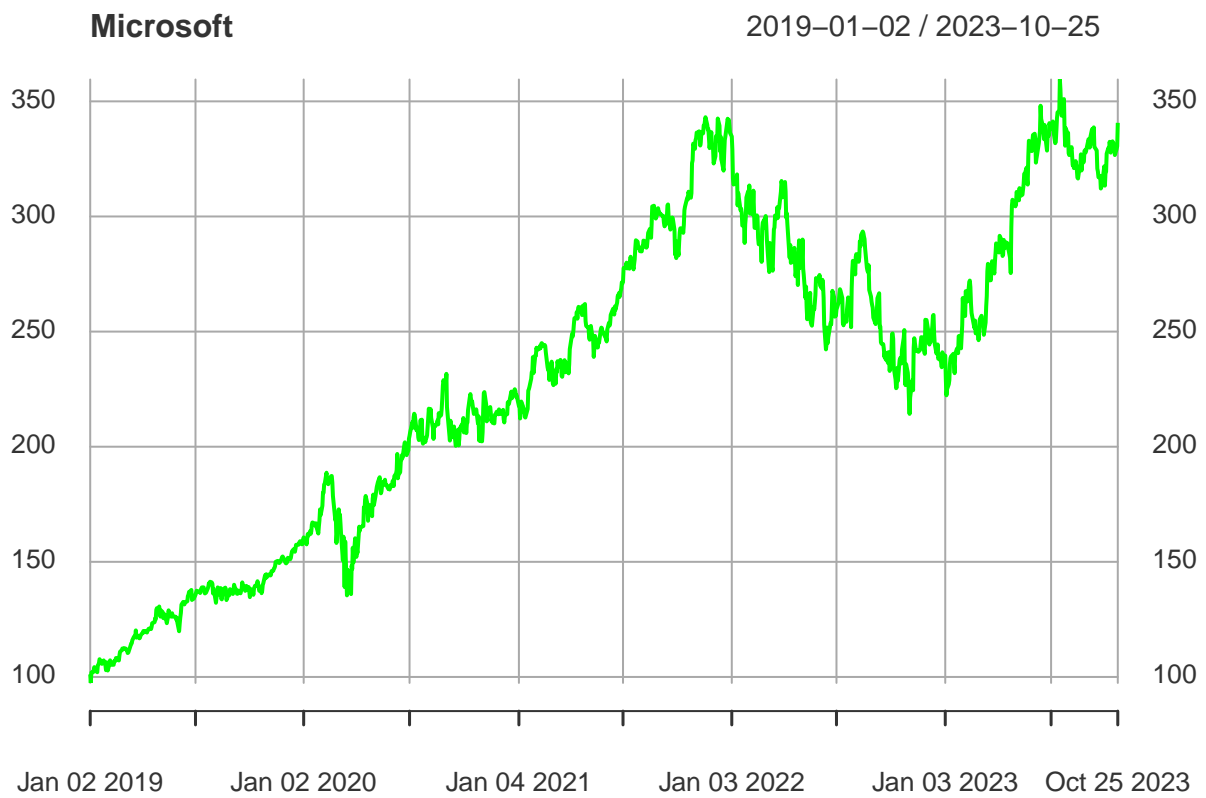
# get desired tickers by getSymbols function
MSFT <- getSymbols("MSFT",from=start, to=end, auto.assign=F)
LMT <- getSymbols("LMT",from=start, to=end, auto.assign=F)
ENPH <- getSymbols("ENPH",from=start, to=end, auto.assign=F)

## Close price
MSFT.close <- MSFT[,4]
LMT.close <- LMT[,4]
ENPH.close <- ENPH[,4]

# Daily Return function - The difference between open and close price of an underlying stock
MSFT.return <- dailyReturn(MSFT.close)
LMT.return <- dailyReturn(LMT.close)
ENPH.return <- dailyReturn(ENPH.close)
```

Microsoft

```
plot(MSFT.close, type='l', col='green', main = "Microsoft")
```



Lockheed Martin Corp.

```
plot(LMT.close, type='l', col='blue', main = "Lockheed Martin")
```



Enphase Energy

```
plot(ENPH.close, type='l', col='red', main = "Enphase Energy")
```

Enphase Energy

2019-01-02 / 2023-10-25



Part 1c:

Annualized Expected Return and Annualized Risk

```
## Microsoft
MSFT.exp.annual.return <- mean(MSFT.return) * 252
MSFT.exp.annual.risk <- sd(MSFT.return) * sqrt(252)
MSFT.rr <- c(MSFT.exp.annual.return, MSFT.exp.annual.risk)
MSFT.rr
```

```
## [1] 0.2999722 0.3083099
```

Microsoft(MSFT) has annualized expected return of 30% and annualized risk of 30.83%

```
## Lockheed Martin
LMT.exp.annual.return <- mean(LMT.return) * 252
LMT.exp.annual.risk <- sd(LMT.return) * sqrt(252)
LMT.rr <- c(LMT.exp.annual.return, LMT.exp.annual.risk)
LMT.rr
```

```
## [1] 0.1443665 0.2647955
```

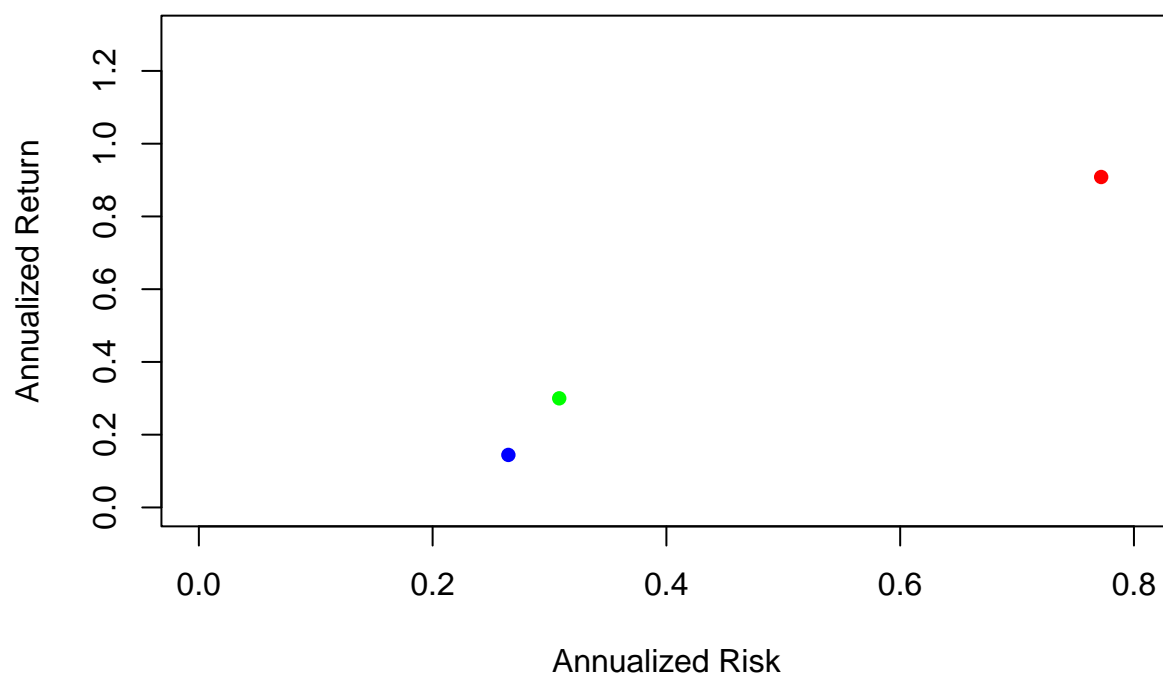
Lockheed Martin(LMT) has annualized expected return of 14.44% and annualized risk of 26.48%

```
## Enphase Energy
ENPH.exp.annual.return <- mean(ENPH.return) * 252
ENPH.exp.annual.risk <- sd(ENPH.return) * sqrt(252)
ENPH.rr <- c(ENPH.exp.annual.return, ENPH.exp.annual.risk)
ENPH.rr
```

```
## [1] 0.9083873 0.7719485
```

Enphase Energy(ENPH) has annualized expected return of 90.84% and annualized risk of 77.19%

```
plot(MSFT.rr[2], MSFT.rr[1], pch=16, col="green", ylim=c(0, 1.30), xlim=c(0, .80), xlab = 'Annualized R.
points(LMT.rr[2], LMT.rr[1], pch=16, col="blue")
points(ENPH.rr[2], ENPH.rr[1], pch=16, col="red")
```

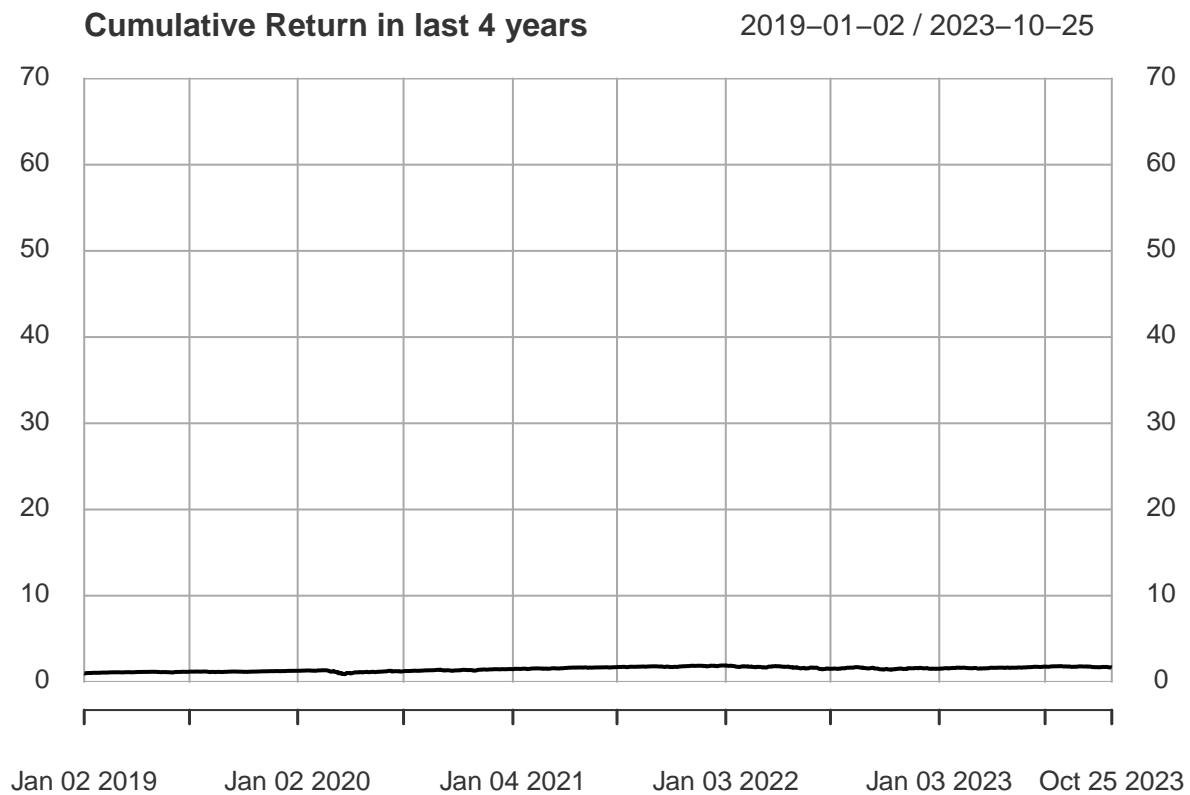


Part 1d:

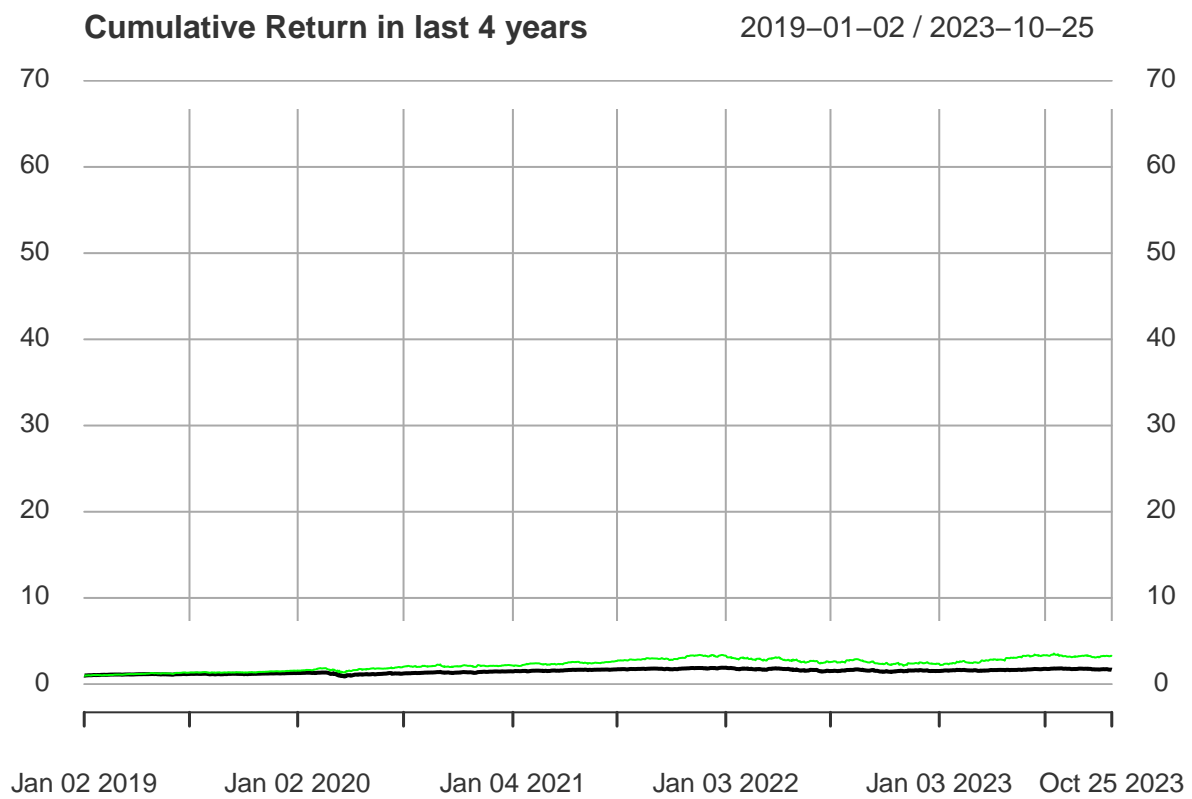
```
## SPY (S&P500 ETF)
SPY <- getSymbols("SPY",from=start, to=end, auto.assign=F)
SPY.close <- SPY[,4]
SPY.return <- dailyReturn(SPY.close)
```

```
MSFT.cum.return <- cumprod(1 + MSFT.return)
LMT.cum.return <- cumprod(1 + LMT.return)
ENPH.cum.return <- cumprod(1 + ENPH.return)
SPY.cum.return <- cumprod(1 + SPY.return)
```

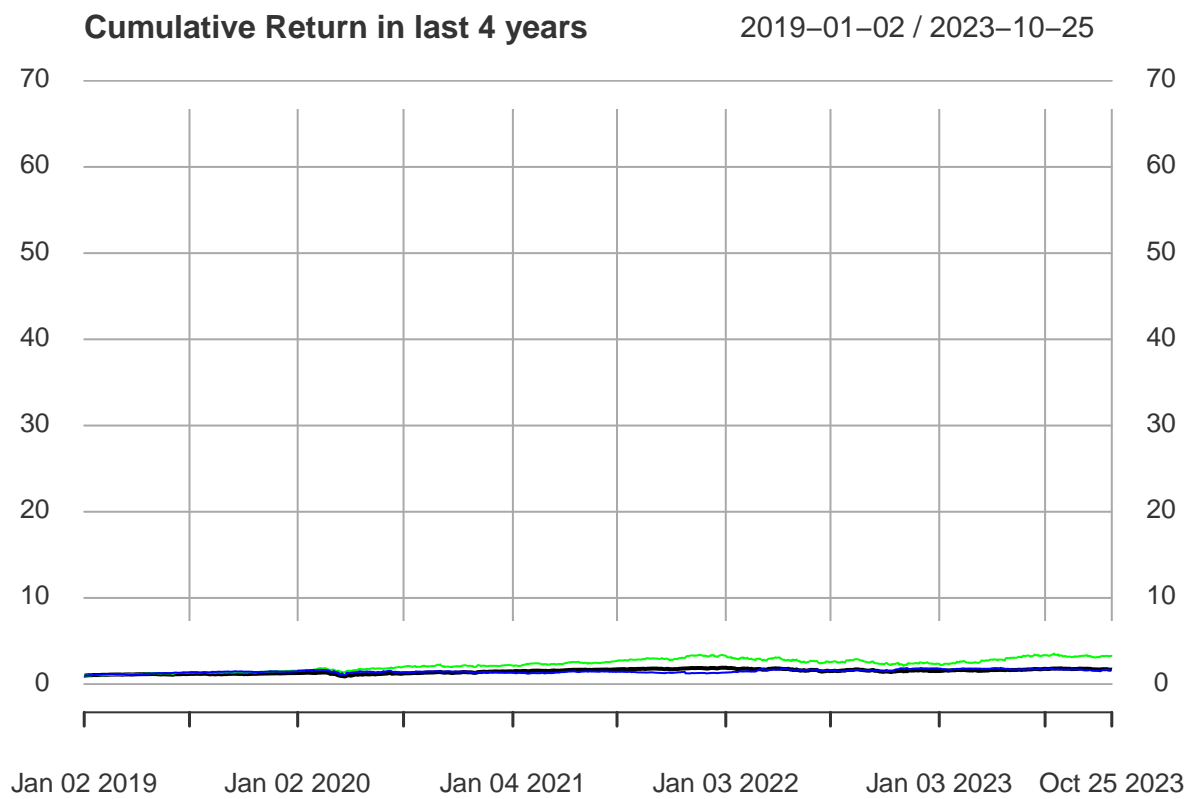
```
plot(SPY.cum.return, type="l", ylim=c(0, 70), main = 'Cumulative Return in last 4 years')
```



```
lines(MSFT.cum.return, type="l", col="green")
```



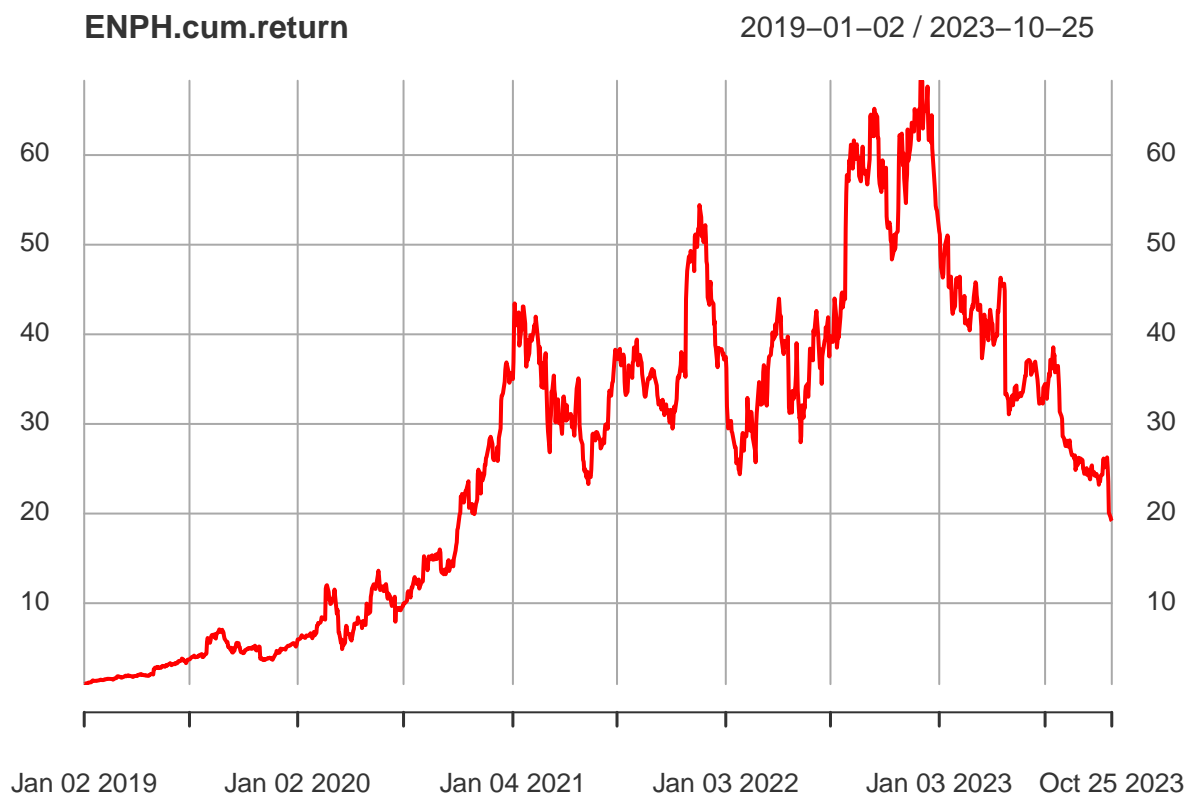
```
lines(LMT.cum.return, type="l", col="blue")
```



```
lines(ENPH.cum.return, type="l", col="red")
```




```
plot(ENPH.cum.return, type="l", col="red")
```



```
plot(SPY.cum.return, type="l", ylim=c(0, 4), main = 'Cumulative Return in last 4 years')
```



```
lines(MSFT.cum.return, type="l", col="green")
```



```
lines(LMT.cum.return, type="l", col="blue")
```



Part2:

Part 2a:

```
rf <- read.csv('F-F_Research_Data_Factors_daily.CSV', head=T, skip=3)
rf$date <- as.Date(rf$X, format='%Y%m%d')
attach(rf)
head(rf)
```

```
##           X Mkt.RF   SMB   HML   RF      date
## 1 19260701   0.10 -0.25 -0.27 0.009 1926-07-01
## 2 19260702   0.45 -0.33 -0.06 0.009 1926-07-02
## 3 19260706   0.17  0.30 -0.39 0.009 1926-07-06
## 4 19260707   0.09 -0.58  0.02 0.009 1926-07-07
## 5 19260708   0.21 -0.38  0.19 0.009 1926-07-08
## 6 19260709  -0.71  0.43  0.57 0.009 1926-07-09
```

```
rf <- na.omit(rf)
rf.avg <- mean(rf$RF)
rf.avg
```

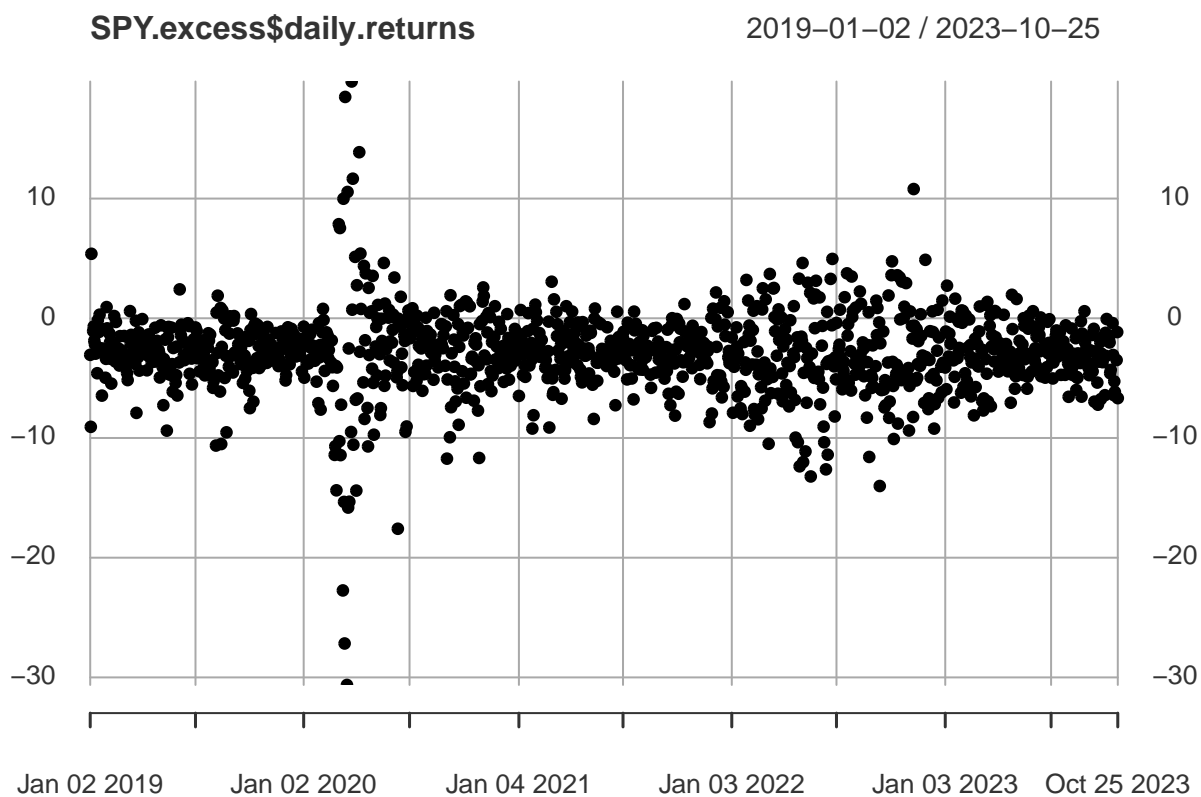
```
## [1] 0.01212313
```

```
# Risk-free rate during the last 4 years
rf.new <- subset(rf, date >= start & date <= end)
rf.average <- mean(rf.new$RF)
```

```
SPY.excess <- 252 * (SPY.return - rf.avg)
MSFT.excess <- 252 * (MSFT.return - rf.avg)
LMT.excess <- 252 * (LMT.return - rf.avg)
ENPH.excess <- 252 * (ENPH.return - rf.avg)
head(SPY.excess)
```

```
##           daily.returns
## 2019-01-02    -3.0550277
## 2019-01-03   -9.0684440
## 2019-01-04    5.3858965
## 2019-01-07   -1.0680972
## 2019-01-08   -0.6874045
## 2019-01-09   -1.8773080
```

```
plot(SPY.excess$daily.returns, MSFT.excess$daily.returns, pch=20, type = 'p')
```



Part 2b:

```
MSFT.Alpha.Beta <- coef(lm(MSFT.excess ~ SPY.excess))
MSFT.Alpha.Beta
```

```
## (Intercept) SPY.excess
## 0.7417678 1.1951988
```

```
LMT.Alpha.Beta <- coef(lm(LMT.excess ~ SPY.excess))
LMT.Alpha.Beta
```

```
## (Intercept) SPY.excess
## -1.0266587 0.6439437
```

```
ENPH.Alpha.Beta <- coef(lm(ENPH.excess ~ SPY.excess))
ENPH.Alpha.Beta
```

```
## (Intercept) SPY.excess
## 2.491308 1.585230
```

```
MSFT.Rsquare <- summary(lm(MSFT.excess ~ SPY.excess))$r.squared
MSFT.Rsquare
```

```
## [1] 0.6840258
```

```
LMT.Rsquare <- summary(lm(LMT.excess ~ SPY.excess))$r.squared
LMT.Rsquare
```

```
## [1] 0.2691794
```

```
ENPH.Rsquare <- summary(lm(ENPH.excess ~ SPY.excess))$r.squared
ENPH.Rsquare
```

```
## [1] 0.1919443
```

Underlying Stock	Ticker	Alpha	Beta	Rsquare
Microsoft	MFST	0.74	1.20	0.68
Lockheed Martin	LMT	-1.02	0.64	0.27
Enphase Energy	ENPH	2.49	1.59	0.19