Kritagya Nepal
Assignment-5
Number of Group Member: 0

Stock Market Investment Evaluation

We want to evaluate two different strategy for investing. The first strategy includes investing $1000 every month irrespective of the market condition. This relies on the fact that the market increases on average and the interest accumulated through in grows exponentially as the year pass by. First, we import library in R, necessary to evaluate these prices. Following are the library that we need:

```
library(quantmod)
library(tidyquant)
library(tidyverse)
```

We then consider the SPY which is designed to track the S&P 500 stock market index. We get the SPY using the getSymbols('SPY') and use tq_get to get the stock of the organization from a specified date until today. We then use quantmod to evaluate the gains obtained from 2 strategy.

```
getSymbols("SPY")
```

Strategy 1:

Here, we Invest $1000 every month irrespective of the rise or fall of the stock in SPY. The investment is added with return of every year. The return may be positive or negative based on the up/downs of the market. The following R code is used to calculate the returns of the 30 years.

```
#--------Strategy-1 --------#

spy_stocks <- c("SPY") %>%
  tq_get(get = "stock.prices",
         from = "1990-01-01",
         to = "2021-05-07") %>%
  group_by(symbol) %>%
  tq_transmute(select = adjusted,
               mutate_fun = periodReturn,
               period = "monthly",col_rename = "SPY_return")

savings = 0
spy_stocks$Strategy1_return <- NA
n <- nrow(spy_stocks)

for (i in 1:n)
{
  return_amt = spy_stocks$SPY_return[i]*savings
  investment = savings +1000
  savings = return_amt+investment
  if(i %% 12 == 0){
    spy_stocks$Strategy1_return[i] <- (savings - (1000*i))
  }
}
```

This returns the amount obtained every year from $1000 investment every month. The cumulative sum is the to total amount.

```
> spy_stocks_return1 <- na.omit(spy_stocks)
> print(spy_stocks_return1)
# A tibble: 28 x 4
# Groups:   symbol [1]
   symbol date       SPY_return Strategy1_return
   <chr>  <date>          <dbl>            <dbl>
 1 SPY    1993-12-31    0.0123              495.
 2 SPY    1994-12-30    0.00728             588.
 3 SPY    1995-12-29    0.0157            11677.
 4 SPY    1996-12-31   -0.0238            23714.
 5 SPY    1997-12-31    0.0191            49230.
 6 SPY    1998-12-31    0.0654            82330.
 7 SPY    1999-12-31    0.0571           115147.
 8 SPY    2000-12-29   -0.00523           94906.
 9 SPY    2001-12-31    0.00564           72139.
10 SPY    2002-12-31   -0.0566            32174.
# ... with 18 more rows
> 
```

```
> gain <- (savings - n*1000)
> print(paste("Gains obtained from the investment in SPY irrespective of market up/down",gain))
[1] "Gains obtained from the investment in SPY irrespective of market up/down 1449837.61535187"
```

The total gains obtained from strategy 1 is $1449837.615. Now we look at strategy 2. Here we calculate the investment and return obtained every year by buying stock when there is a fall of

SPY and sell when there is a rise of the SPY Stock. We use TTR to buy or sell during the ups and down in the market.

```
> #---Strategy-2----#
> spy_data <- c("SPY") %>%
+   tq_get(get = "stock.prices",
+          from = "1990-01-01",
+          to = "2021-05-07")
> head(spy_data)
# A tibble: 6 x 8
  symbol date        open  high   low close  volume adjusted
  <chr>  <date>     <dbl> <dbl> <dbl> <dbl>   <dbl>    <dbl>
1 SPY    1993-01-29  44.0  44.0  43.8  43.9 1003200     25.9
2 SPY    1993-02-01  44.0  44.2  44.0  44.2  480500     26.1
3 SPY    1993-02-02  44.2  44.4  44.1  44.3  201300     26.1
4 SPY    1993-02-03  44.4  44.8  44.4  44.8  529400     26.4
5 SPY    1993-02-04  45.0  45.1  44.5  45    531500     26.5
6 SPY    1993-02-05  45.0  45.1  44.7  45.0  492100     26.5
```

The above figure shows the open, high low, close, volume and adjusted amount of the SPY index. The date from monthly stock of can be merged with spy_data daily the amount can be obtained for a particular date every month.

```
> spy_stocks <- c("SPY") %>%
+   tq_get(get = "stock.prices",
+          from = "1990-01-01",
+          to = "2021-05-07") %>%
+   group_by(symbol) %>%
+   tq_transmute(select = adjusted,
+                mutate_fun = periodReturn,
+                period = "monthly",col_rename = "SPY_return")
> save = 0
> balance = 0
> adjusted =0
> ret =0
>
> spy_data_return <- as_tibble(merge(spy_data, spy_stocks, by.spy_data = 'date', by.spy_stocks = 'date'))
> head(spy_data_return)
# A tibble: 6 x 9
  symbol date        open  high   low close  volume adjusted SPY_return
  <chr>  <date>     <dbl> <dbl> <dbl> <dbl>   <dbl>    <dbl>      <dbl>
1 SPY    1993-01-29  44.0  44.0  43.8  43.9 1003200     25.9    0
2 SPY    1993-02-26  44.4  44.4  44.2  44.4   66200     26.2    0.0107
3 SPY    1993-03-31  45.3  45.5  45.2  45.2  111600     26.7    0.0224
4 SPY    1993-04-30  44.1  44.3  44.0  44.0   88500     26.1   -0.0256
5 SPY    1993-05-28  45.4  45.4  45    45.2   79100     26.8    0.0270
6 SPY    1993-06-30  45.1  45.2  45    45.1  437600     26.9    0.00361
```

The spy_data_return is the merged table of monthly stock details of SPY company. This include the open,high, close and low details of the closure of the month. On basis of this the stock is bought and sold. Then the adjusted valued is multiplied with the return of the day's stock to get the average of the adjusted stock. If the average of the stock is higher than the return then the stock must be bought. If the balance is zero, then the saving is added with the adjusted value less than the time of investment. If the balance is not zero, it is considered instead of investment. And if the stock value is less than the return, then the stock is sold.

```
n <- nrow(spy_data_return)

for(i in 2:n){
  ret <- ret + spy_data_return$SPY_return[i]
  adjusted <-  spy_data_return$adjusted[i] + ret
  if(adjusted > ret){
    if (balance == 0){
      save = save + (1000 / adjusted)}
    else{
      save = save + (balance / adjusted)
      balance = 0
    }}
  else if(adjusted < return) {
    balance = balance + 1000
    if (save > 0){
      selling = 1000 / adjusted
      save = save - selling
      if (save < 0) {
        save = 0 }
      balance = balance + (adjusted * selling)
    }}
  if (i %% 12 == 0){

    spy_data_return[i,"Strategy2_return"] <- (balance + (save * adjusted)  - 1000 * i)
  }
}
```

The spy_stock_return2 is the table with the return every year from the investment made by buying and selling stocks.

```
> gain = (balance + (save * adjusted) - 1000 * n)
>
> print(paste("Savings made by buying the total amount of ", save, "stocks "))
[1] "Savings made by buying the total amount of  4186.62616283437 stocks "
> print(paste("Profit made by buying stocks only when the market is up in SPY", gain))
[1] "Profit made by buying stocks only when the market is up in SPY 1426471.8771253"
> |
```

The final saving in the account with initial investment is 4123.32 and the profit made by buying stocks is $1426471.877.

Now we analyze the two different strategies:

```
analysis <- cbind(spy_stocks_return1[,'Strategy1_return'], spy_stocks_return2[,c('Strategy2_return','date')])

ggplot(analysis)+ xlab('Date')+ylab ('Strategies_return')+
  geom_line(mapping = aes(x = date,y = Strategy1_return ), col = "red") +
  geom_point(mapping = aes(x = date, y = Strategy2_return), col = "green")

getSymbols("SPY")
chartSeries(SPY, from = "1990-01-01", to = "2020-04-30")
addMACD(type = "EMA")
addBBands()
```

Here we see that the difference in amount from two different strategy is 1426471.877 - 1449837.615 = -23365.74. This calculation implies that buying stock on average disregarding the price is better. Thus Strategy 1 should be implemented for long term investment. The assumption here is that the stock market grows on average and thus the return of each year is being invested again thus resulting in compound interest. However, if the stock market were to decrease in average over long term instead of increasing than Strategy 2 would be beneficial.