

# 財務分析-Final Project

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## I. Motivation

It is definitely a knowledge for all of the investors that it's a most to do a portfolio to diversify risks. However, as a student, we do not have enough capital to purchase large stocks as those senior investors. Hence, we want to choose some low-price level stock to perform a portfolio. In addition, we have learned various strategies in class. These strategies will be applied to test whether the strategy will be a good fit to the portfolio we have or not.

## II. Data Explanation

### i. Input Data

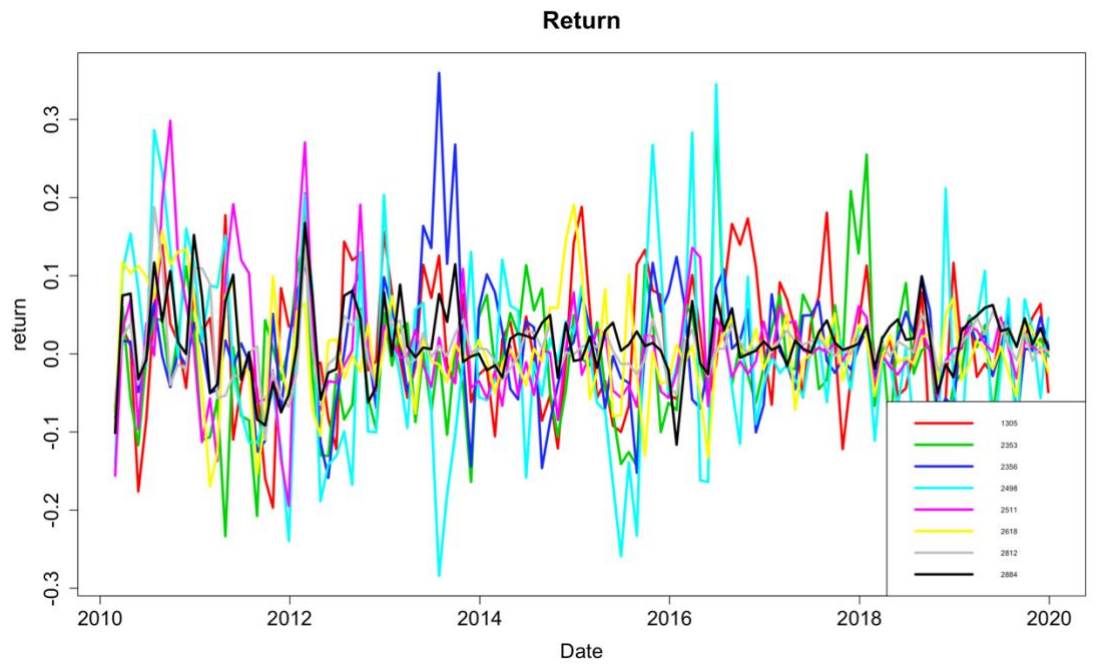
In this project, we chose eight stocks to perform some portfolio strategies, all of them were download from Yahoo Finance in daily frequency from 2010/01/01 to 2019/12/31. They are listed as below.

1. China General Plastics Corporation (1305.TW)
2. Acer Incorporated (2353.TW)
3. Inventec Corporation (2356.TW)
4. HTC Corporation (2498.TW)
5. Prince Housing & Development Corp. (2511.TW)
6. EVA Airways Corp. (2618.TW)
7. Taichung Commercial Bank Co., Ltd. (2812.TW)
8. E.SUN Financial Holding Company, Ltd. (2884.TW)

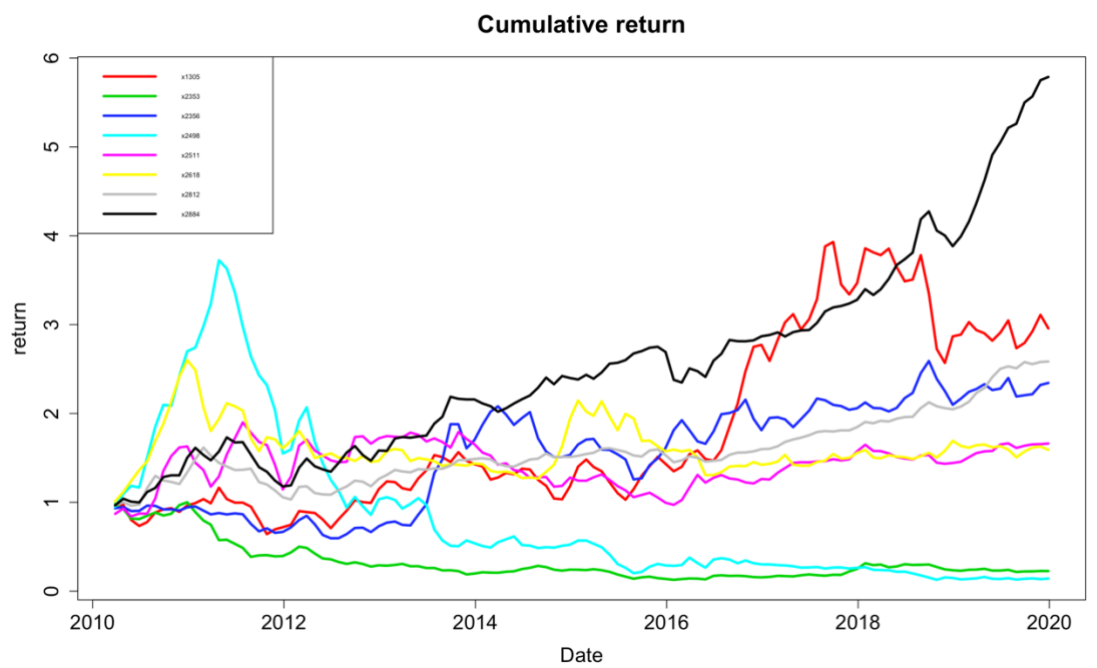
The reason we chose these stocks was trying to use limited budget (not buying high price level stock) while buying as diverse the industries are as we could. Here, we have five different industries and all of the eight stocks' prices are generally cheaper than others in their own industries.

### ii. Return of Stocks

For the return of each stock, we used monthly return to perform all of the portfolio strategies we are going to use. Since the sample period is from 2010/01/01 to 2019/12/31, there is 119 return data in total.



(Return of Each Stock)



(Cumulative Return of Each Stock)

### III. Summary of Data

> summary\_por

	Min.	1st Qu.	Median	Mean	3rd Qu.	Max.	Var	Std.	Skewness	Kurtosis	ACF1
x1305	-0.197	-0.049	0.008	0.016	0.080	0.205	0.008	0.090	0.034	-0.533	0.329
x2353	-0.233	-0.074	-0.018	-0.019	0.041	0.298	0.007	0.083	0.388	1.716	0.183
x2356	-0.159	-0.047	0.007	0.011	0.059	0.360	0.008	0.087	0.857	2.734	0.403
x2498	-0.284	-0.100	-0.015	-0.006	0.083	0.345	0.017	0.132	0.343	-0.111	0.295
x2511	-0.195	-0.047	-0.005	0.006	0.038	0.298	0.007	0.086	0.950	1.881	0.338
x2618	-0.170	-0.035	-0.002	0.007	0.059	0.191	0.005	0.074	0.076	-0.041	0.404
x2812	-0.110	-0.019	0.004	0.007	0.027	0.188	0.002	0.047	1.097	3.016	0.282
x2884	-0.116	-0.019	0.008	0.014	0.044	0.167	0.003	0.055	0.278	0.364	0.186

As the table above showed, Acer and HTC both have negative mean return. Furthermore, HTC is the most risky one and the safest one is TCB. About skewness, all of them are positive skewness, which shows they don't tend to have high return often. Last, only CGPC, HTC and EVA Airways are platykurtic shows that these three stocks are more likely to have shrinkage in return.

### IV. Portfolio Strategy

In this project, we used six different portfolio strategies to fit all of our stocks.

#### i. Buy and Hold

Buy and hold is a long-term passive strategy where investors keep a relatively stable portfolio over time, regardless of short-term fluctuations. Thus, we chose the portfolio in the last period and plot its weight of each asset.

#### ii. Fixed-Weighted

A fixed-weighted is a strategy that the portfolio weights are set manually by personal preference. In this project, we gave each stock same weight as others, 0.125 for each.

#### iii. Global Mean-Variance Portfolio

Global mean-variance portfolio tries to find an optimal solution for all possible portfolios. Since this strategy will find the 'global' mean-variance portfolio, there is no need to set any expected portfolio return. What we did was let R help us to find the optimal solution.

#### iv. Mean-Variance Portfolio

Mean-variance portfolio is similar to global mean-variance portfolio; however, it only looks in the area that has higher return than the expected return. In this project, we set target return as 0.01 and trying to find an optimal portfolio to fit this constraint.

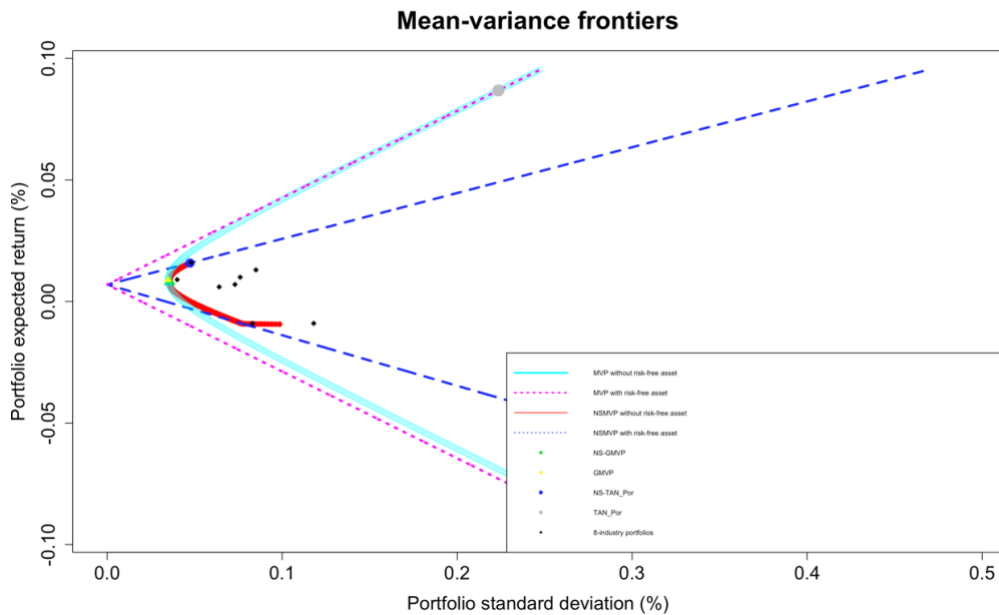
#### v. Tangency Portfolio

The ratio 'Expected Return/Risks' called Sharpe Ratio. Tangency portfolio is a portfolio with maximized Sharpe ratio. We chose the point

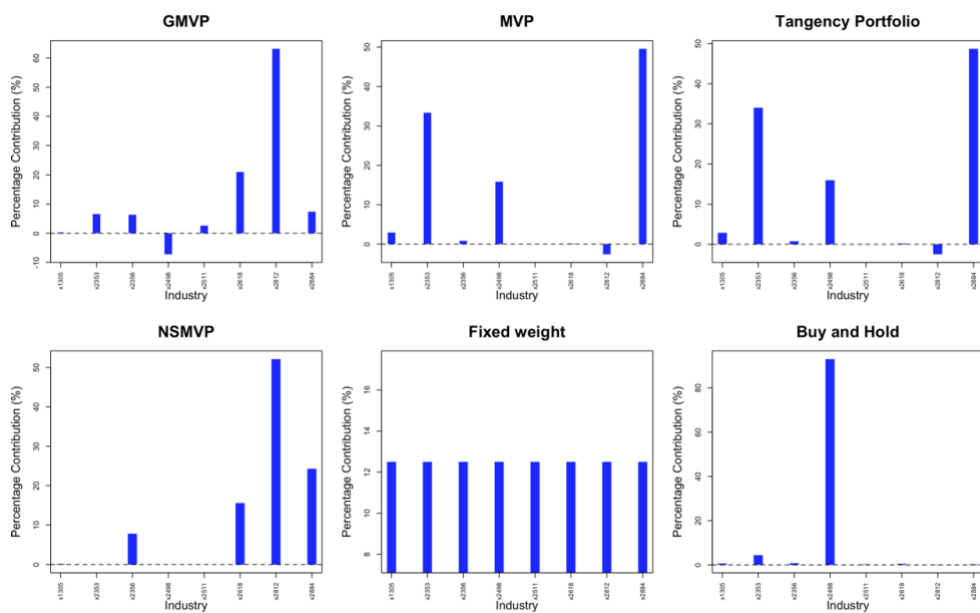
that Capital Allocation Line and the efficient frontier intersect, which is the most efficient portfolio.

#### vi. No Short-Sale Mean-Variance Portfolio

No short-sale mean-variance portfolio is one kind of mean-variance portfolio while NSMVP does not allow investor to sell any stock in a short term. In this project, not only did we set expected portfolio return as 0.01 just like MVP but also added a no short-sale constraint to find the optimal portfolio.



(Mean-Variance Frontiers)



(Assets Weight of Each Stock)<sup>1</sup>

<sup>1</sup> Note that we only plotted weight of last period for Buy-and-Hold here. Not the mean weight.

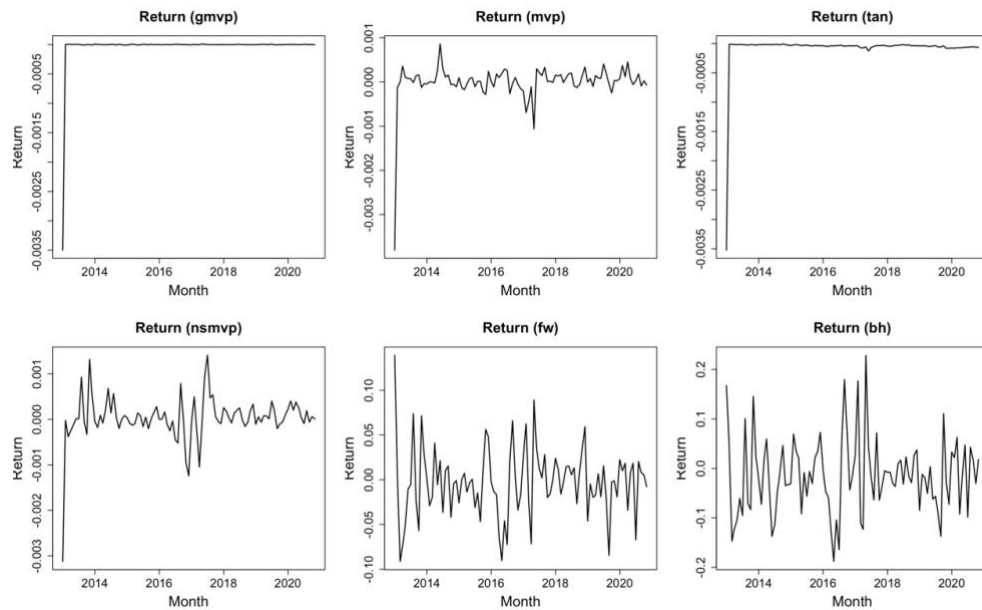
## V. Out-of-Sample

After choosing portfolio strategy, we used dataset from 2010/01/01 to 2019/12/31, ten years in total, to fit out-of-sample and try to compare each strategy's performance. Moreover, the rolling window length was set as 24, 24 months in two years. Thirdly, we set risk-free return and expected portfolio return equal to 0.0069% and 0.01% respectively. Last, we added one more parameter here, such as transaction cost, which is equaled to 0.0035. After all the presetting, we used all those six strategies discussed above to calculate the Out-of-Sample return and other index, like turnover rate, Sharp Ratio, HHI and SLR.

### i. Net Return

```
> ##some summary statistics for net portfolio returns
> c(summary(por_netrx_gmvp), sd(por_netrx_gmvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
-3.498786e-03 -1.600593e-06  8.886289e-07 -3.612724e-05  3.134807e-06  1.026472e-05  3.590581e-04
> c(summary(por_netrx_mvvp), sd(por_netrx_mvvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
-3.804205e-03 -5.981546e-05  2.816729e-05 -3.709302e-06  1.500700e-04  8.590801e-04  4.548143e-04
> c(summary(por_netrx_tan), sd(por_netrx_tan))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
-3.522102e-03 -4.914927e-05 -3.855222e-05 -7.668896e-05 -2.462326e-05 -8.442434e-06  3.578306e-04
> c(summary(por_netrx_nsmvp), sd(por_netrx_nsmvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
-3.121414e-03 -9.399198e-05  1.405068e-05  3.002167e-05  1.933248e-04  1.409173e-03  5.032405e-04
> c(summary(por_netrx_fw), sd(por_netrx_fw))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
-0.091247874 -0.020917982 -0.001325743 -0.002898518  0.015342765  0.139060274  0.038635114
> c(summary(por_netrx_bh), sd(por_netrx_bh))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
-0.18800880 -0.06298720 -0.01908282 -0.01492301  0.02652457  0.22868493  0.07678185
```

Surprisingly, the net return for all these portfolios were pretty bad. Most of their mean return were negative, which was not glad to been found honestly. However, there is still some acceptable results. In NSMVP, despite its mean return was close to zero, the mean return of NSMVP was still positive. Also, most of the third quartile return of each strategies were positive.



## ii. Turnover Rate

```
> ##turnover rate
> c(summary(tor_gmvp),sd(tor_gmvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
3.754790e-06 2.111374e-05 3.154691e-05 1.056909e-02 5.429672e-05 1.000215e+00 1.026157e-01
> c(summary(tor_mvp),sd(tor_mvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
0.0005999043 0.0015349154 0.0023076208 0.0140425326 0.0038935916 1.0068774324 0.1030309636
> c(summary(tor_tan),sd(tor_tan))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
0.004022986 0.007270006 0.010994594 0.022158069 0.014143701 1.006877432 0.102271998
> c(summary(tor_nsmvp),sd(tor_nsmvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
0.0005163505 0.0012835104 0.0023551760 0.0149669945 0.0039635420 1.0000000000 0.1023587712
> c(summary(tor_fw),sd(tor_fw))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
1.00687743 1.74022799 1.74695371 1.73827145 1.75141128 1.78154150 0.07652805
> c(summary(tor_bh),sd(tor_bh))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
1.00000000 1.81419134 1.82422288 1.81334891 1.83208824 1.85787452 0.08575876
```

Turnover rate represents the percentage of assets in a portfolio changed during the past period. The strategy with high turnover rate means it is more aggressive and easy to increase expenses, such as transaction fee and management fee, which might reduce overall performance. As the result showed, Fixed-Weight and Buy-and-Hold are kind of high turnovers strategies, which requires more attention on its performance compared to other strategies.

### iii. Sharp Ratio

```
> ##Annualized Sharpe ratio, annualized interest rate 1%
> rfx<-0.01/12
> (mean(por_netrx_gmvp)-rfx)/(sd(por_netrx_gmvp))*sqrt((12))
[1] -8.388336
> (mean(por_netrx_mvvp)-rfx)/(sd(por_netrx_mvvp))*sqrt((12))
[1] -6.375351
> (mean(por_netrx_tan)-rfx)/(sd(por_netrx_tan))*sqrt((12))
[1] -8.809783
> (mean(por_netrx_nsmvp)-rfx)/(sd(por_netrx_nsmvp))*sqrt((12))
[1] -5.529669
> (mean(por_netrx_fw)-rfx)/(sd(por_netrx_fw))*sqrt((12))
[1] -0.3346052
> (mean(por_netrx_bh)-rfx)/(sd(por_netrx_bh))*sqrt((12))
[1] -0.7108656
```

Sharp Ratio measures the performance of an investment compared to a risk-free asset, after adjusting for its risk. It represents the additional amount of return that an investor receives per unit of increase in risk, the higher the better. Thus, all strategies we did have negative Sharp ratio, which means all of them have high levels of risk.

### iv. HHI

```
> ##HHI index
> c(summary(hhi_gmvp),sd(hhi_gmvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
0.9992980372 0.9996297670 0.9997083978 0.9996837827 0.9997697404 0.9998286718 0.0001066349
> c(summary(hhi_mvvp),sd(hhi_mvvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
0.950292927 0.978352149 0.983212008 0.982199659 0.988727784 0.993058737 0.007901671
> c(summary(hhi_tan),sd(hhi_tan))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
0.9992978428 0.9996297972 0.9997083788 0.9996837340 0.9997696875 0.9998286064 0.0001066374
> c(summary(hhi_nsmvp),sd(hhi_nsmvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
0.93546802 0.98345327 0.98661372 0.98474318 0.99175740 0.99545159 0.01120157
> c(summary(hhi_fw),sd(hhi_fw))
      Min. 1st Qu.  Median  Mean 3rd Qu.  Max.
0.125 0.125 0.125 0.125 0.125 0.125 0.000
> c(summary(hhi_bh),sd(hhi_bh))
      Min. 1st Qu.  Median  Mean 3rd Qu.  Max.
0.4115011 0.4115011 0.4115011 0.4115011 0.4115011 0.4115011 0.0000000
```

As we can see from the result, exclude Fixed-Weight and Buy-and-Hold, all other strategies were highly unbalanced in weights. Their HHI were all closed to 1, which was not an ideal result to fit our expectation.

v. SLR

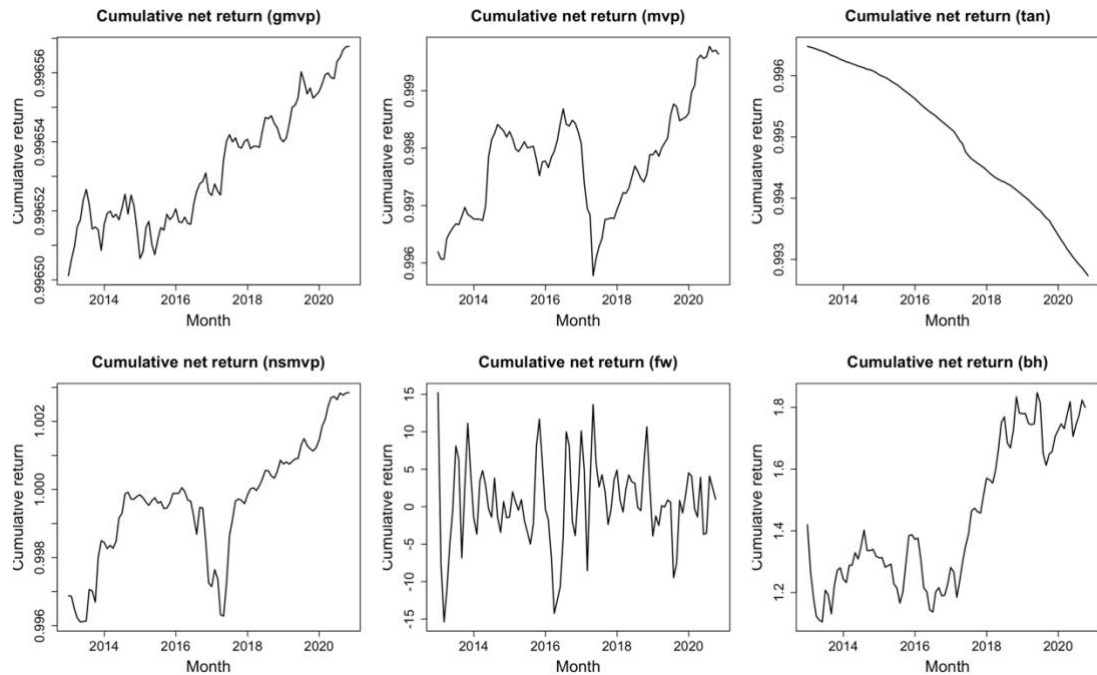
```
> ##SLR
> c(summary(slr_gmvp),sd(slr_gmvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
6.640689e-05 9.837140e-05 1.127625e-04 1.187737e-04 1.321901e-04 2.300853e-04 3.291558e-05
> c(summary(slr_mvvp),sd(slr_mvvp))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
0.001155606 0.002518629 0.003168608 0.003424723 0.004436876 0.006701635 0.001351680
> c(summary(slr_tan),sd(slr_tan))
      Min.      1st Qu.      Median      Mean      3rd Qu.      Max.
6.642071e-05 9.837255e-05 1.127606e-04 1.187910e-04 1.322262e-04 2.301408e-04 3.291718e-05
> c(summary(slr_nsmvp),sd(slr_nsmvp))
      Min. 1st Qu.  Median  Mean 3rd Qu.  Max.
      0      0      0      0      0      0
> c(summary(slr_fw),sd(slr_fw))
      Min. 1st Qu.  Median  Mean 3rd Qu.  Max.
      0      0      0      0      0      0
> c(summary(slr_bh),sd(slr_bh))
      Min. 1st Qu.  Median  Mean 3rd Qu.  Max.
      0      0      0      0      0      0
```

For SLR, since Buy-and-Hold, Fixed-Weight and NSMVP do not allow short sale, their SLR will be always equal to 0. Hence, we will not discuss these two strategies here. Subsequently, the result told us that all of the other four strategies' SLR were also closed to 0, which mean that these portfolios had a better value in the long run than in the short run.

## VI. Conclusion

As all the performance showed before, with six strategies' SLR were all closed to zero. No matter which strategy is using by the investor, we suggest that investors should hold the stocks for long-time period. Moreover, for Fixed-Weight and Buy-and-Hold, they both have high turnover rate, which means they are aggressive strategy, so we should track whether their performances keep outnumbering their expenses. In this case, these two strategies' returns were not much ideal. Hence, Fixed-Weight and Buy-and-Hold will not be a good fit to the portfolio. Additionally, NSMVP is more like a conservative strategy, while its returns is positive but not huge. Our suggestion will be that investors could be more aggressive while using this strategy to get more return. Nevertheless, we are not saying that NSMVP is the best strategy here, like what we have said in the part of HHI, only Fixed-Weight and Buy-and-Hold are equally-weighted. NSMVP was highly-relied on TCB which still had a problem that was not well diversify the risk. To summarize, we tend to suggest NSMVP if investors could accept the unbalanced weighted portfolio but it will give back a positive return with investing conservative.





(Out-of-Sample Cumulative Return for Each Strategy)

## VII. Future Work

Like what we talked about in Out-of-Sample net return, the return were little disappointed. We thought the reason for this bad result was the stocks we chose were not good enough. For example, HTC Corporation (2498.TW) was not considered as 'healthy' stock by many investors in the stock market. And it did not perform well in return and cumulative return. Consequently, it might be better to replace some stocks with better choices.