ETFS AND PORTFOLIOS ANALYSIS

ROGER WEN

2020-08-03

BACKGROUND

It makes sense that the life insurers focus their attention on managing the risks that they are exposed to. However, a firm holds adequate capital does not means that it has adequate liquidity. Although the liquidity problems among insurers over recent history has been relatively low, but it can not ensure the same in the future. Not enough liquidity could cause terrible outcomes during some special period(such as the financial crisis in 2008), thus, keeping the portfolios at a good liquidity level is of great significance.

THE LIQUIDITY CHALLENGE

SUMMARY

In this presentation, we will first did the asset allocation by constructing typical ETF portfolios with and without rebalancing. We will also applied the efficient frontier to construct special portfolios and find that the portfolios using Efficient Frontier with weight restriction 60:40(Equity: FI) perform better. Other portfolios using efficient frontier but no weight constraint have less drawdown overall and even during the financial crisis in 2008.

Moreover, we also focus on the declining weight proportion in equity. In fact, with the decline weight in Equity, the portfolios will be more stable, however, the return, at the same time, will be lower. All the portfolios with rebalancing are more profitable than those without, and the drawdowns of them are about the same. In the end, we will add in liquidity constraint which makes us to ensure enough liquidity of the portfolios. We find that portfolios with liquidity constraint have similar performance, however, the weight of ETFs in those portfolios do change. We are now able to construct portfolios with higher level of liquidity.

CONTENT

Section 1

- Introduction
- ETFs’ overview and analysis
- Simple portfolio
- Protfolios with efficient frontier
- Comparison and analysis

INTRODUCTION

ETF OVERVIEW AND ANALYSIS

ETF OVERVIEW

10 ETFs are chosen as constituents to the portfolios. Those ETFs are mostly focused on the U.S. and common to the pension industry us to study.

See below for a brief overview

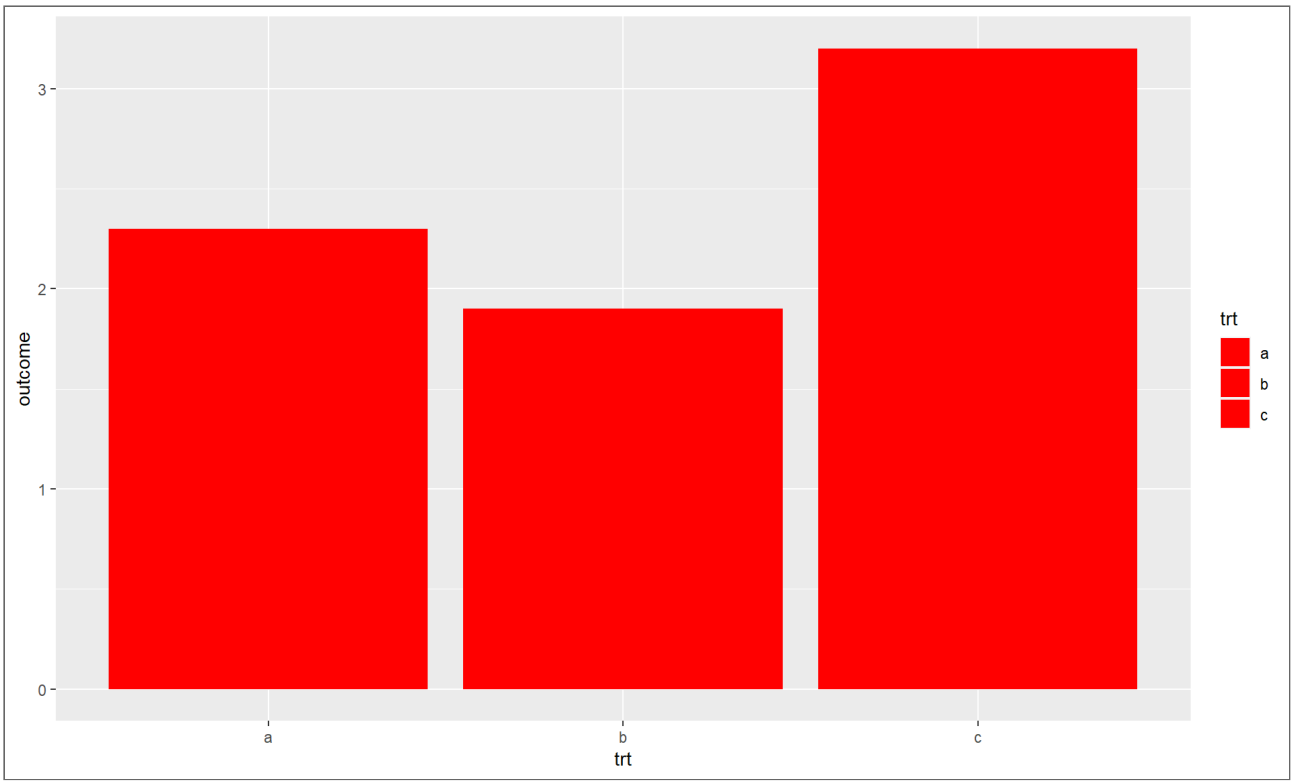
PRICE DATA

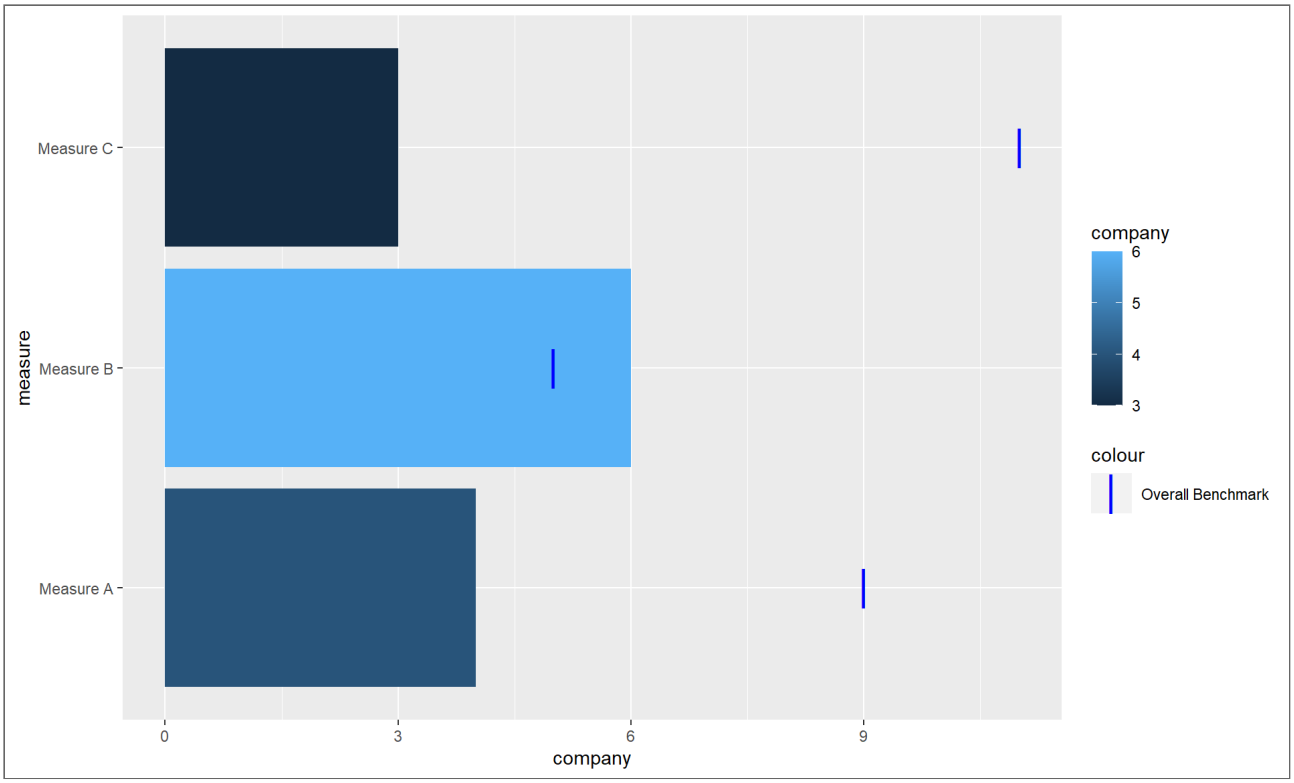
Below is the historical price analysis. Since the backtestings start form 2007, we only focus on the time period from 2007 to 2019.

```
##         Date IVV.Adjusted
## 1 2003-12-31     79.77972
## 2 2004-01-02     79.87296
## 3 2004-01-05     80.65483
## 4 2004-01-06     80.78394
## 5 2004-01-07     81.06374
## 6 2004-01-08     81.35064
```

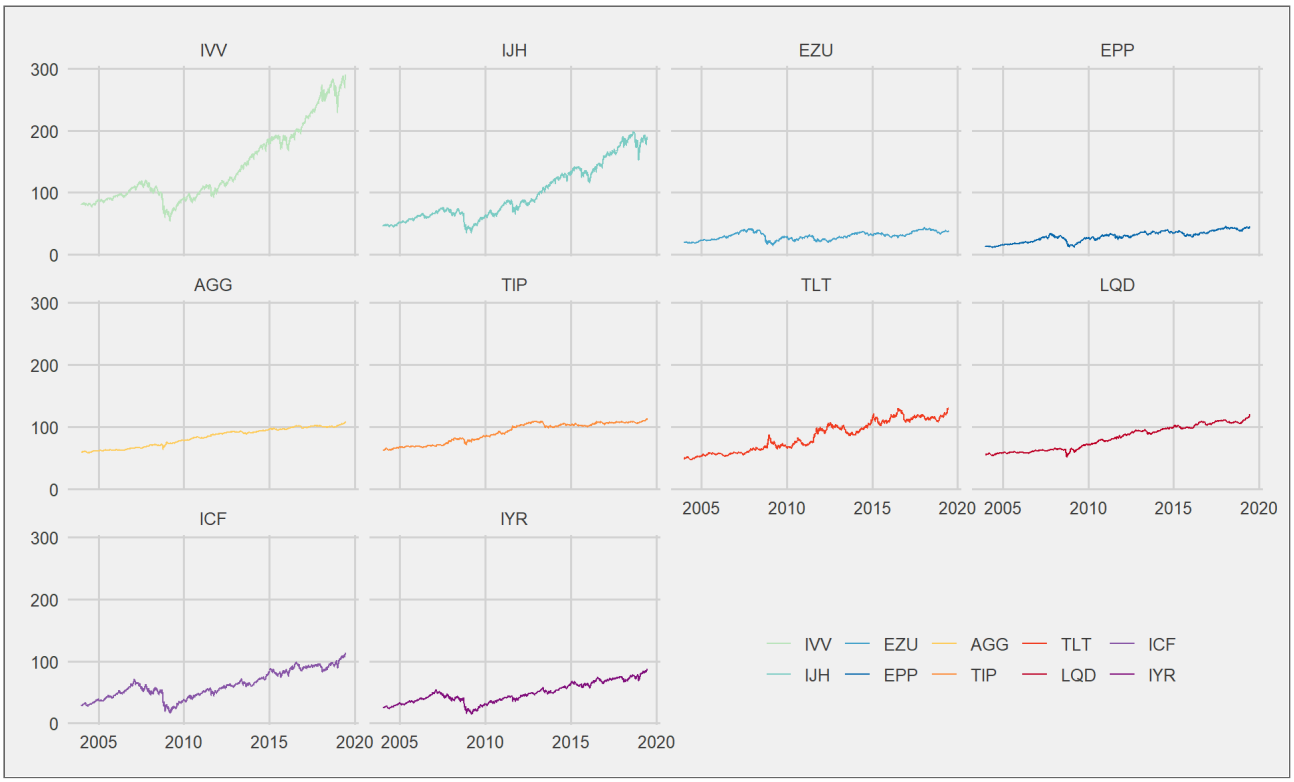
```
##    Convertible Arbitrage  CTA Global Distressed Securities Emerging Mar
## ES             -0.03655 -0.04126429           -0.03669286      -0.0723
##    Event Driven Fixed Income Arbitrage Global Macro Long/Short Equity M
## ES  -0.03856429            -0.02825714  -0.02062857       -0.04220714
##    Relative Value Short Selling Funds of Funds
## ES       -0.02465   -0.09682143    -0.03320714
```

```
## [1] 0.05656878
```



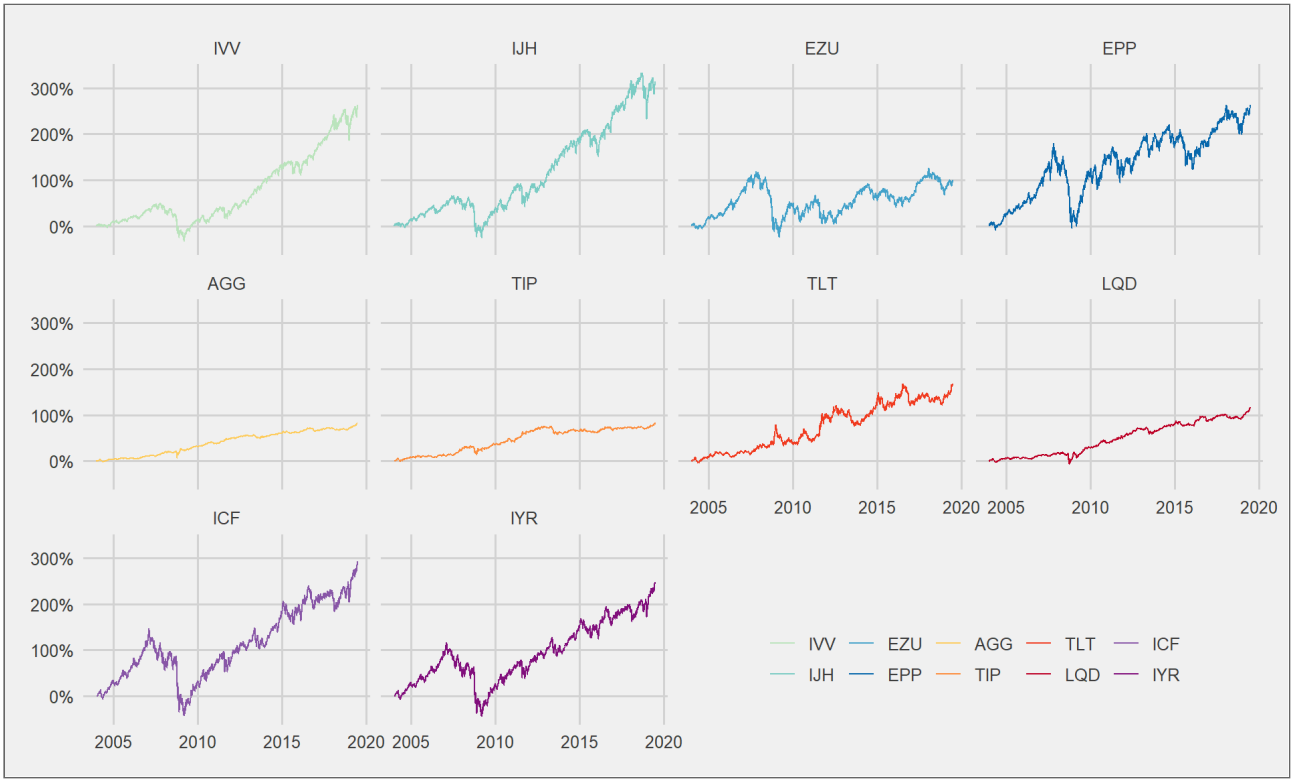


	Asset.1	Asset.2	Asset.3	Asset.4	Asset.5	Asset.6	Asset.7	Asset.8
[1,]	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
[2,]	0.10	0.01	0.01	0.12	0.03	0.01	0.30	0.06
[3,]	0.03	0.02	0.39	0.06	0.03	0.01	0.01	0.36
[4,]	0.04	0.01	0.01	0.02	0.22	0.09	0.01	0.35
[5,]	0.10	0.35	0.02	0.04	0.01	0.30	0.02	0.13
[6,]	0.35	0.01	0.01	0.05	0.02	0.13	0.18	0.21
[7,]	0.04	0.05	0.15	0.23	0.13	0.04	0.03	0.24
[8,]	0.31	0.01	0.36	0.10	0.08	0.08	0.02	0.01
[9,]	0.02	0.01	0.27	0.35	0.04	0.22	0.02	0.03



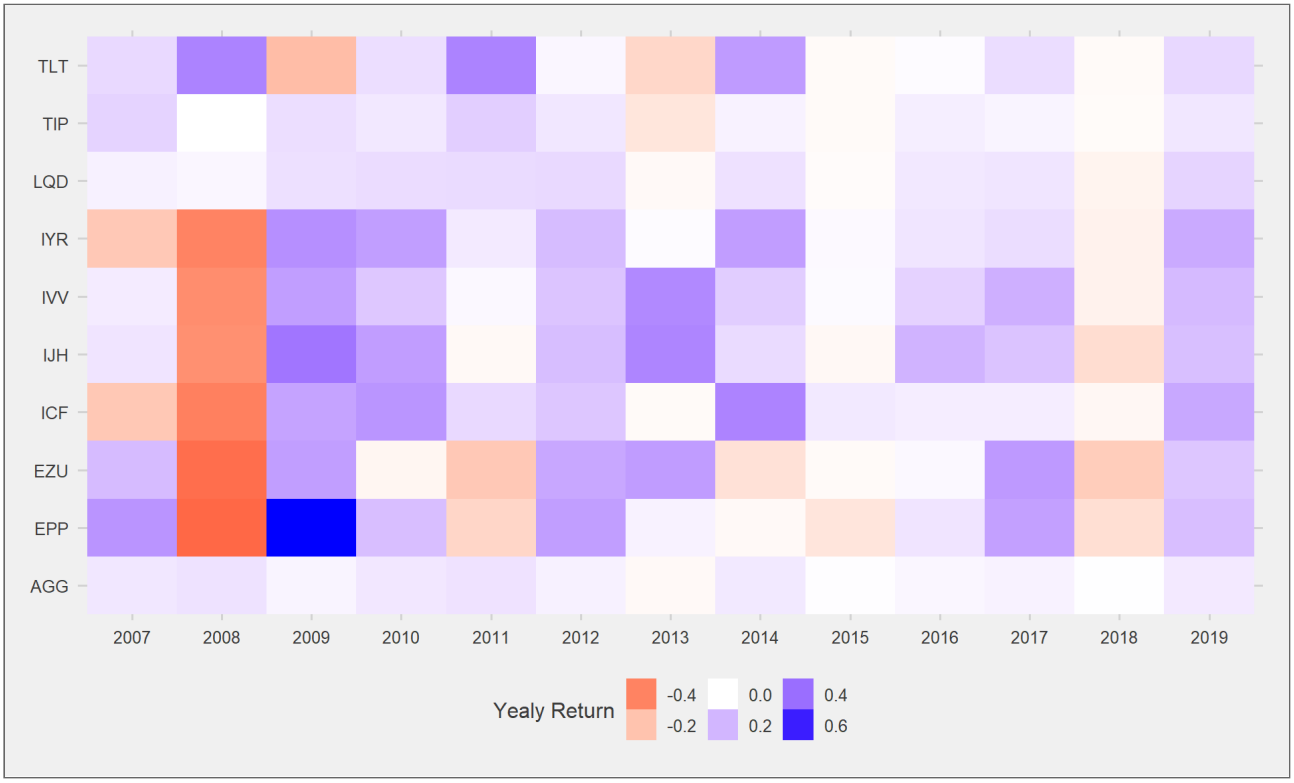
INVESTMENT RETURN FOR INDIVIDUAL ETF

This subsection shows the individual return of every ETF.



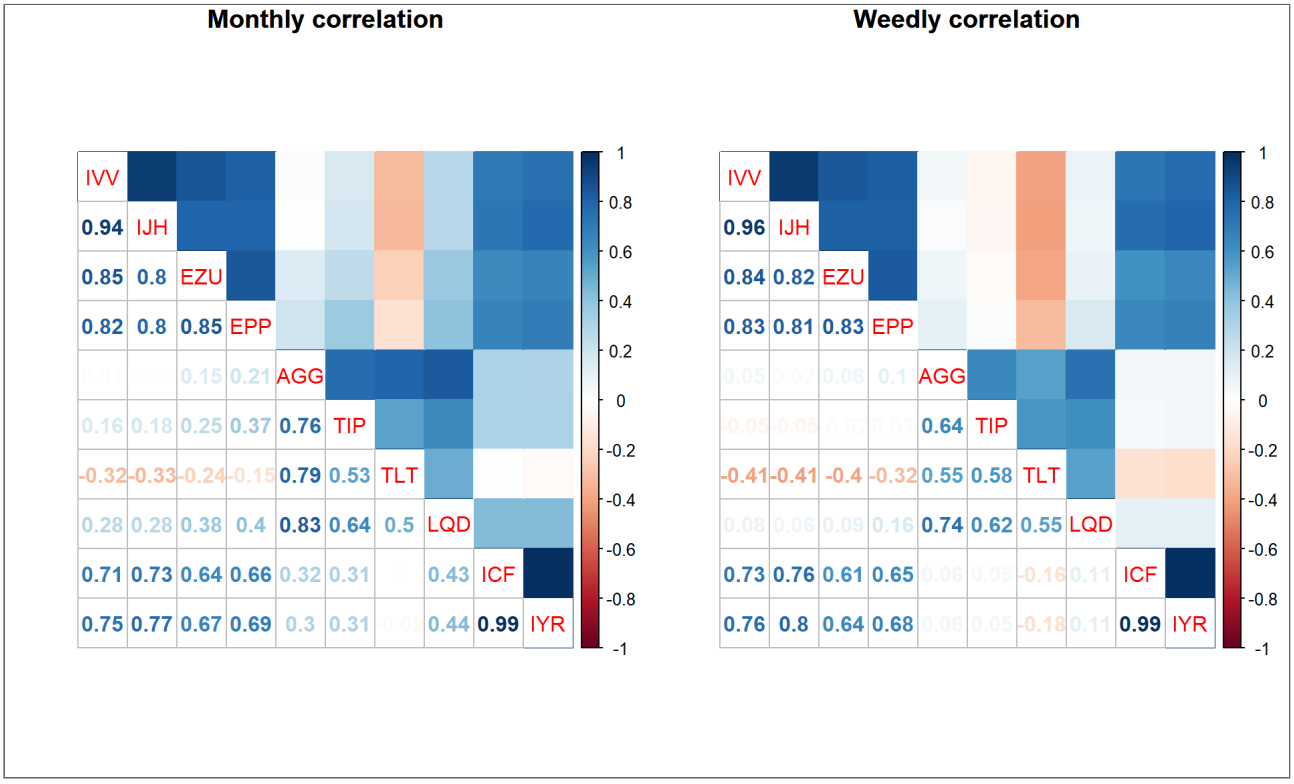
OVERVIEW OF ETFS YEARLY RETURN

Besides, we also want to see the performance during every year. In the heatmap below, blue represents negative yearly return while red stands for the positive.



WEEKLY AND MONTHLY RETURN CORRELATION BETWEEN ETFS

The first chart describes the monthly return correlation and the second is the weekly. From these pictures, we can see some ETFs have high correlation. And the monthly correlation is less extreme than the weekly correlation. When doing the allocation, we need to be cautious about the ETFs that have high correlation and try to lower the total risk



INDIVIDUAL ETF PERFORMANCE: IVV

INDIVIDUAL ETF PERFORMANCE: IJH

INDIVIDUAL ETF PERFORMANCE: ICF

INDIVIDUAL ETF PERFORMANCE: AGG

INDIVIDUAL ETF PERFORMANCE: IYR

INDIVIDUAL ETF PERFORMANCE: TIP

INDIVIDUAL ETF PERFORMANCE: TLT

INDIVIDUAL ETF PERFORMANCE: LQD

INDIVIDUAL ETF PERFORMANCE: EZU

INDIVIDUAL ETF PERFORMANCE: EPP

SIMPLE PORTOFOLIO CONSTRUCTION

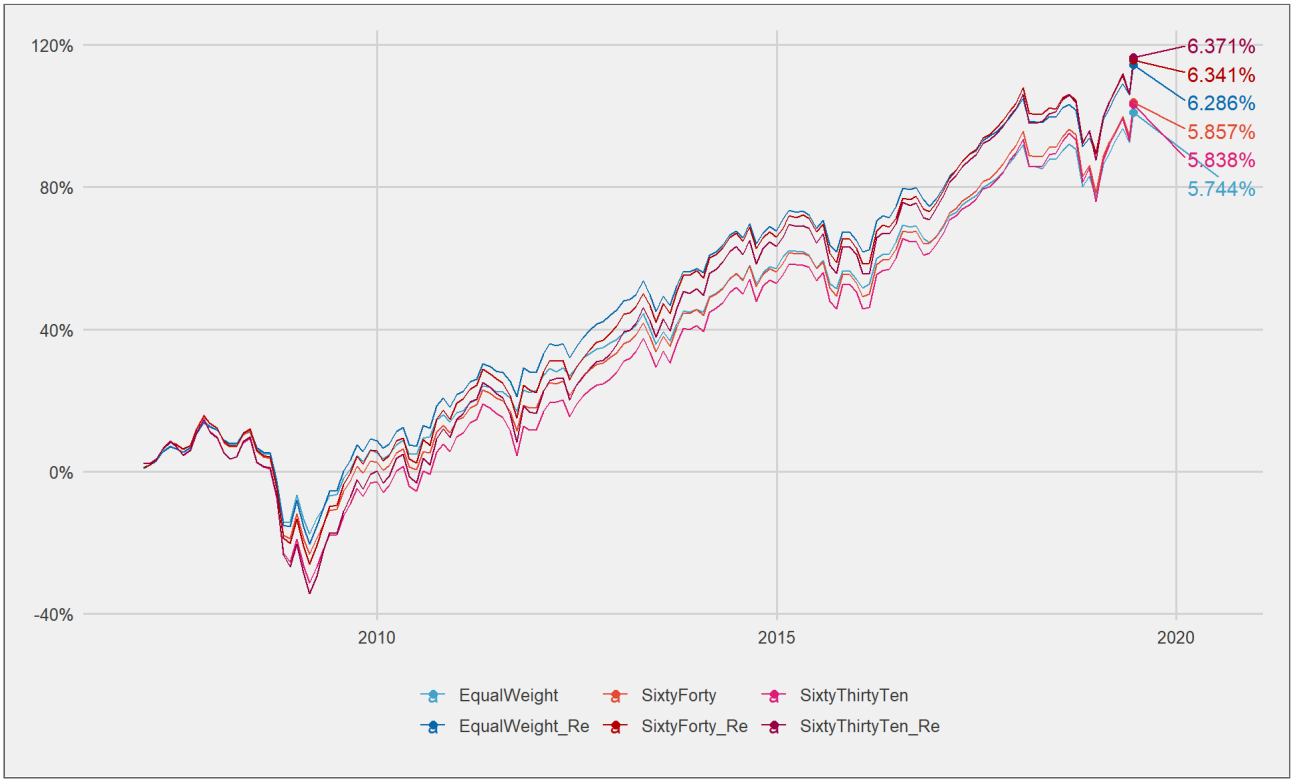
CONSTRUCTION OVERVIEW

We construct the following simple portfolios with and without rebalancing. The weight distribution of Equity and Fixed Income is changed to see whether there is a particular performance pattern when the weight of Equity decreases and the weight of Fixed Income increases. The other group will be rebalanced quarterly.
(The ratio is Equity: Fixed Income: Alternative)

30:70 portfolio 40:60 portfolio, Equal weight portfolio, 60:40 portfolio, 70:30 portfolio, 80:20 portfolio, 60:30:10 portfolio with and without rebalancing

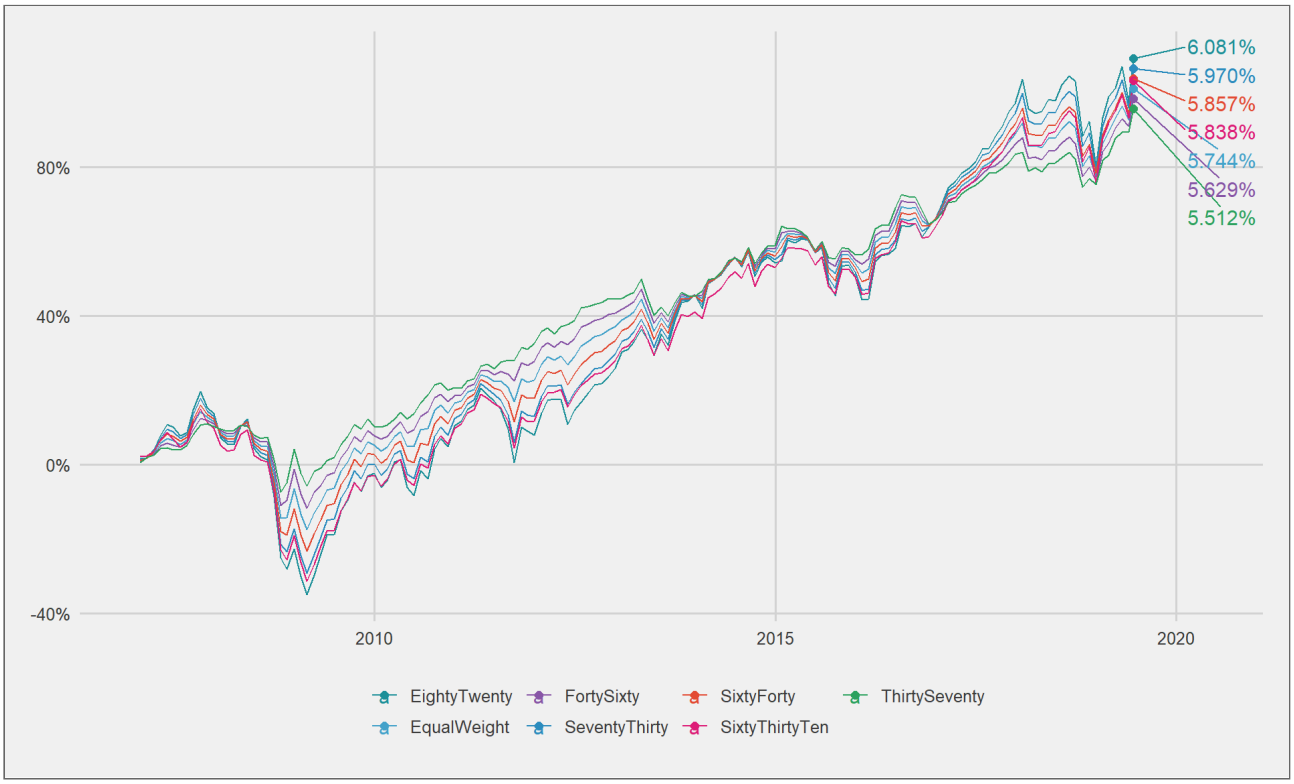
RETURN COMPARISONS FOR 6 COMMON PORTFOLIOS

We first do the comparison between 6 common portfolios, they are respectively: equal weight, 60:40, 60:30:10 portfolios with and without rebalancing. We are able to see that The final returns are similar if the portfolios in the same group. The overall performances of portfolios with rebalancing are better.



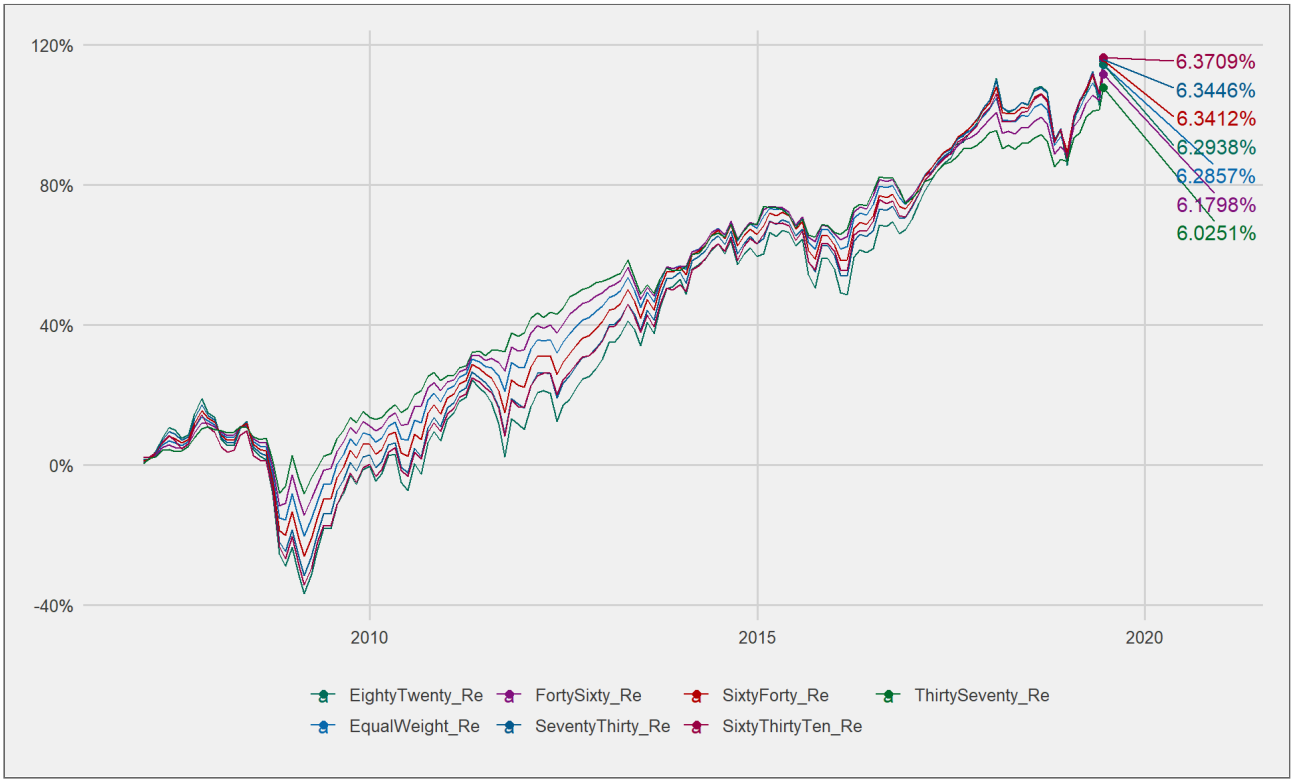
RETURN COMPARISONS FOR DECLINING WEIGHT IN EQUITY (WITHOUT REBALANCING)

Below is the graph where we could see how the returns change if the weight in Equity is declining. The chart shows that with the declining weight in equity, the portfolios become less risky but also less return.



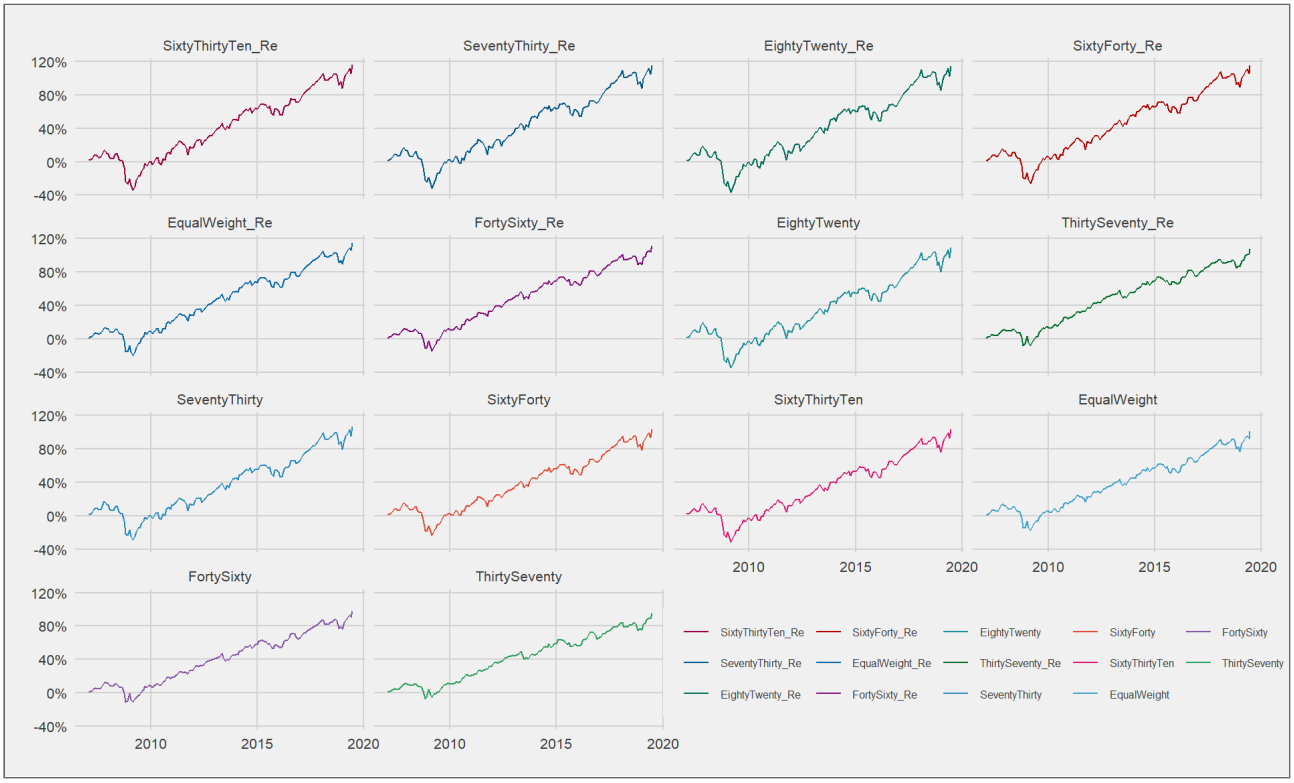
RETURN COMPARISONS FOR DECLINING WEIGHT IN EQUITY (WITH REBALANCING)

Also, we want to check whether the situation is the same among portfolios with rebalancing. It is easy to draw the same conclusion as the non-rebalancing group. But the exception is that the portfolio with weight distribution 60:30:10(Equity:FI:Alternative) performs the best now.



PLOT OF ALL SIMPLE PORTFOLIOS

We put all the portfolios together to see the performance differences between them. The order of the portfolios is arraged by the ranking of their final returns.

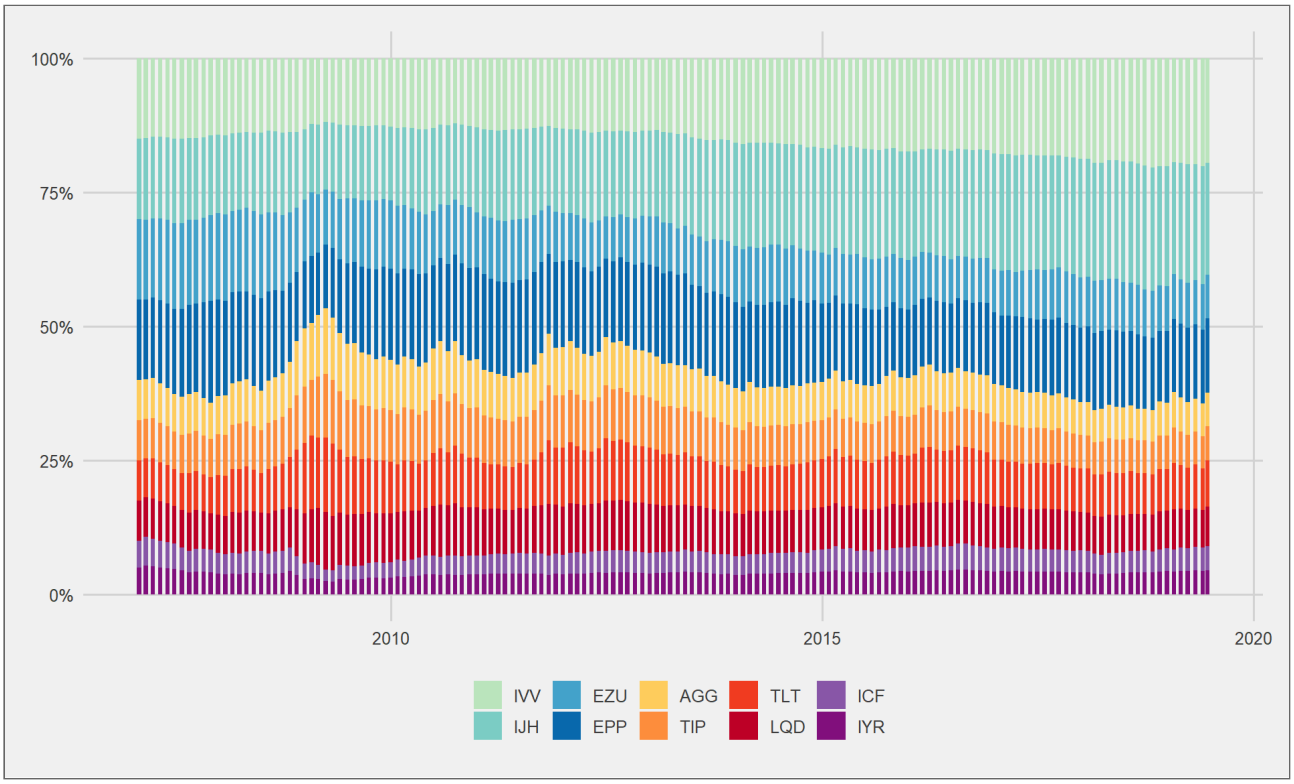


DRAWDOWNS OF NO REBALANCING PORTFOLIOS

The drawdown graphs for no rebalancing portfolios are shown below, we are able to see that during 2008, the portfolios with more Equity drop greater.

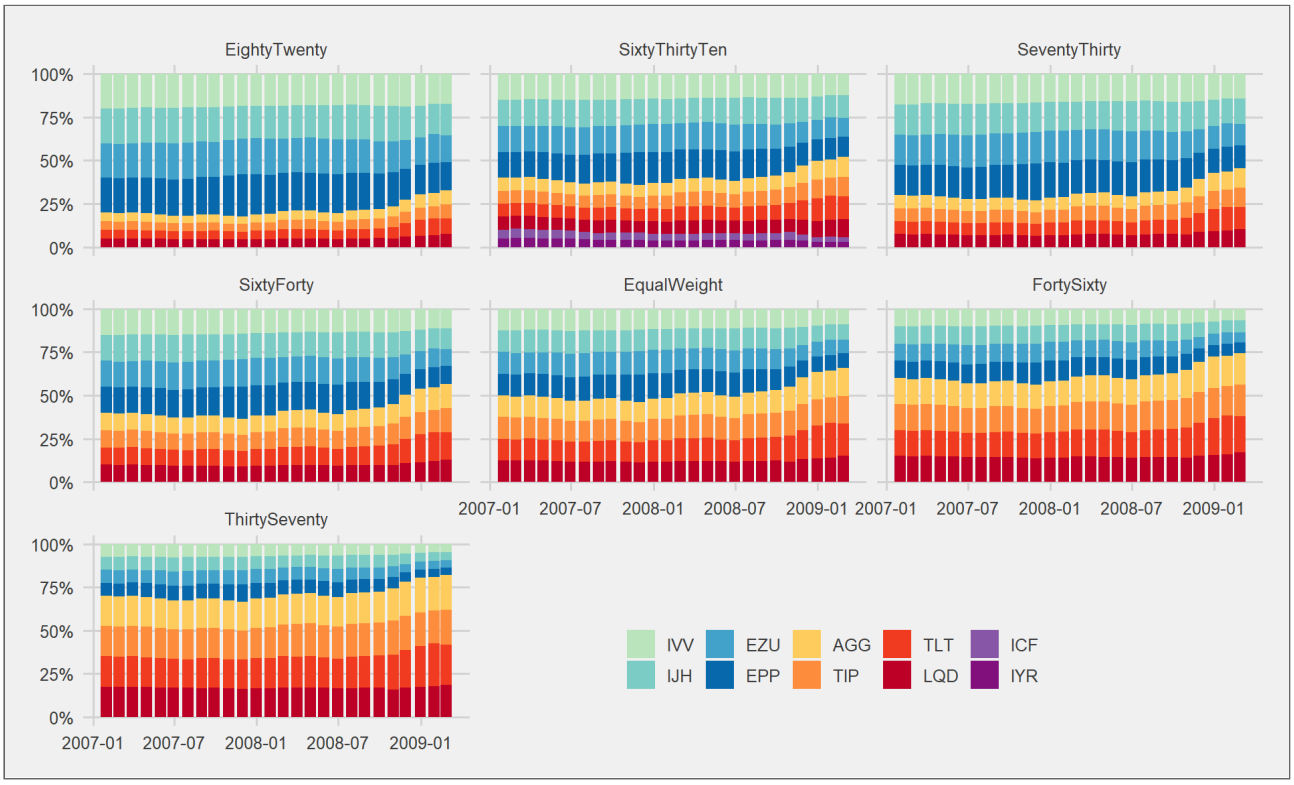
WEIGHT GRAPH OF SIXTY-THIRTY-TEN(WITHOUT REBALANCING)

The following graphs shows the weight of the 60:30:10 portfolio(Equity:FI:Alternative) as an example.



WEIGHT GRAPH OVERVIEW OF ALL NO REBALANCING PORTFOLIOS(2007-2009)

This graph shows the specifically weight allocation between 2007 to 2009, during this period, all the portfolios drop greatly.

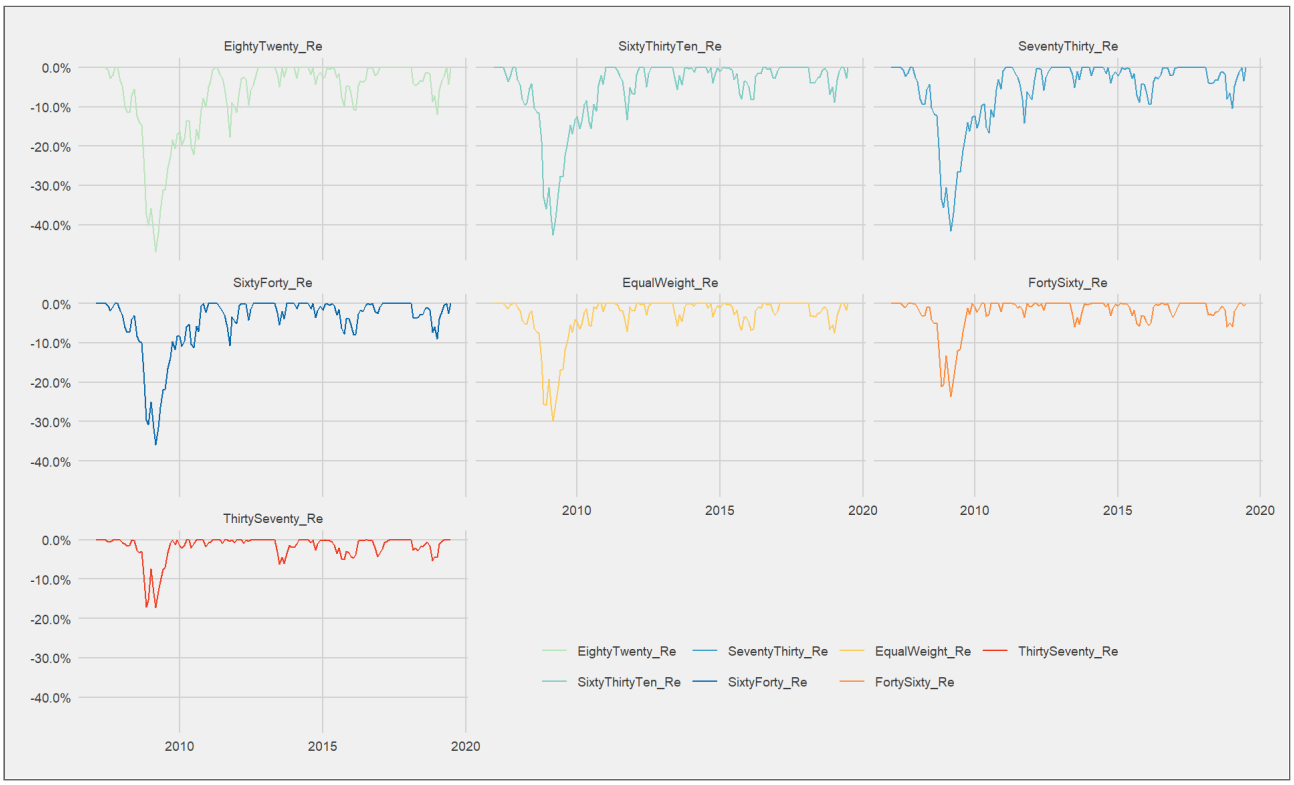


WEIGHT GRAPH OVERVIEW OF ALL NO REBALANCING PORTFOLIOS(2009-2014)

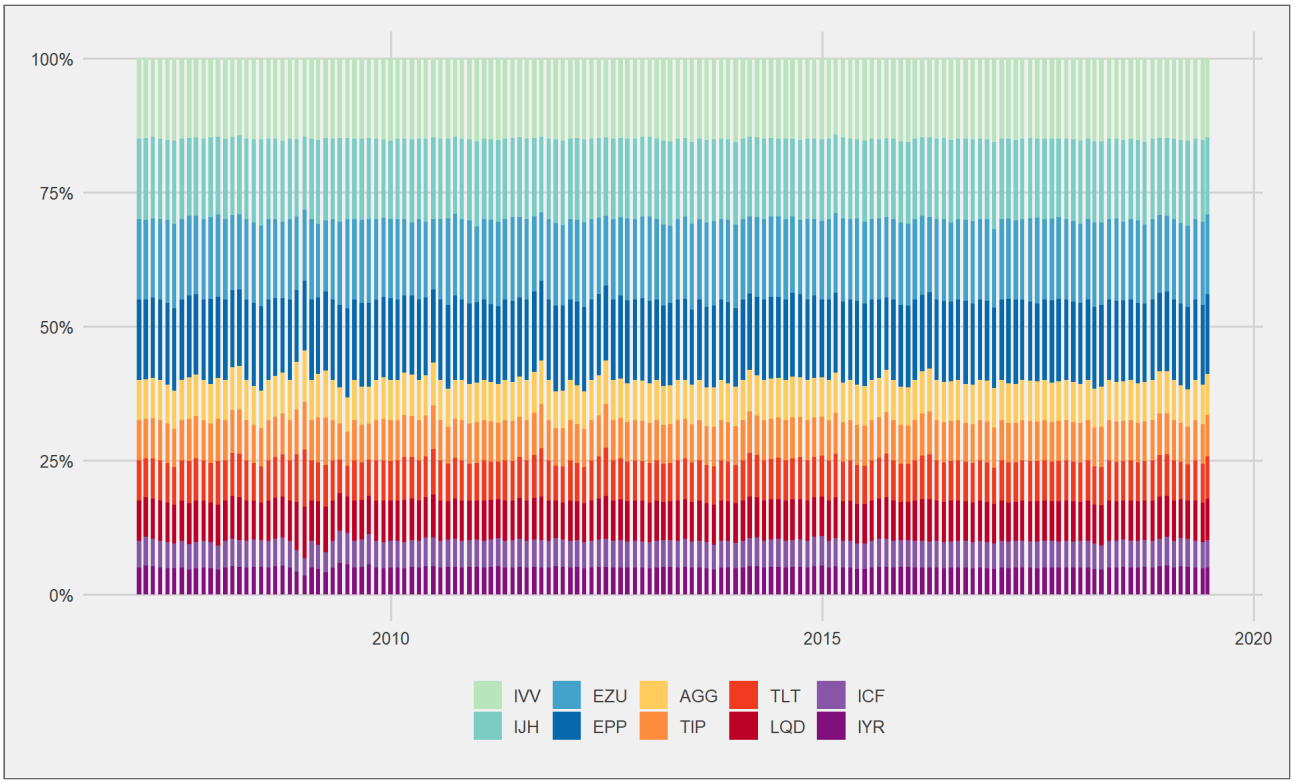
This graph shows the specifically weight allocation between 2009 to 2014, during this period, all the portfolios start to recover. And the final return of all portfolios are close at 2014.

DRAWDOWNS OF REBALACING PORTFOLIOS

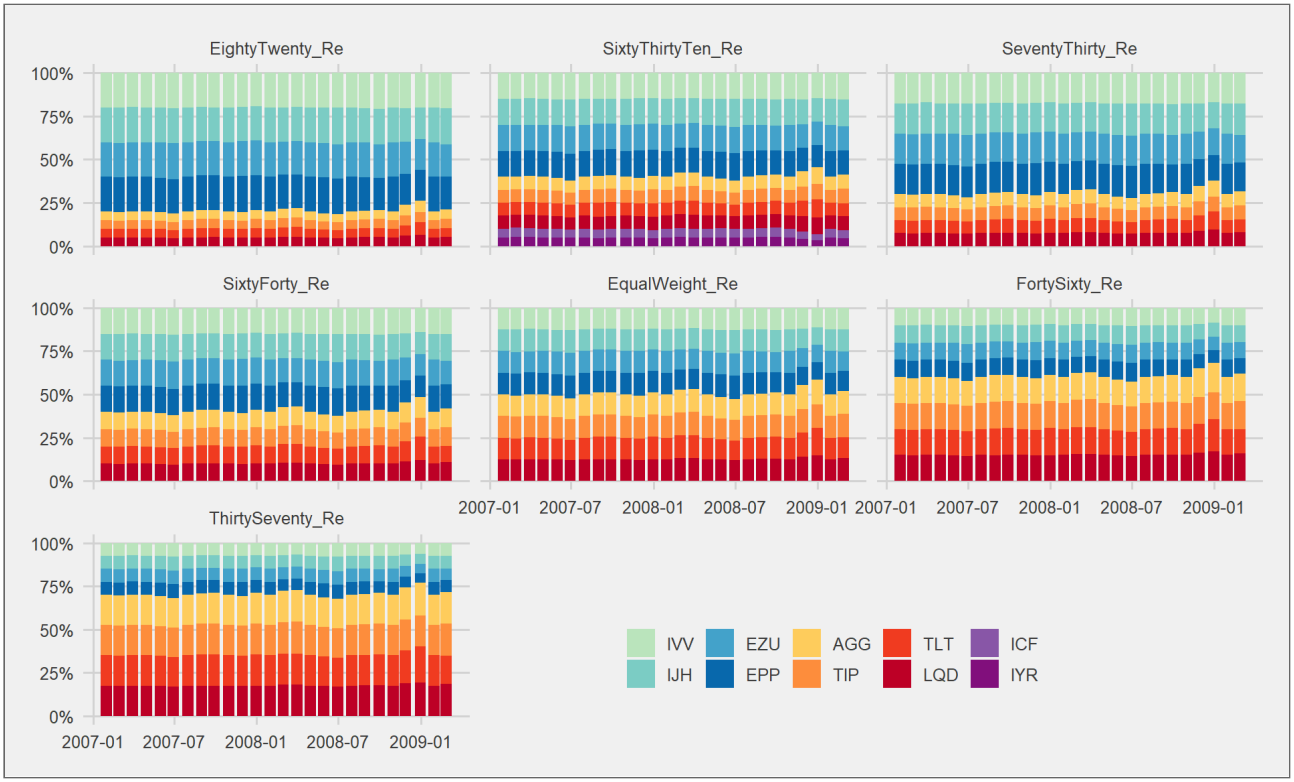
The drawdown graphs for rebalancing portfolios are shown below, we are able to see that during 2008, the portfolios with more Equity also drop greater.



WEIGHT GRAPH OF EIGHTY-TWENTY WITH REBALANCING

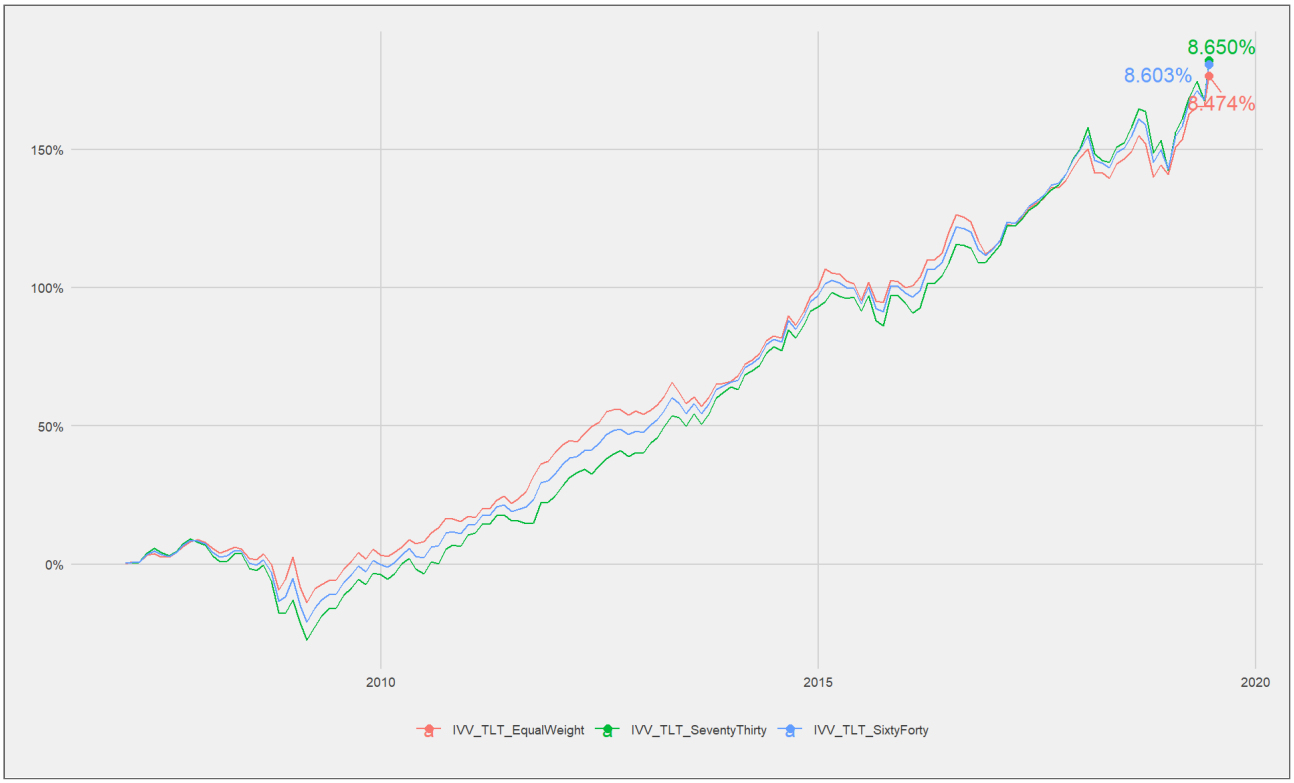


WEIGHT GRAPH OF ALL SIMPLE PORTFOLIOS WITH REBALANCING(2007-2009)



WEIGHT GRAPH OF ALL SIMPLE PORTFOLIOS WITH REBALANCING(2009-2014)

TEST PART(USING ONLY IVV AND TLT)



TEST PART2(USING ONLY IVV AND TLT)

PORTFOLIOS WITH EFFICIENT FRONTIER

SECTION OVERVIEW

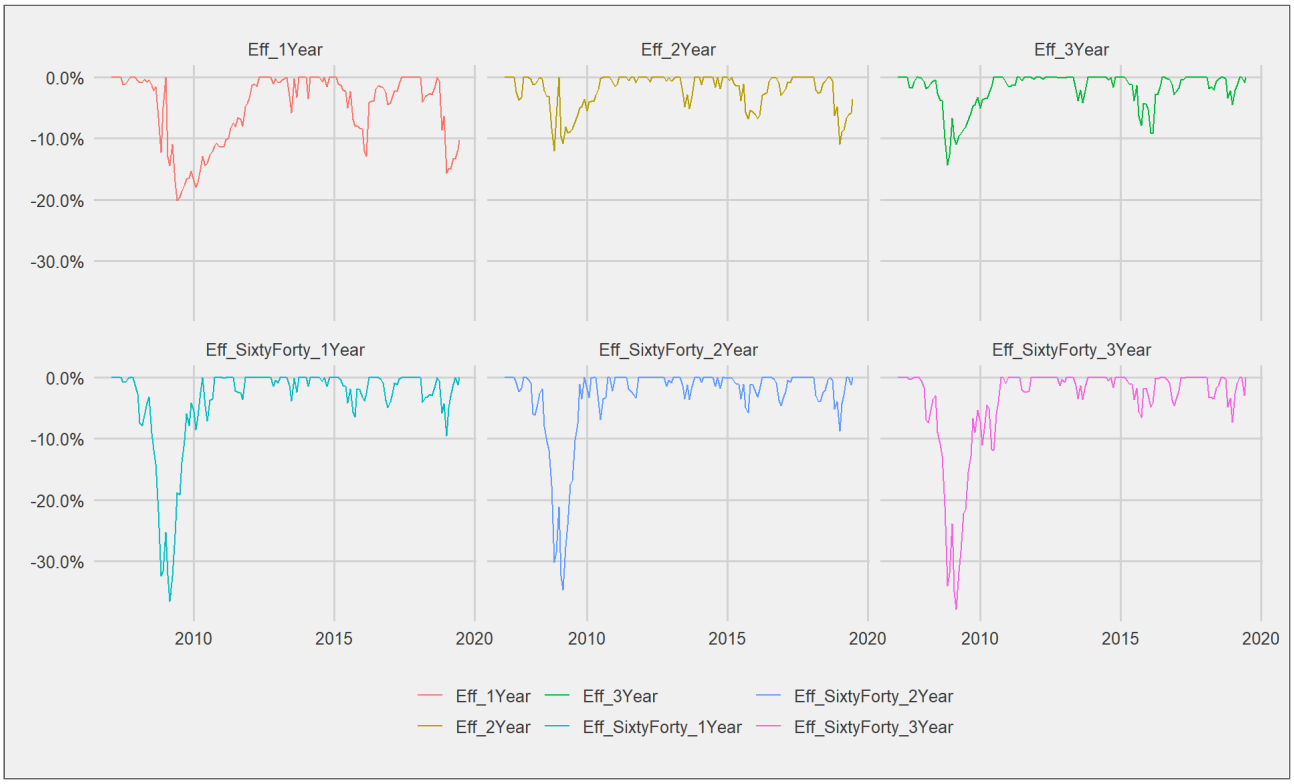
In this section, we will first construct portfolios using efficient frontier with different lengths of training periods(1, 2, 3 year(s)). Then we add the weight constraint to them(60% in equity and 40% in fixed income). They will be rebalanced quarterly. The comparison will be conducted by their drawdowns and weight graph at the end.

SIX EF PORTFOLIOS CUMMULATIVE RETURN PLOTTING

Below is the plot of 6 portfolios using the efficient frontier. As we can see, the portfolios using the weight constraint 60:40 perform better. However, in the period of financial crisis, we also observe that without weight constraint, the portfolios would have less drawdowns.

DRAWDOWNS OF PORTFOLIOS USING EFFICIENT FRONTIER

Next, we we can see clearly that the portfolios using efficient frontier and weight constraint have greater drawdowns.



WEIGHT DISTRIBUTION OF 6 PORTFOLIOS USING EFFICIENT FRONTIER

CONCLUSION OF SECTION

SUMMARY OF PORTFOLIOS

From our analysis, the portfolios using rebalancing clearly outperform those without rebalancing with similar drawdowns. We can also draw the following conclusion that: the portfolio using the efficient frontier with weight constraint 60:40 performs the best among all the portfolios. However, the drawdown of them are also much more than other portfolios.

In the financial crisis in 2008, we can find that the portfolios with frontier efficient have less drawdowns(except the one with 60:40 constraint). For risk averse investor, those portfolios will be good choices. And the portfolios with rolling windows of 2 years and 3 years are better. As for the simple portfolios, the higher the weight of Equity, the worse the drawdown will be.