HW4 109304019 統計四周佳萱

1.

(a)

	Fixed-weighted	Buy-and-hold
Sample mean	0.04620656	0.04637781
Standard deviation	1.083831	1.163629
minimum	-5.77182596	-5.92766870
median	0.01607321	0.02013965
maximum	5.96828827	6.45393274
skewness	-0.1664934	-0.1050336
kurtosis	2.728861	2.450553
Acf(1)	-0.06102311	-0.04932901

```
2.728861 2.450553
> apply(datax[, 7:8], 2, summary)
               retN       retbh
Min.    -5.77182596 -5.92766870
1st Qu. -0.51964717 -0.57244358
Median   0.01607321  0.02013965
Mean     0.04620656  0.04637781
3rd Qu.  0.67949821  0.71862541
Max.     5.96828827  6.45393274
> apply(datax[, 7:8], 2, sd)          ## s
    retN    retbh
1.083831 1.163629
> apply(datax[, 7:8], 2, my_skewness)
unction skewnessx used in class
      retN      retbh
-0.1664934 -0.1050336
> apply(datax[, 7:8], 2, my_kurtosis)
s with kurtosisx used in class
    retN    retbh
2.728861 2.450553
> apply(datax[, 7:8], 2, my_acf1)
       retN       retbh
-0.06102311 -0.04932901
```

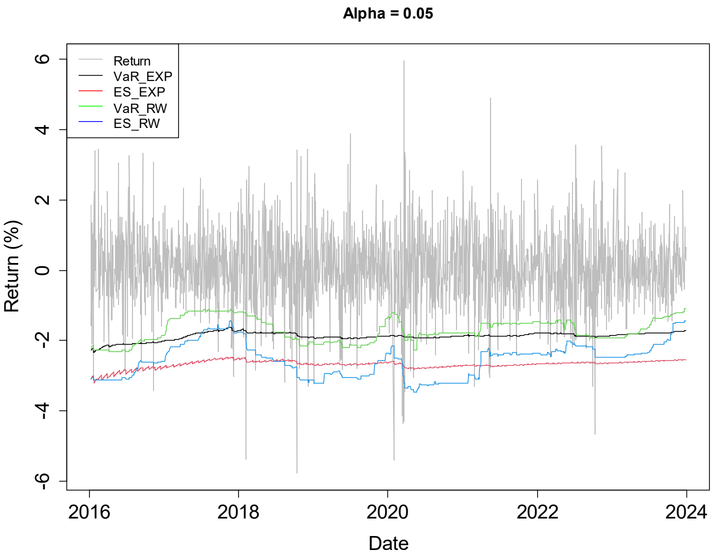
(b)

	Fixed-weighted	Buy-and-hold
VaR at 5%	-1.720868	-1.870258
ES at 5%	-2.536235	-2.671989
VaR at 1%	-3.022745	-3.166372
ES at 1%	-3.802361	-3.998315

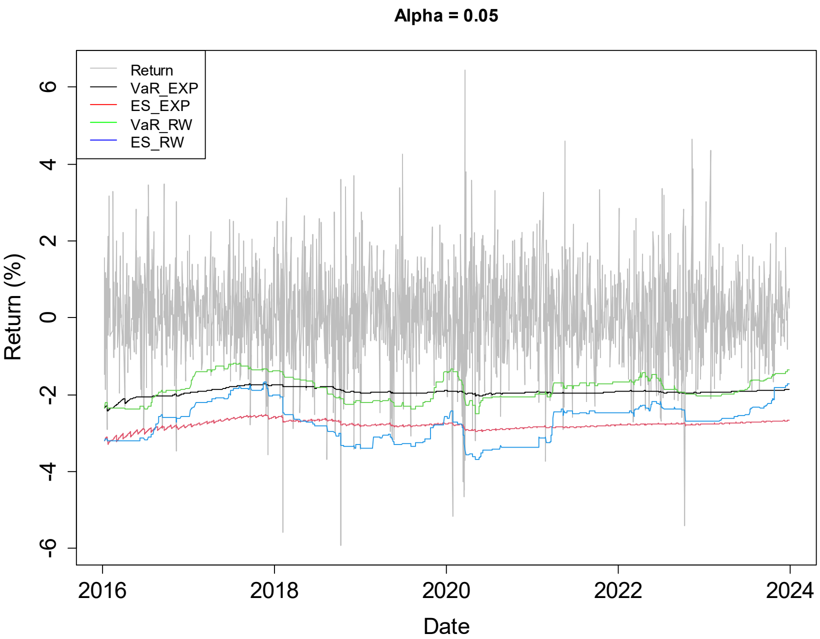
```
> apply(datax[, 7:8], 2, VaR_samplex, amountx = 1, alphax = 0.05)
     retN      retbh
-1.720868 -1.870258
> apply(datax[, 7:8], 2, ES_samplex, amountx = 1, alphax = 0.05)
     retN      retbh
-2.536235 -2.671989
> ## Alpha = 0.01
> apply(datax[, 7:8], 2, VaR_samplex, amountx = 1, alphax = 0.01)
     retN      retbh
-3.022745 -3.166372
> apply(datax[, 7:8], 2, ES_samplex, amountx = 1, alphax = 0.01)
     retN      retbh
-3.802361 -3.998315
```

(c)

Time series of estimated VaR, ES and fixed-weighted return：



Time series of estimated VaR, ES and buy-and-hold return：



(d)

fixed-weighted portfolio return 有 76 筆資料的值比 exapanding windows 計算的 5%VaR 的值小，有 94 筆資料的值比 rolling windows 計算的 5%VaR 的值小。

Buy-and-hold portfolio return 有 82 筆資料的值比 exapanding windows 計算的 5%VaR 的值小，有 96 筆資料的值比 rolling windows 計算的 5%VaR 的值小。

```
> ## -----------------------------
> ## d.
> ## Realized exceed
> ## Fixed-weighted portfolio
> sum(datax1$r<datax1$VaR_Exp)
[1] 76
> sum(datax1$r<datax1$VaR_Rw)
[1] 94
> ## Buy-and-hold portfolio
> sum(datax2$r<datax2$VaR_Exp)
[1] 82
> sum(datax2$r<datax2$VaR_Rw)
[1] 96
> 
```

(e)

	Fixed-weighted	Buy-and-hold
Maximum drawdown	0.2361313	0.2945803
Calmar Ratio	0.3616528	0.3144507

```
> View(xts_datax1)
> ## Calculate MDD
> ## Fixed-weighted portfolio
> N_MDD<-maxDrawdown(xts_datax1$retN)
> N_MDD
[1] 0.2361313
> ## Buy-and-hold portfolio
> bh_MDD<-maxDrawdown(xts_datax1$retbh)
> bh_MDD
[1] 0.2945803
> ## Calculate Calmar ratio
> ## Fixed-weighted portfolio
> N_CR<-CalmarRatio(xts_datax1$retN)
> N_CR
                  retN
Calmar Ratio 0.3616528
> ## Buy-and-hold portfolio
> bh_CR<-CalmarRatio(xts_datax1$retbh)
> bh_CR
                 retbh
Calmar Ratio 0.3144507
> 
```

2.

(a)

daily data of S&P500 index 有 7641 筆資料，monthly data of CBOE VIX index 有 364 筆資料，兩筆資料都沒有缺失值。

```
> ## a.
> ## Number of observations
> nrow(GSPCd)
[1] 7641
> nrow(VIXm)
[1] 364
> ## Number of missing values
> sum(is.na(GSPCd))
[1] 0
> sum(is.na(VIXm))
[1] 0
>
```

(b)

Summary statistics of GSPCd

```
> ## b.
> ## Calculate summary statistics
> summary(GSPCd)
      Date                 Open             High             Low              Close           Adj.Close     
 Min.   :1990-01-02   Min.   : 295.4   Min.   : 301.4   Min.   : 294.5   Min.   : 295.5   Min.   : 295.5  
 1st Qu.:1997-07-22   1st Qu.: 820.3   1st Qu.: 832.1   1st Qu.: 811.8   1st Qu.: 822.1   1st Qu.: 822.1  
 Median :2005-02-24   Median :1197.8   Median :1205.1   Median :1189.8   Median :1197.9   Median :1197.9  
 Mean   :2005-02-23   Mean   :1284.9   Mean   :1292.4   Mean   :1276.9   Mean   :1285.2   Mean   :1285.2  
 3rd Qu.:2012-09-24   3rd Qu.:1507.3   3rd Qu.:1515.0   3rd Qu.:1498.3   3rd Qu.:1507.5   3rd Qu.:1507.5  
 Max.   :2020-04-29   Max.   :3380.4   Max.   :3393.5   Max.   :3378.8   Max.   :3386.2   Max.   :3386.2  
     Volume         
 Min.   :1.499e+07  
 1st Qu.:5.229e+08  
 Median :1.707e+09  
 Mean   :2.221e+09  
 3rd Qu.:3.568e+09  
 Max.   :1.146e+10  
```

Summary statistics of VIXm

```
> summary(VIXm)
      Date                 Open            High            Low             Close          Adj.Close         Volume  
 Min.   :1990-01-01   Min.   : 9.59   Min.   :12.44   Min.   : 8.56   Min.   : 9.51   Min.   : 9.51   Min.   :0  
 1st Qu.:1997-07-24   1st Qu.:13.72   1st Qu.:17.09   1st Qu.:11.63   1st Qu.:13.70   1st Qu.:13.70   1st Qu.:0  
 Median :2005-02-15   Median :17.36   Median :21.35   Median :14.70   Median :17.28   Median :17.28   Median :0  
 Mean   :2005-02-14   Mean   :19.54   Mean   :24.27   Mean   :16.13   Mean   :19.37   Mean   :19.37   Mean   :0  
 3rd Qu.:2012-09-08   3rd Qu.:22.88   3rd Qu.:28.16   3rd Qu.:19.29   3rd Qu.:23.37   3rd Qu.:23.37   3rd Qu.:0  
 Max.   :2020-04-01   Max.   :60.47   Max.   :89.53   Max.   :44.25   Max.   :59.89   Max.   :59.89   Max.   :0  
```

(c)

	ret2
1990-01-31	17.579274
1990-02-28	11.001362
1990-03-30	11.129659
1990-04-30	10.770966
1990-05-31	12.781772
1990-06-29	12.731815
1990-07-31	12.482495
1990-08-31	26.444950
1990-09-28	15.432936
1990-10-31	23.219234
1990-11-30	17.111017

(d)

Summary statistics for the volatility risk premia：

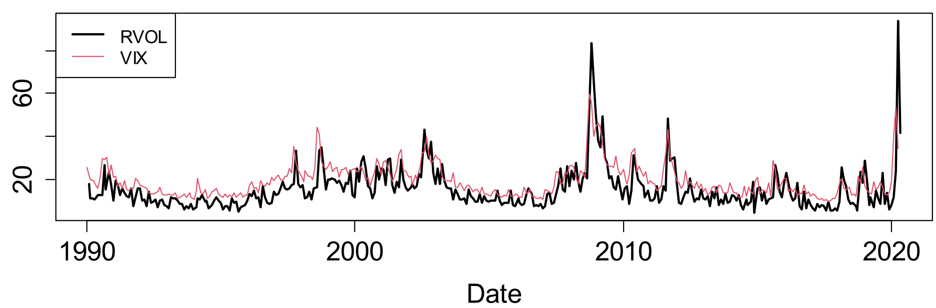
```
> ## How many positive and nonnegative volatility
> summary(vrpm)
   Min.  1st Qu.  Median    Mean  3rd Qu.    Max.
-40.153   2.485   4.357   4.083   6.610  16.615
```

有 45 個 volatility risk premia are negative.有 309 個 volatility risk premia is nonnegative.

```
> sum(vrpm<0)
[1] 45
> sum(vrpm>=0)
[1] 319
```

(e)

Monthly realized volatility and VIX of S&P500 (annualized percentage)



Monthly volatility risk premium of S&P500 (annualized percentage)