Application of principal component analysis in portfolio management

Group7

Luo zehui, Qichao Li

Dataset

Description of data

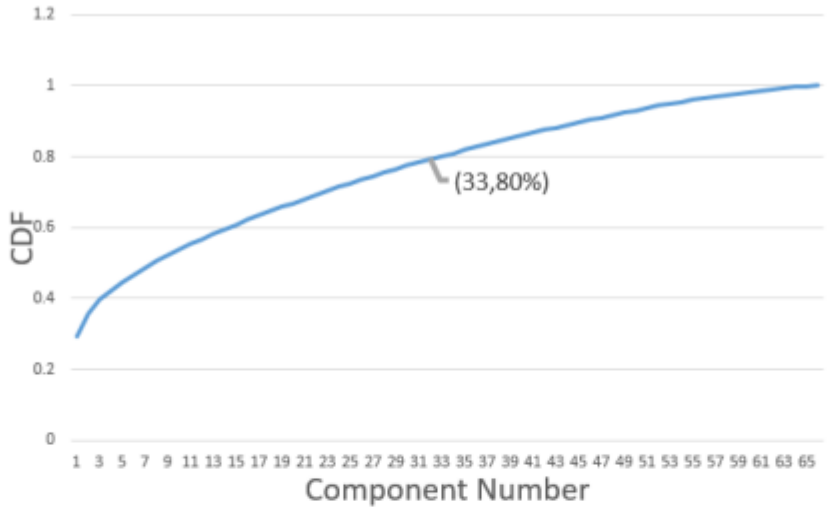
- ASX200 stock index
- Data range 2002/9/24-2021/11/29
- 66 stocks
- 3496 trading days
- 9 fields

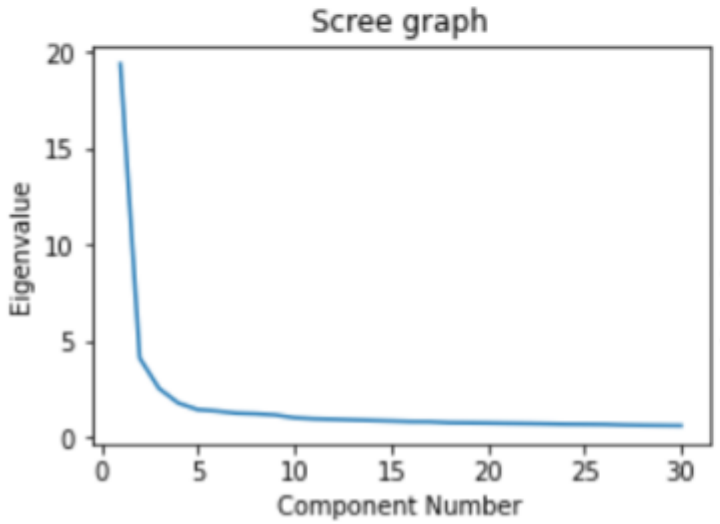
The component stocks of the ASX200 index

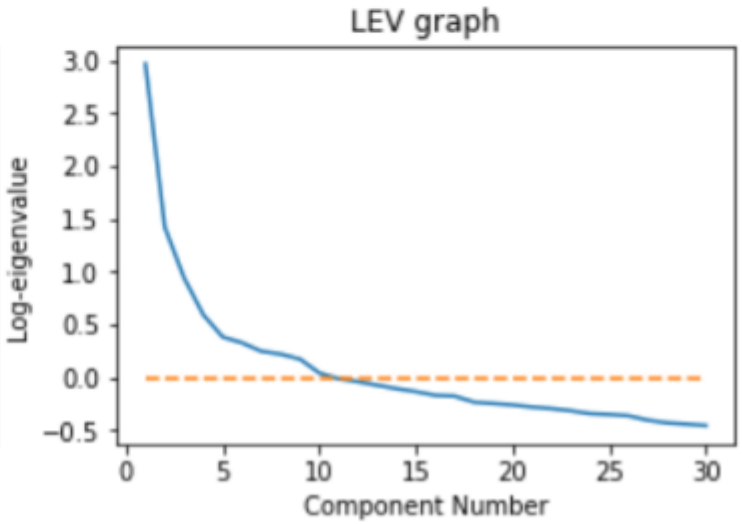
Industries	Number of stocks
Basic Materials	10
Consumer Goods	10
Financials	22
Health Care	6
Industrials	10
Oil & Gas	4
Technology	2
Telecommunicationss	1
Utilities	1

Choose number of components

Cumulative Variance







Kaiser's rule

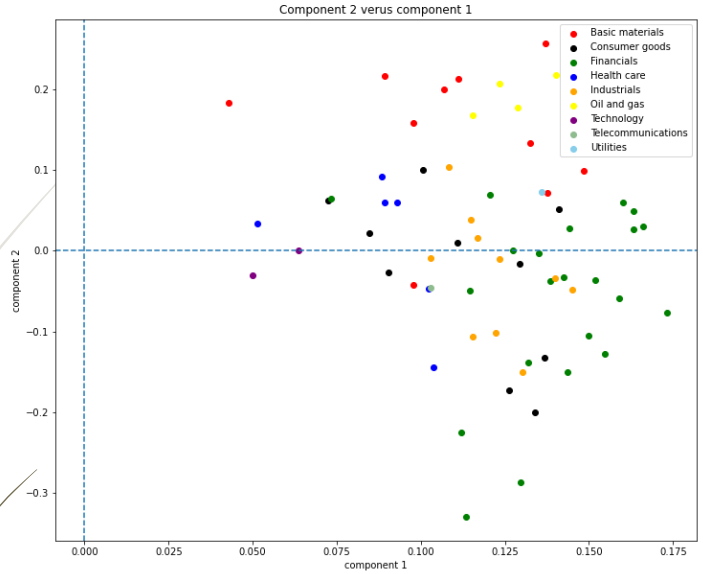
Table 1. The 10 components with eigenvalue larger than 1

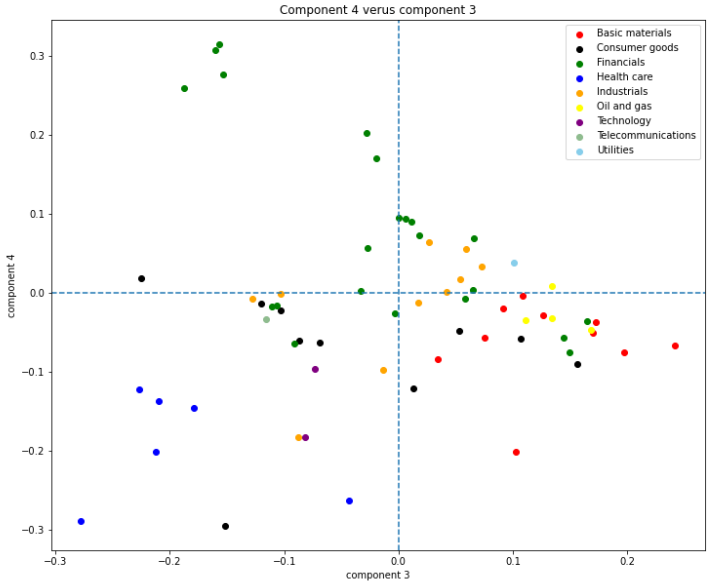
component	1	2	3	4	5
eigenvalue	19.41182993	4.141725196	2.559374381	1.802498243	1.46310926
component	6	7	8	9	10
eigenvalue	1.384663399	1.277892387	1.244037328	1.186395071	1.039942665

According to the above three strategies, we should retain 10 components.

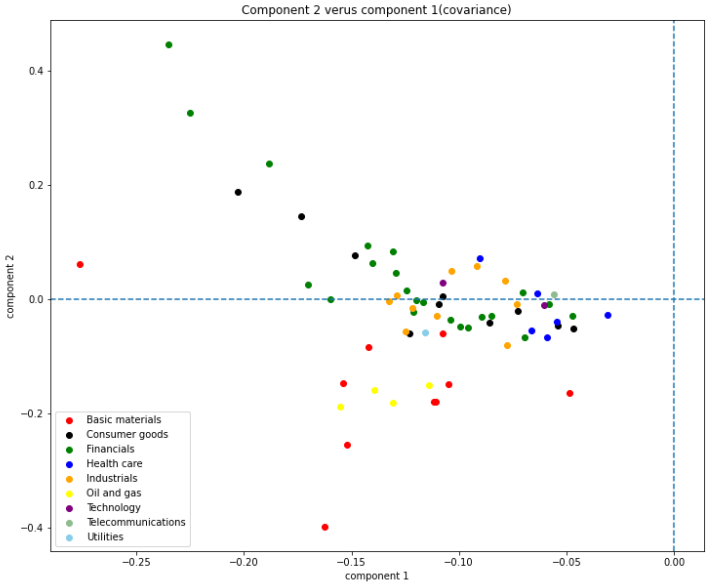
Eigenvectors of 10 components

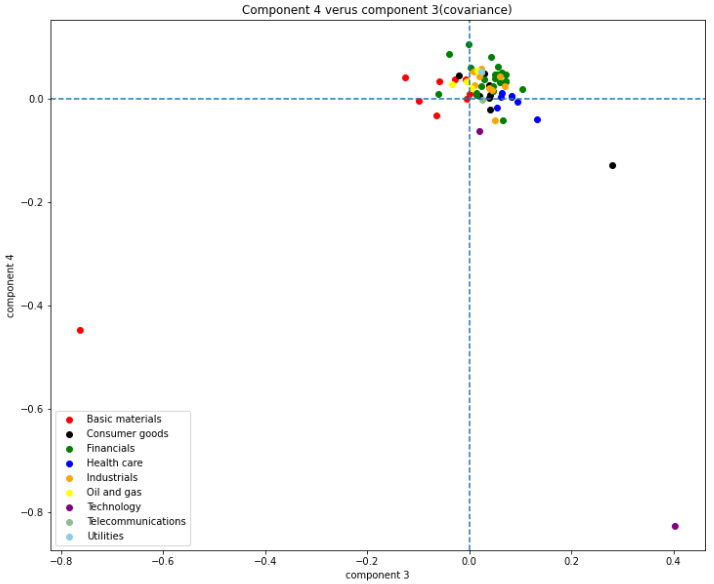
Correlation



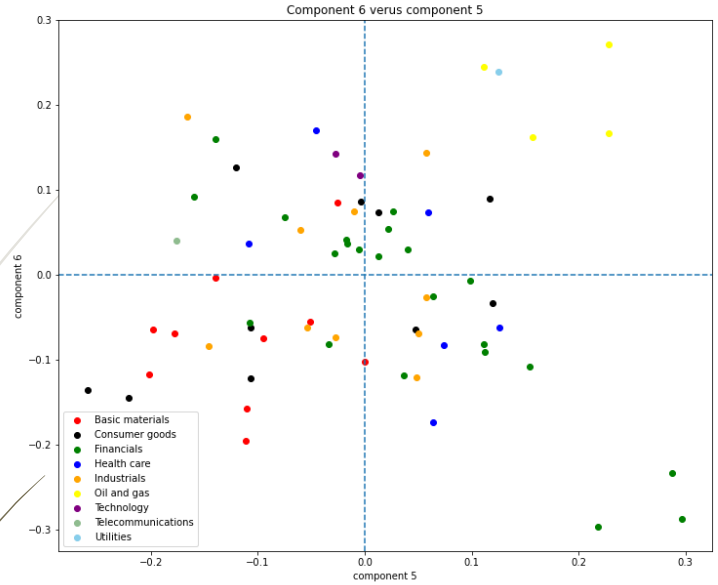


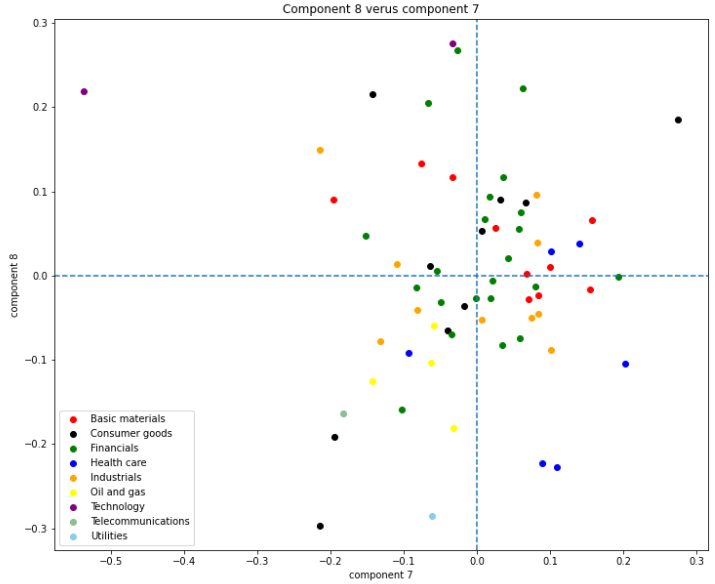
Covariance



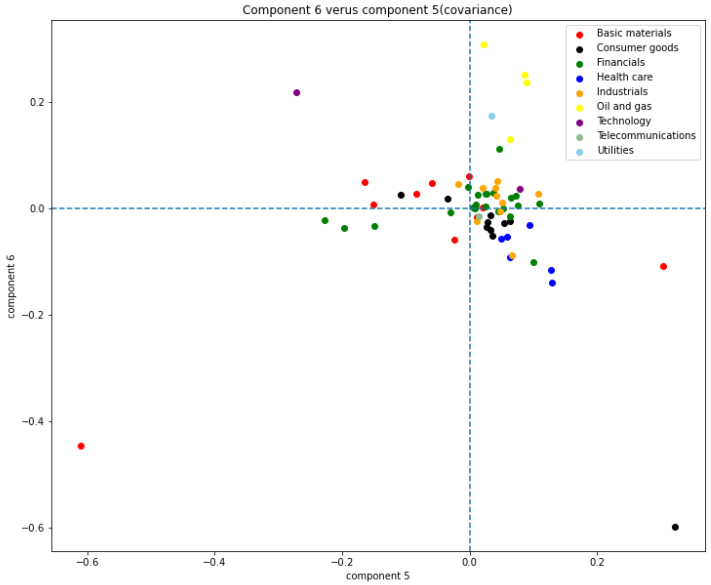


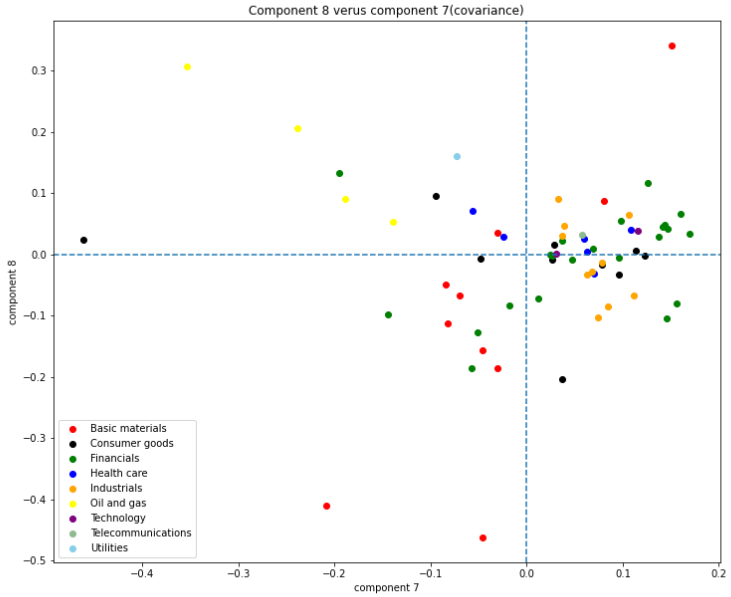
Correlation



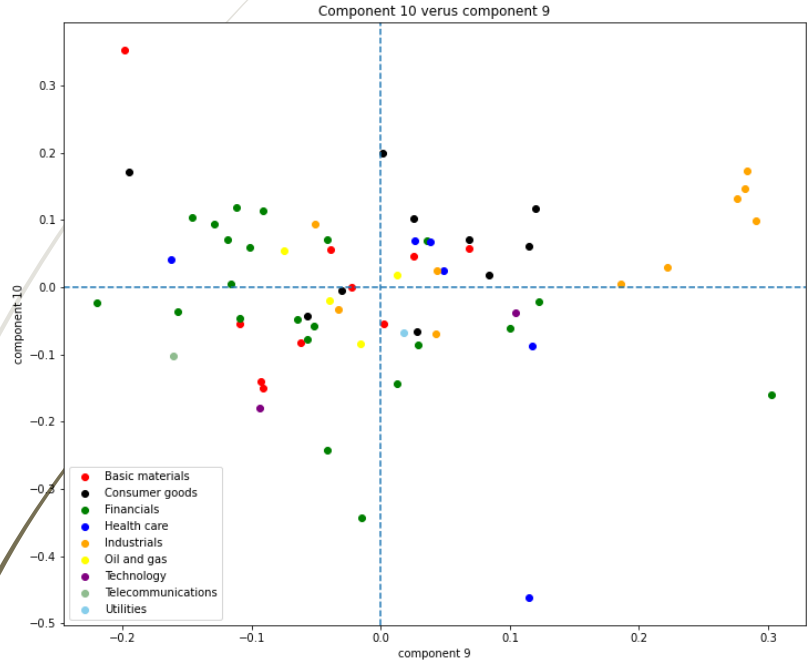


Covariance

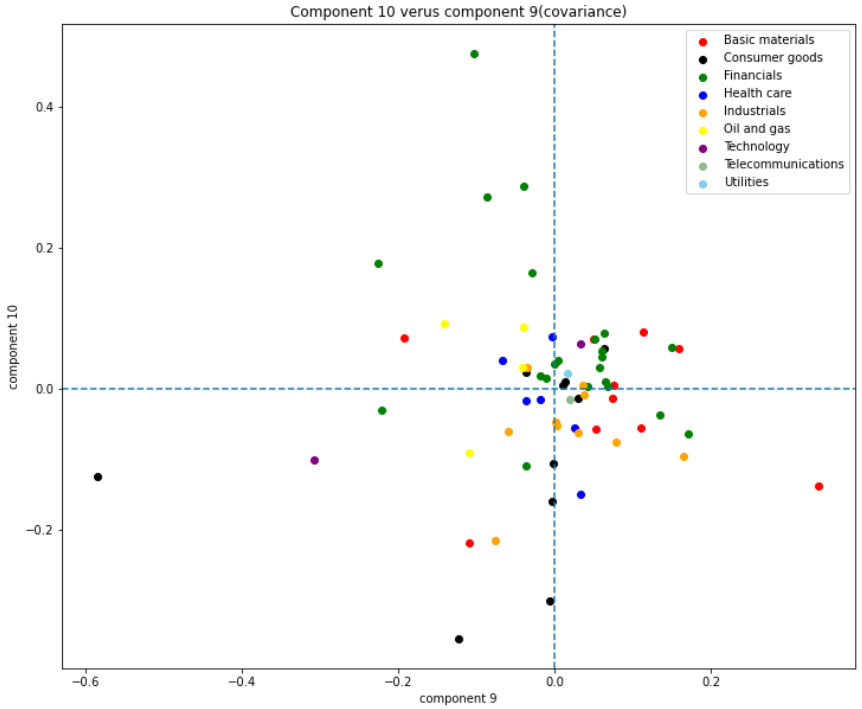




Correlation

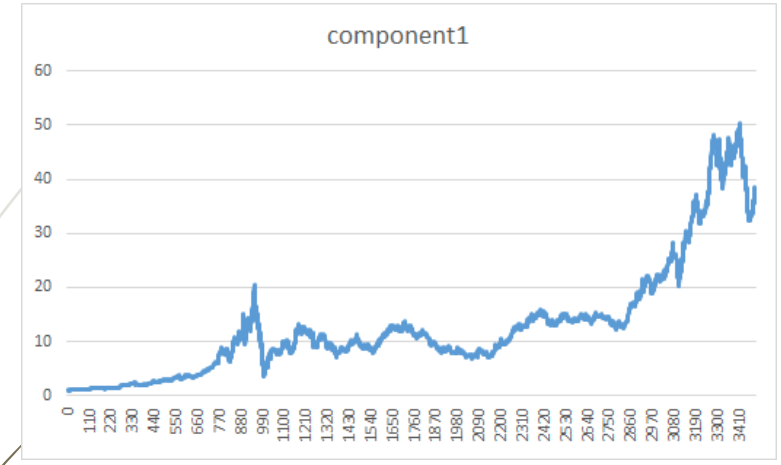


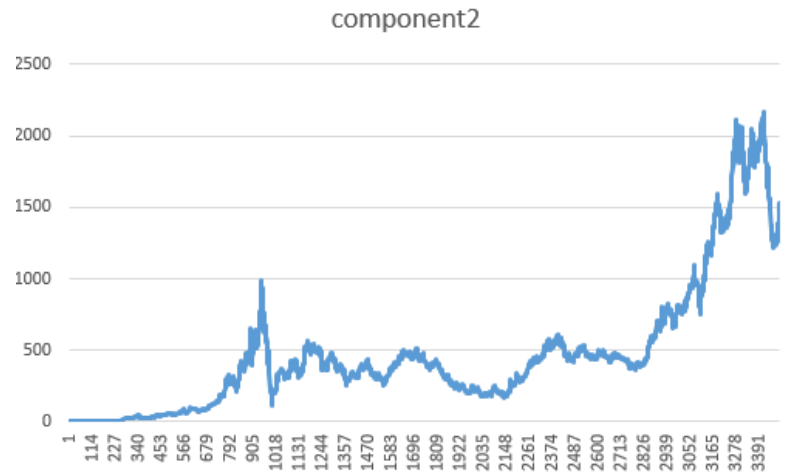
Covariance



We can find correlation is better than covariance, as the figures of components calculated by correlation matrix are more divergent.

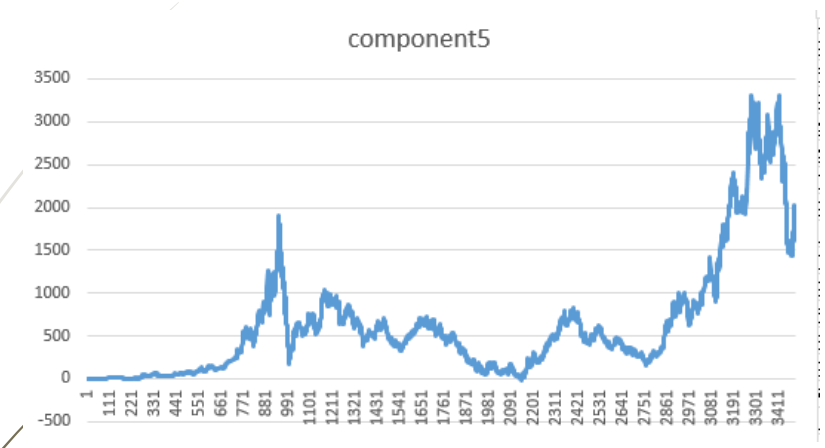
Plots of principal portfolios

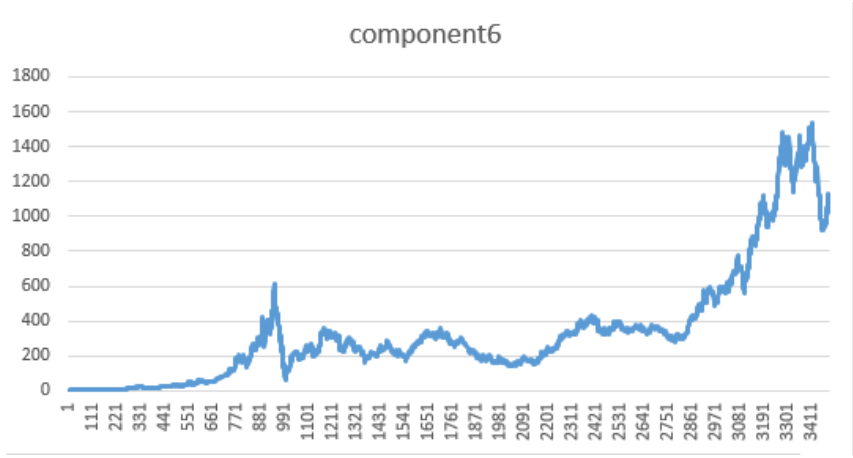

component1
60
50
40
30
20
10
0
0 110 220 330 440 550 660 770 880 990 1100 1210 1320 1430 1540 1650 1760 1870 1980 2090 2200 2310 2420 2530 2640 2750 2860 2970 3080 3190 3300 3410

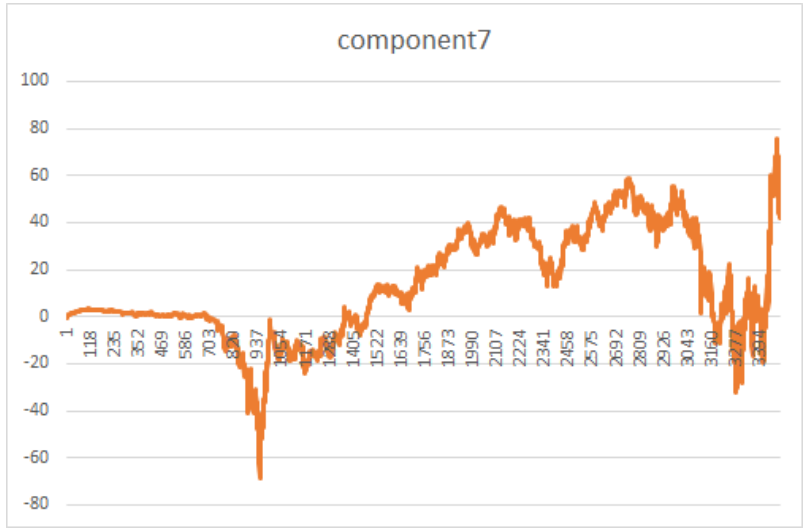

component2
2500
2000
1500
1000
500
0
1 114 227 340 453 566 679 792 905 1018 1131 1244 1357 1470 1583 1696 1809 1922 2035 2148 2261 2374 2487 2600 2713 2826 2939 3052 3165 3278 3391

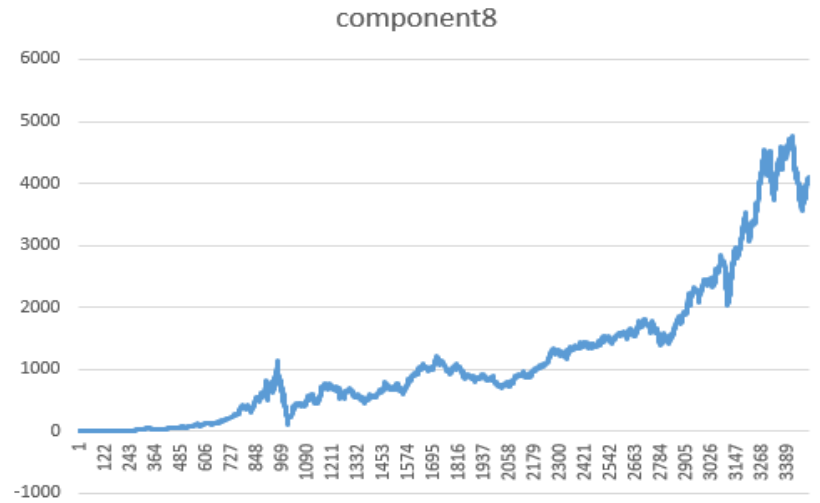
component3
100
0
-100
-200
-300
-400
-500
-600
-700
1 107 213 319 425 531 637 743 849 955 1061 1167 1273 1379 1485 1591 1697 1803 1909 2015 2121 2227 2333 2439 2545 2651 2757 2863 2969 3075 3181 3287 3393

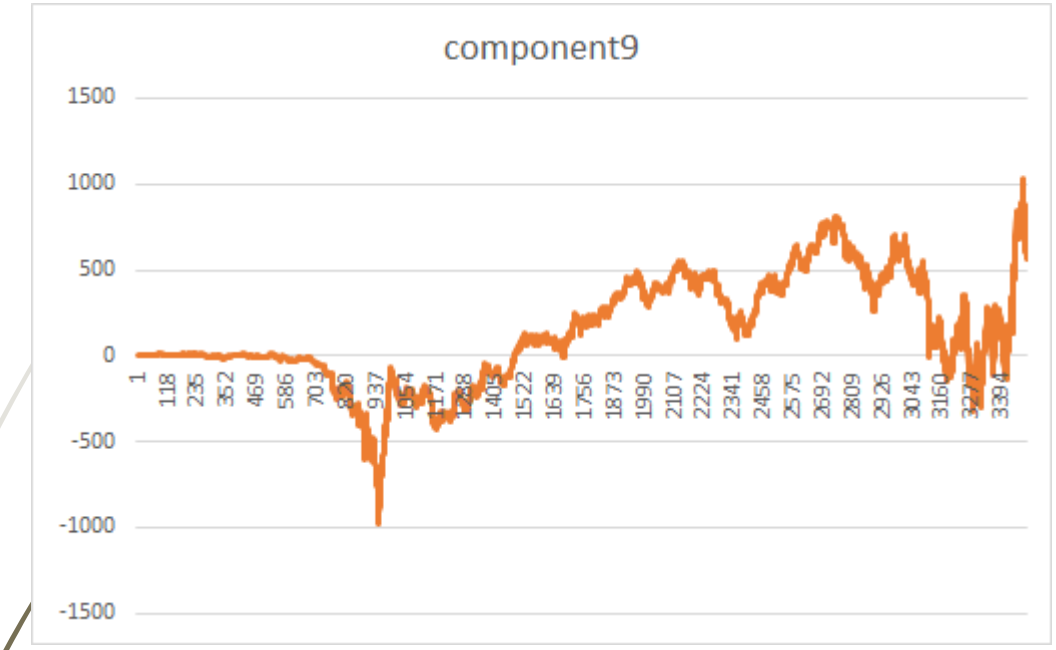
component4
140
120
100
80
60
40
20
0
1 107 213 319 425 531 637 743 849 955 1061 1167 1273 1379 1485 1591 1697 1803 1909 2015 2121 2227 2333 2439 2545 2651 2757 2863 2969 3075 3181 3287 3393

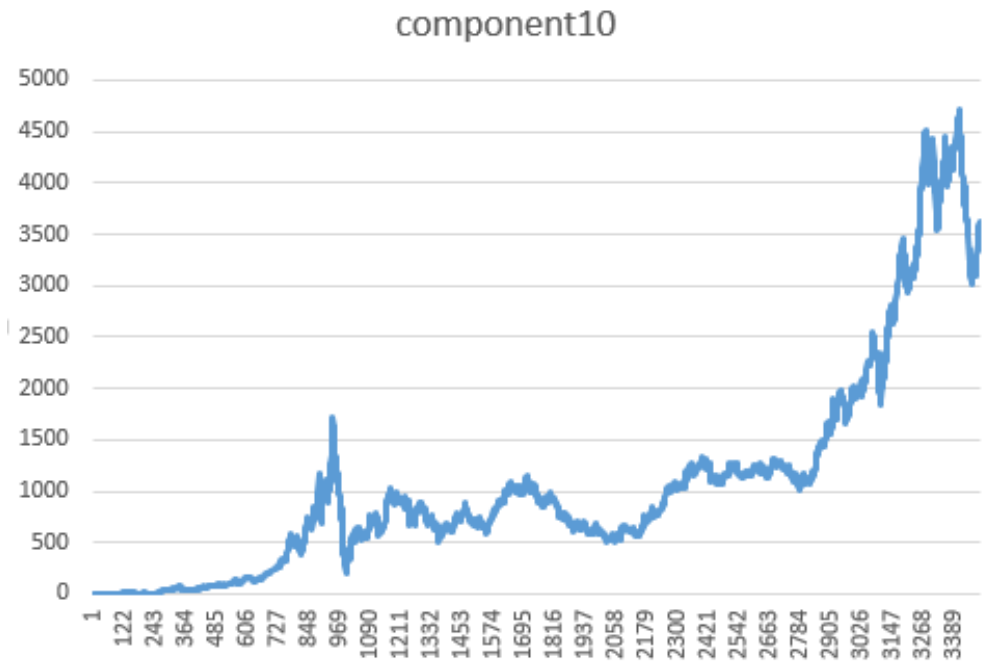

component5
3500
3000
2500
2000
1500
1000
500
0
-500
1
111
221
331
441
551
661
771
881
991
1101
1211
1321
1431
1541
1651
1761
1871
1981
2091
2201
2311
2421
2531
2641
2751
2861
2971
3081
3191
3301
3411


component6
1800
1600
1400
1200
1000
800
600
400
200
0
1
111
221
331
441
551
661
771
881
991
1101
1211
1321
1431
1541
1651
1761
1871
1981
2091
2201
2311
2421
2531
2641
2751
2861
2971
3081
3191
3301
3411


component7
100
80
60
40
20
0
-20
-40
-60
-80
1
118
235
352
469
586
703
820
937
1054
1171
1288
1405
1522
1639
1756
1873
1990
2107
2224
2341
2458
2575
2692
2809
2926
3043
3160
3277
3394


component8
6000
5000
4000
3000
2000
1000
0
-1000
1
122
243
364
485
606
727
848
969
1090
1211
1332
1453
1574
1695
1816
1937
2058
2179
2300
2421
2542
2663
2784
2905
3026
3147
3268
3389





We can find that the portfolios generated by component3, component7, and component9 are relatively opposite trends from the others.

The performance of different portfolios

- 1/N—stocks (EWS)
- Risk Parity—stocks (RE)
- 1/N—principals (EWP)
- Risk Parity—principals (DRP)

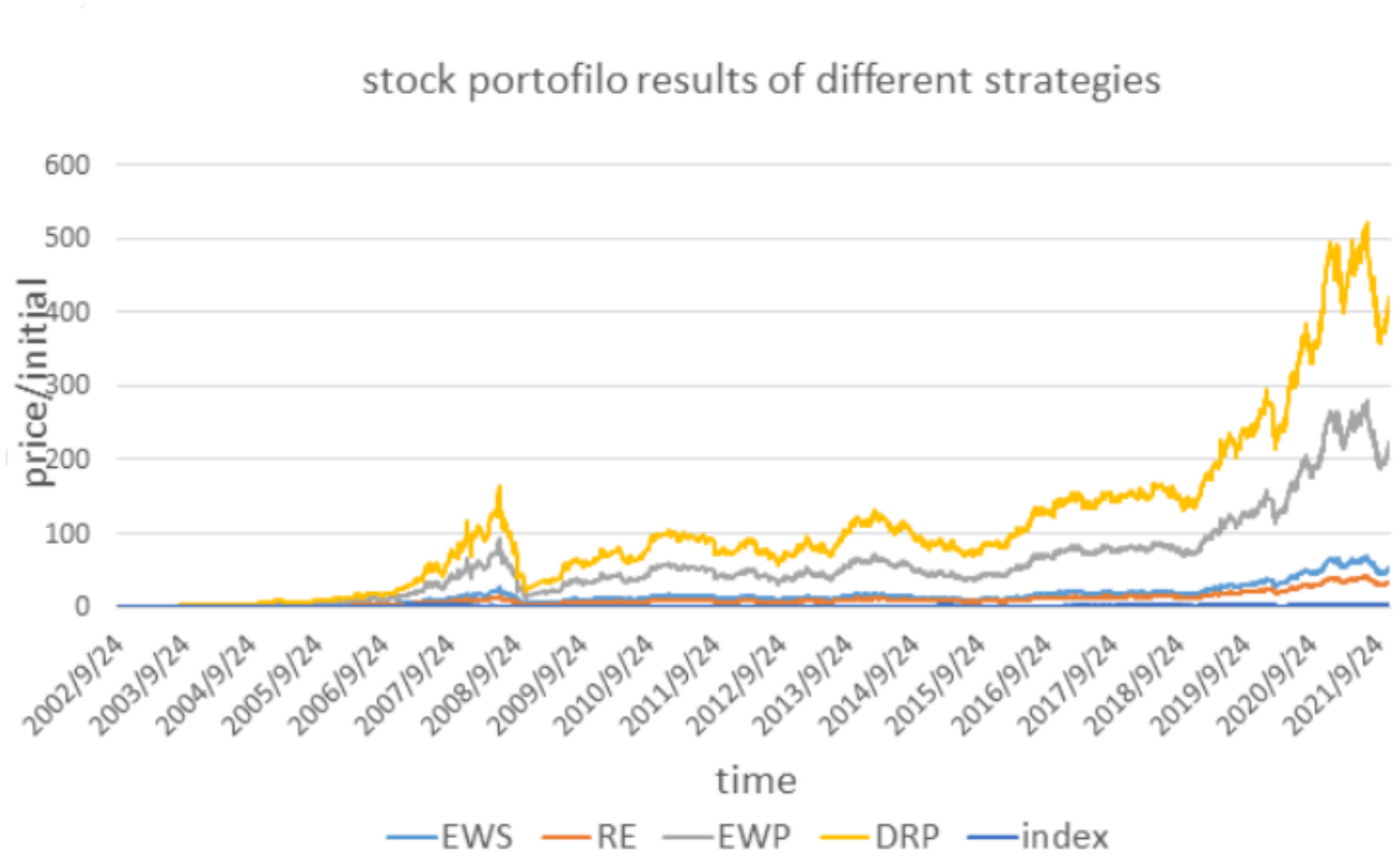

stock portofilo results of different strategies
600
500
400
300
200
100
0
price/initial
2002/9/24
2003/9/24
2004/9/24
2005/9/24
2006/9/24
2007/9/24
2008/9/24
2009/9/24
2010/9/24
2011/9/24
2012/9/24
2013/9/24
2014/9/24
2015/9/24
2016/9/24
2017/9/24
2018/9/24
2019/9/24
2020/9/24
2021/9/24
time
EWS
RE
EWP
DRP
index

Table 2. Final gain, SD and minimum of the four portfolios.

Strategies	EWS	RE	EWP	DRP
Final gain	52.90	33.71	218.97	413.67
SD	0.86	0.80	0.93	0.94
Minimum	0.92	0.92	0.86	0.91
Sharpe ratio	-0.10612	-0.13139	-0.08092	-0.07207

The holding time is too long, which makes the Sharpe ratio to be less than 0 for all the strategies

THANK YOU!