# Problem Set 3: Momentum

*Jiaming Huang*

*2019/5/5*

**Name: Jiaming Huang**

**Names of whom I discussed this problem set with: [Yanxiang Zhao],[Xiahao Wang]**

## Question 1

Using CRSP stock data, define the universe of monthly returns that can be used in calculating momentum portfolios, as well as their ranking return, following the procedure in Daniel and Moskowitz (2016). Your output should be from 1927-2018.

Firstly I will show the result of ranking returns:

```
##           Year Month PERMNO EXCHCD  lag_Mkt_Cap       Ret Ranking_Ret
##       1: 1987     2  10000      3 1.581531e+03  0.000000          16
##       2: 1987     3  10000      3 1.581531e+03 -0.384615           8
##       3: 1987     4  10000      3 9.732500e+02 -0.062500           7
##       4: 1987     5  10000      3 9.124413e+02 -0.066667           3
##       5: 1987     2  10001      3 6.689250e+03 -0.074074        3710
##      ---
## 3157512: 2018     8  93436      3 5.086060e+07  0.011806        1509
## 3157513: 2018     9  93436      3 5.146108e+07 -0.122290         587
## 3157514: 2018    10  93436      3 4.542871e+07  0.274011         827
## 3157515: 2018    11  93436      3 5.792898e+07  0.039013         638
## 3157516: 2018    12  93436      3 6.018898e+07 -0.050445        2359
```

## 1. Restriction of data:

Firstly I download all stock monthly returns from CRSP database. As shown in Daniel and Moskowitz's preocedure, the restrictions of data contain: 1. common share stocks(with share codes 10 and 11) 2. stocks traded in the New York Stock Exchange, American Stock Exchange or the Nasdaq Stock Exchange(with exchange code 1,2,3) 3. prices at t - 13 are not missing 4. returns at t- 2 are not missing 5. lag market values are not missing

## 2. Return Calculation:

To calculate Cum-dividend return, when delisting return and return both exist, follow the formula$r_{i,t} = (1 + r^d_{i,t})(1 + r^h_{i,t}) - 1$. When only delisting return or return exist, just use that return.

## 3. Ranking stocks based on historical cumulative return:

The ranking process of stocks are based on cumulative log return from t - 12 to t - 2, skipping one month as formation date. The formulua for ranking basis is:

$$r_{i,t}^{ranking} = \sum_{s=2}^{12} ln(1 + r_{i,t-s})$$

## Question 2

Define the monthly momentum portfolio decile of each stock as defined by both Daniel and Moskowitz (2016) and Kenneth R. French. Your output should be from 1927-2018.

Firstly I will show the result:

```
##           Year Month PERMNO  lag_Mkt_Cap       Ret DM_decile KRF_decile
##       1: 1987     2  10000 1.581531e+03  0.000000         1          1
##       2: 1987     3  10000 1.581531e+03 -0.384615         1          1
##       3: 1987     4  10000 9.732500e+02 -0.062500         1          1
##       4: 1987     5  10000 9.124413e+02 -0.066667         1          1
##       5: 1987     2  10001 6.689250e+03 -0.074074         8          7
##      ---
## 3157512: 2018     8  93436 5.086060e+07  0.011806         5          5
## 3157513: 2018     9  93436 5.146108e+07 -0.122290         2          1
## 3157514: 2018    10  93436 4.542871e+07  0.274011         3          2
## 3157515: 2018    11  93436 5.792898e+07  0.039013         2          2
## 3157516: 2018    12  93436 6.018898e+07 -0.050445         7          8
```

## KRF decile:

Each of the portfolios has an equal number of NYSE firms, setting decile cut so that each decile portfolio has same number of NYSE firms.

## DM decile:

Set breakpoints so that there are an equal number of firms in each decile portfolio.

## Question 3

Calculate the monthly momentum portfolio decile returns as defined by both Daniel and Moskowitz (2016) and Kenneth R. French. Your output should be from 1927-2018.

Firstly, I will show the result momentum portfolio returns:

```
##         Year Month decile       DM_Ret      KRF_Ret     Rf
##     1: 1927     1      1 -0.032067596 -0.032067596 0.0025
##     2: 1927     1      2 -0.039582683 -0.039582683 0.0025
##     3: 1927     1      3  0.019708143  0.019708143 0.0025
##     4: 1927     1      4  0.004212304  0.004212304 0.0025
##     5: 1927     1      5 -0.005907735 -0.005907735 0.0025
##    ---
## 11036: 2018    12      6 -0.104139186 -0.101498170 0.0019
```

```
## 11037: 2018    12      7 -0.085242722 -0.088067473 0.0019
## 11038: 2018    12      8 -0.084983752 -0.084427952 0.0019
## 11039: 2018    12      9 -0.086557631 -0.089123574 0.0019
## 11040: 2018    12     10 -0.097595996 -0.083008367 0.0019
```

### Value-Weighted Return:

After I set decile for each term. I calculate each decile portfolio by value weighted mean return of the firms in each decile portfolio. The weights are based on lagged market capitalization

## Question 4

Replicate Table 1 in Daniel and Moskowitz (2016), except for ??, t(??), ??, and sk(d) rows, and the Market column. Match the format and methodology to the extent possible.

The table below is my estimated result:

```
##    Variables     Decile1     Decile2    Decile3    Decile4    Decile5
## 1:      r-rf -2.48506657  2.48704312  3.0190720  6.3812871  7.2977659
## 2:     sigma 36.69955014 30.52214212 26.0411678 23.1799627 21.5836383
## 3:        SR -0.06771382  0.08148324  0.1159346  0.2752932  0.3381157
## 4:     sk(m)  0.08951825 -0.12286824 -0.1729669  0.1226883 -0.0806756
##       Decile6    Decile7    Decile8    Decile9   Decile10        WML
## 1:  7.0798103  9.0284071 10.2548791 11.4277643 15.4424044 17.4302295
## 2: 20.4021935 19.5287114 19.1679488 20.5230268 23.9769074 29.6721949
## 3:  0.3470122  0.4623145  0.5350014  0.5568265  0.6440532  0.5874264
## 4: -0.2434551 -0.6485296 -0.5489227 -0.7533936 -0.7994083 -5.0111782
```

### Explaination for little difference between result from Daniel and Moskowitz (2016)'s paper and Mine:

1. The data proprocessing step may be a little bit different. How I handle missing data and how to constrain stocks maybe different from Daniel and Moskowitz's
2. How I handle the cut methods for decile is different from Daniel and Moskowitz's. As not all Months' data can be divided by 10, how to allocate residule stocks, whether put them into winner portfolio or loser portfolio may count for the difference.

## Question 5

Calculate the correlation of your portfolio returns with the Daniel and Moskowitz (2016) breakpoints (by decile), to the portfolio returns on Daniel???s website. Also calculate the correlation of your portfolio returns with the Kenneth R. French breakpoints (by decile), to the portfolio returns on French???s website. Round to 4 decimal places. Correlations should be calculated from 1927-2018.

The correlations between my momentum portfolio, Daniel and Moskowitz's and Kenneth R. French's are shown below:

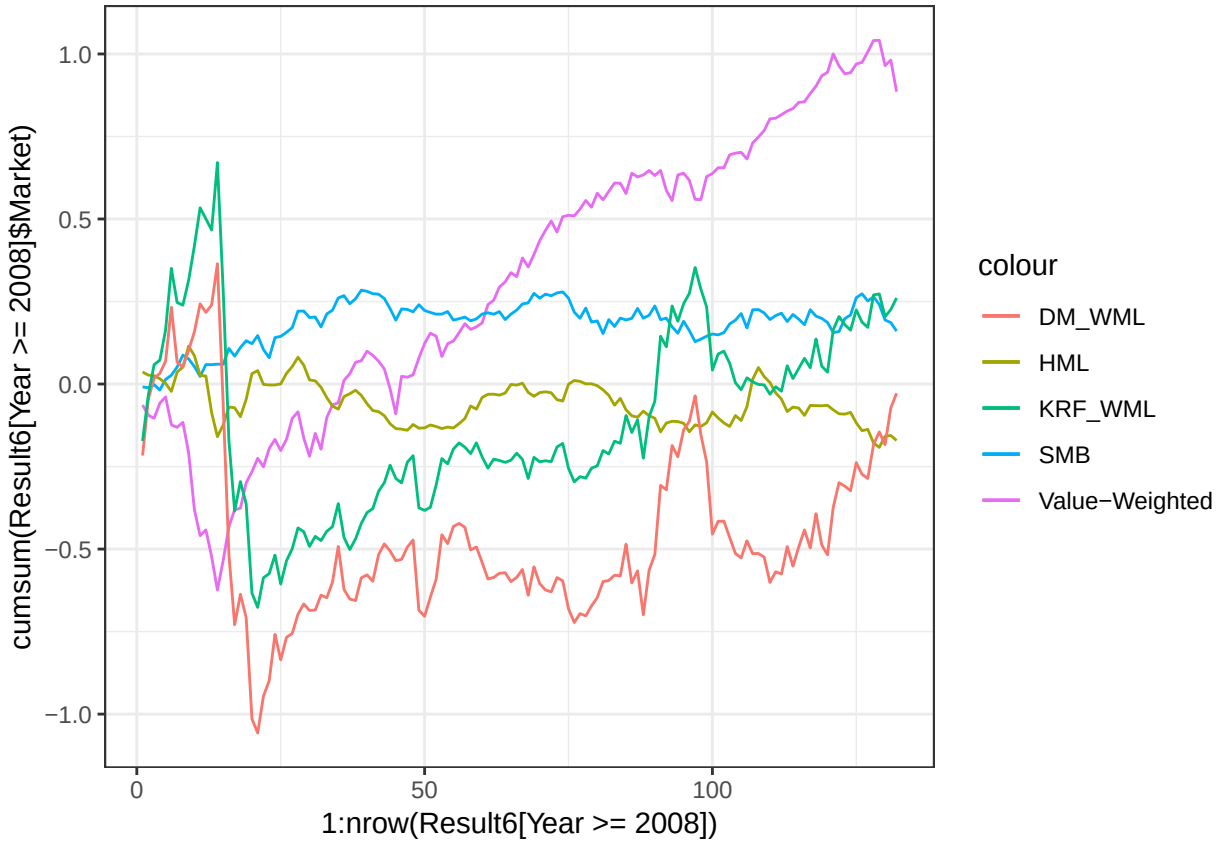
```
##           variable   Decile1   Decile2   Decile3   Decile4   Decile5
## 1:  DM correlation 0.9975063 0.9973971 0.9977704 0.9977053 0.9978568
## 2: KRF correlation 0.9977260 0.9985071 0.9975224 0.9978321 0.9978718
##      Decile6   Decile7   Decile8   Decile9  Decile10       WML
## 1: 0.9981549 0.9987024 0.9989333 0.9984936 0.9981052 0.9950947
```

```
## 2: 0.9972131 0.9981500 0.9987409 0.9983010 0.9989460 0.9955881
```

## Question 6

Has the momentum anomaly worked in the past few years? Show some empirical evidence.

The evidence of Momentum strategy for past few years is shown below:




It is shown that for past 5, 10 years, Momentum anomaly did not work well. The momentum strategy did not even beat the Market.

## Question 7

Would you implement this trading strategy if you were running your own fund? What arethe main implementation challenges to consider?

Initially, I will not implement this trading strategy for two reason:

1. The cumulative return did not even beat the market for past few years.
2. Compared with Market portfolio, Momentum portfolio has to be rebalanced every month.

The main challenged to consider:

1. Turnover, which is connected with trading cost. Too frequent rebalancing times will cost too much for the strategy.
2. Liquidity, which is connected with How easy we can implement our trading strategy and how easy for us to succeed trading.