**Problem Set 3**

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**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) 1. Your output should be from 1927-2018.

1. Universe of stocks: I restrict the sample to common shares (share codes 10 and 11) and to securities traded in the New York Stock Exchange, American Stock Exchange, or the Nasdaq Stock Exchange (exchange codes 1, 2, and 3).
2. Missing returns: First, I replace all letters in returns and delisting returns to NA. Next, I use the rule that, Holding period returns: , Delisting returns:

If both are missing, remove those rows. And remove all those rows with price NA.

1. Market Capitalization: Absolute value of price multiply shares outstanding. Then group-by PERMNO of each firm and shift down to get the value of previous month.
2. Ranking returns: cumulative log return from month t-12 through month t-2.

Output of question 1:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Year** | **Month** | **PERMNO** | **EXCHCD** | **lag\_Mkt\_Cap** | **RET** | **Ranking\_Ret** |
| 0 | 1986 | 1 | 10000 | 3 | NaN | NaN | NaN |
| 1 | 1986 | 2 | 10000 | 3 | 1.61E+04 | -0.257143 | NaN |
| 2 | 1986 | 3 | 10000 | 3 | 1.20E+04 | 0.365385 | NaN |
| 3 | 1986 | 4 | 10000 | 3 | 1.63E+04 | -0.098592 | NaN |
| 4 | 1986 | 5 | 10000 | 3 | 1.52E+04 | -0.222656 | NaN |
| 5 | 1986 | 6 | 10000 | 3 | 1.18E+04 | -0.005025 | NaN |
| 6 | 1986 | 7 | 10000 | 3 | 1.17E+04 | -0.080808 | NaN |
| 7 | 1986 | 8 | 10000 | 3 | 1.08E+04 | -0.615385 | NaN |
| 8 | 1986 | 9 | 10000 | 3 | 4.15E+03 | -0.057143 | NaN |
| 9 | 1986 | 10 | 10000 | 3 | 3.91E+03 | -0.242424 | NaN |
| 10 | 1986 | 11 | 10000 | 3 | 3.00E+03 | 0.06 | NaN |
| 11 | 1986 | 12 | 10000 | 3 | 3.18E+03 | -0.377358 | NaN |
| 12 | 1987 | 1 | 10000 | 3 | 1.98E+03 | -0.212121 | NaN |
| 13 | 1987 | 2 | 10000 | 3 | 1.58E+03 | 0 | -2.138282 |
| 14 | 1987 | 3 | 10000 | 3 | 1.58E+03 | -0.384615 | -2.079441 |
| 15 | 1987 | 4 | 10000 | 3 | 9.73E+02 | -0.0625 | -2.390877 |
| 16 | 1987 | 5 | 10000 | 3 | 9.12E+02 | -0.066667 | -2.772587 |
| 17 | 1987 | 6 | 10000 | 3 | 8.52E+02 | 0 | -2.585254 |
| 18 | 1986 | 1 | 10001 | 3 | NaN | NaN | NaN |
| 19 | 1986 | 2 | 10001 | 3 | 6.03E+03 | 0.020408 | NaN |
| 20 | 1986 | 3 | 10001 | 3 | 6.16E+03 | 0.0252 | NaN |
| 21 | 1986 | 4 | 10001 | 3 | 6.22E+03 | 0.009901 | NaN |
| 22 | 1986 | 5 | 10001 | 3 | 6.28E+03 | -0.009804 | NaN |
| 23 | 1986 | 6 | 10001 | 3 | 6.22E+03 | -0.013069 | NaN |
| 24 | 1986 | 7 | 10001 | 3 | 6.03E+03 | -0.010204 | NaN |
| 25 | 1986 | 8 | 10001 | 3 | 5.97E+03 | 0.072165 | NaN |
| 26 | 1986 | 9 | 10001 | 3 | 6.40E+03 | -0.003077 | NaN |
| 27 | 1986 | 10 | 10001 | 3 | 6.32E+03 | 0.039216 | NaN |
| 28 | 1986 | 11 | 10001 | 3 | 6.57E+03 | 0.056604 | NaN |
| 29 | 1986 | 12 | 10001 | 3 | 6.94E+03 | 0.015 | NaN |
| ... | ... | ... | ... | ... | ... | ... | ... |
| 3545347 | 2016 | 7 | 93436 | 3 | 3.14E+07 | 0.106039 | -0.183756 |
| 3545348 | 2016 | 8 | 93436 | 3 | 3.49E+07 | -0.097023 | -0.226156 |
| 3545349 | 2016 | 9 | 93436 | 3 | 3.16E+07 | -0.03764 | -0.059004 |
| 3545350 | 2016 | 10 | 93436 | 3 | 3.06E+07 | -0.030878 | -0.158409 |
| 3545351 | 2016 | 11 | 93436 | 3 | 2.96E+07 | -0.042128 | -0.014116 |
| 3545352 | 2016 | 12 | 93436 | 3 | 2.84E+07 | 0.128247 | -0.152309 |
| 3545353 | 2017 | 1 | 93436 | 3 | 3.45E+07 | 0.178951 | -0.236822 |
| 3545354 | 2017 | 2 | 93436 | 3 | 4.07E+07 | -0.007701 | 0.111205 |
| 3545355 | 2017 | 3 | 93436 | 3 | 4.04E+07 | 0.113244 | 0.272019 |
| 3545356 | 2017 | 4 | 93436 | 3 | 4.57E+07 | 0.12853 | 0.08434 |
| 3545357 | 2017 | 5 | 93436 | 3 | 5.16E+07 | 0.085777 | 0.144897 |
| 3545358 | 2017 | 6 | 93436 | 3 | 5.60E+07 | 0.060409 | 0.341411 |
| 3545359 | 2017 | 7 | 93436 | 3 | 6.03E+07 | -0.105473 | 0.474004 |
| 3545360 | 2017 | 8 | 93436 | 3 | 5.40E+07 | 0.100257 | 0.431873 |
| 3545361 | 2017 | 9 | 93436 | 3 | 5.94E+07 | -0.041585 | 0.422471 |
| 3545362 | 2017 | 10 | 93436 | 3 | 5.73E+07 | -0.028056 | 0.556382 |
| 3545363 | 2017 | 11 | 93436 | 3 | 5.57E+07 | -0.06841 | 0.545272 |
| 3545364 | 2017 | 12 | 93436 | 3 | 5.19E+07 | 0.008095 | 0.559856 |
| 3545365 | 2018 | 1 | 93436 | 3 | 5.26E+07 | 0.13798 | 0.368329 |
| 3545366 | 2018 | 2 | 93436 | 3 | 5.98E+07 | -0.031752 | 0.211766 |
| 3545367 | 2018 | 3 | 93436 | 3 | 5.79E+07 | -0.224246 | 0.348752 |
| 3545368 | 2018 | 4 | 93436 | 3 | 4.52E+07 | 0.104347 | 0.209206 |
| 3545369 | 2018 | 5 | 93436 | 3 | 4.99E+07 | -0.031201 | -0.165629 |
| 3545370 | 2018 | 6 | 93436 | 3 | 4.83E+07 | 0.204474 | -0.148671 |
| 3545371 | 2018 | 7 | 93436 | 3 | 5.85E+07 | -0.13066 | -0.239024 |
| 3545372 | 2018 | 8 | 93436 | 3 | 5.09E+07 | 0.011806 | 0.058479 |
| 3545373 | 2018 | 9 | 93436 | 3 | 5.15E+07 | -0.12229 | -0.177086 |
| 3545374 | 2018 | 10 | 93436 | 3 | 4.54E+07 | 0.274011 | -0.122874 |
| 3545375 | 2018 | 11 | 93436 | 3 | 5.79E+07 | 0.039013 | -0.224856 |
| 3545376 | 2018 | 12 | 93436 | 3 | 6.02E+07 | -0.050445 | 0.088176 |

**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.

1. DM decile: For each month, rank each firm’s ranking return. we set our breakpoints so that there are an equal number of firms in each portfolio. And the ranking return is from low to high with decile 1 to decile 10.
2. KRF decile: Create breakpoints based on only NYSE stocks ranking return. Then divide all the returns based on those breakpoints into 10 deciles, with decile 1 the lowest and decile 10 the highest. If a firm’s ranking return is lower than the first breakpoint, it would be classified as decile 1, and if a firm’s ranking return is higher than the last breakpoint, it would be considered as decile 10.

Output of question 2

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Year** | **Month** | **PERMNO** | **lag\_Mkt\_Cap** | **RET** | **DM\_decile** | **KRF\_decile** |
| 0 | 1986 | 1 | 10000 | NaN | NaN | NaN | 10 |
| 1 | 1986 | 2 | 10000 | 1.61E+04 | -0.257143 | NaN | 10 |
| 2 | 1986 | 3 | 10000 | 1.20E+04 | 0.365385 | NaN | 10 |
| 3 | 1986 | 4 | 10000 | 1.63E+04 | -0.098592 | NaN | 10 |
| 4 | 1986 | 5 | 10000 | 1.52E+04 | -0.222656 | NaN | 10 |
| 5 | 1986 | 6 | 10000 | 1.18E+04 | -0.005025 | NaN | 10 |
| 6 | 1986 | 7 | 10000 | 1.17E+04 | -0.080808 | NaN | 10 |
| 7 | 1986 | 8 | 10000 | 1.08E+04 | -0.615385 | NaN | 10 |
| 8 | 1986 | 9 | 10000 | 4.15E+03 | -0.057143 | NaN | 10 |
| 9 | 1986 | 10 | 10000 | 3.91E+03 | -0.242424 | NaN | 10 |
| 10 | 1986 | 11 | 10000 | 3.00E+03 | 0.06 | NaN | 10 |
| 11 | 1986 | 12 | 10000 | 3.18E+03 | -0.377358 | NaN | 10 |
| 12 | 1987 | 1 | 10000 | 1.98E+03 | -0.212121 | NaN | 10 |
| 13 | 1987 | 2 | 10000 | 1.58E+03 | 0 | 1 | 1 |
| 14 | 1987 | 3 | 10000 | 1.58E+03 | -0.384615 | 1 | 1 |
| 15 | 1987 | 4 | 10000 | 9.73E+02 | -0.0625 | 1 | 1 |
| 16 | 1987 | 5 | 10000 | 9.12E+02 | -0.066667 | 1 | 1 |
| 17 | 1987 | 6 | 10000 | 8.52E+02 | 0 | 1 | 1 |
| 18 | 1986 | 1 | 10001 | NaN | NaN | NaN | 10 |
| 19 | 1986 | 2 | 10001 | 6.03E+03 | 0.020408 | NaN | 10 |
| 20 | 1986 | 3 | 10001 | 6.16E+03 | 0.0252 | NaN | 10 |
| 21 | 1986 | 4 | 10001 | 6.22E+03 | 0.009901 | NaN | 10 |
| 22 | 1986 | 5 | 10001 | 6.28E+03 | -0.009804 | NaN | 10 |
| 23 | 1986 | 6 | 10001 | 6.22E+03 | -0.013069 | NaN | 10 |
| 24 | 1986 | 7 | 10001 | 6.03E+03 | -0.010204 | NaN | 10 |
| 25 | 1986 | 8 | 10001 | 5.97E+03 | 0.072165 | NaN | 10 |
| 26 | 1986 | 9 | 10001 | 6.40E+03 | -0.003077 | NaN | 10 |
| 27 | 1986 | 10 | 10001 | 6.32E+03 | 0.039216 | NaN | 10 |
| 28 | 1986 | 11 | 10001 | 6.57E+03 | 0.056604 | NaN | 10 |
| 29 | 1986 | 12 | 10001 | 6.94E+03 | 0.015 | NaN | 10 |
| ... | ... | ... | ... | ... | ... | ... | ... |
| 3545347 | 2016 | 7 | 93436 | 3.14E+07 | 0.106039 | 4 | 4 |
| 3545348 | 2016 | 8 | 93436 | 3.49E+07 | -0.097023 | 4 | 3 |
| 3545349 | 2016 | 9 | 93436 | 3.16E+07 | -0.03764 | 4 | 4 |
| 3545350 | 2016 | 10 | 93436 | 3.06E+07 | -0.030878 | 3 | 2 |
| 3545351 | 2016 | 11 | 93436 | 2.96E+07 | -0.042128 | 5 | 4 |
| 3545352 | 2016 | 12 | 93436 | 2.84E+07 | 0.128247 | 4 | 3 |
| 3545353 | 2017 | 1 | 93436 | 3.45E+07 | 0.178951 | 2 | 1 |
| 3545354 | 2017 | 2 | 93436 | 4.07E+07 | -0.007701 | 4 | 3 |
| 3545355 | 2017 | 3 | 93436 | 4.04E+07 | 0.113244 | 6 | 6 |
| 3545356 | 2017 | 4 | 93436 | 4.57E+07 | 0.12853 | 4 | 4 |
| 3545357 | 2017 | 5 | 93436 | 5.16E+07 | 0.085777 | 5 | 5 |
| 3545358 | 2017 | 6 | 93436 | 5.60E+07 | 0.060409 | 8 | 9 |
| 3545359 | 2017 | 7 | 93436 | 6.03E+07 | -0.105473 | 9 | 10 |
| 3545360 | 2017 | 8 | 93436 | 5.40E+07 | 0.100257 | 9 | 10 |
| 3545361 | 2017 | 9 | 93436 | 5.94E+07 | -0.041585 | 9 | 10 |
| 3545362 | 2017 | 10 | 93436 | 5.73E+07 | -0.028056 | 10 | 10 |
| 3545363 | 2017 | 11 | 93436 | 5.57E+07 | -0.06841 | 9 | 10 |
| 3545364 | 2017 | 12 | 93436 | 5.19E+07 | 0.008095 | 10 | 10 |
| 3545365 | 2018 | 1 | 93436 | 5.26E+07 | 0.13798 | 9 | 9 |
| 3545366 | 2018 | 2 | 93436 | 5.98E+07 | -0.031752 | 7 | 7 |
| 3545367 | 2018 | 3 | 93436 | 5.79E+07 | -0.224246 | 9 | 9 |
| 3545368 | 2018 | 4 | 93436 | 4.52E+07 | 0.104347 | 8 | 7 |
| 3545369 | 2018 | 5 | 93436 | 4.99E+07 | -0.031201 | 3 | 2 |
| 3545370 | 2018 | 6 | 93436 | 4.83E+07 | 0.204474 | 3 | 2 |
| 3545371 | 2018 | 7 | 93436 | 5.85E+07 | -0.13066 | 2 | 2 |
| 3545372 | 2018 | 8 | 93436 | 5.09E+07 | 0.011806 | 5 | 5 |
| 3545373 | 2018 | 9 | 93436 | 5.15E+07 | -0.12229 | 2 | 1 |
| 3545374 | 2018 | 10 | 93436 | 4.54E+07 | 0.274011 | 3 | 2 |
| 3545375 | 2018 | 11 | 93436 | 5.79E+07 | 0.039013 | 2 | 2 |
| 3545376 | 2018 | 12 | 93436 | 6.02E+07 | -0.050445 | 7 | 8 |

**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.

1. DM Ret: Every month, for each decile, calculate the value weighted return. And the weight is the lagged market cap of each firm divided by the total market capitalization within the same month and same decile.
2. KRF Ret: It’s similar to DM Ret except that the KRF decile is used to calculate KRF Ret instead of DM decile.
3. RF is from FF\_mkt with the values divided by 100, so that the all the values are formatted in decimal (not percent)

Output of question 3

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Year** | **Month** | **RF** | **decile** | **DM\_Ret** | **KRF\_Ret** |
| 0 | 1927 | 1 | 0.0025 | 1 | -0.032149 | -0.032149 |
| 1 | 1927 | 1 | 0.0025 | 2 | -0.039637 | -0.039637 |
| 2 | 1927 | 1 | 0.0025 | 3 | 0.026585 | 0.026585 |
| 3 | 1927 | 1 | 0.0025 | 4 | 0.001283 | 0.001283 |
| 4 | 1927 | 1 | 0.0025 | 5 | -0.005852 | -0.004959 |
| 5 | 1927 | 1 | 0.0025 | 6 | 0.00747 | 0.006211 |
| 6 | 1927 | 1 | 0.0025 | 7 | 0.006932 | 0.006932 |
| 7 | 1927 | 1 | 0.0025 | 8 | 0.004339 | 0.004339 |
| 8 | 1927 | 1 | 0.0025 | 9 | -0.004112 | -0.004112 |
| 9 | 1927 | 1 | 0.0025 | 10 | -0.002769 | -0.002769 |
| 10 | 1927 | 2 | 0.0026 | 1 | 0.069617 | 0.069617 |
| 11 | 1927 | 2 | 0.0026 | 2 | 0.058773 | 0.058773 |
| 12 | 1927 | 2 | 0.0026 | 3 | 0.081154 | 0.081154 |
| 13 | 1927 | 2 | 0.0026 | 4 | 0.072006 | 0.072006 |
| 14 | 1927 | 2 | 0.0026 | 5 | 0.033876 | 0.033876 |
| 15 | 1927 | 2 | 0.0026 | 6 | 0.031713 | 0.031713 |
| 16 | 1927 | 2 | 0.0026 | 7 | 0.042339 | 0.042339 |
| 17 | 1927 | 2 | 0.0026 | 8 | 0.030973 | 0.030973 |
| 18 | 1927 | 2 | 0.0026 | 9 | 0.043915 | 0.043915 |
| 19 | 1927 | 2 | 0.0026 | 10 | 0.06996 | 0.06996 |
| 20 | 1927 | 3 | 0.003 | 1 | -0.031291 | -0.031291 |
| 21 | 1927 | 3 | 0.003 | 2 | -0.027749 | -0.027749 |
| 22 | 1927 | 3 | 0.003 | 3 | -0.051911 | -0.051911 |
| 23 | 1927 | 3 | 0.003 | 4 | -0.040301 | -0.040301 |
| 24 | 1927 | 3 | 0.003 | 5 | -0.004266 | -0.004182 |
| 25 | 1927 | 3 | 0.003 | 6 | -0.023466 | -0.023476 |
| 26 | 1927 | 3 | 0.003 | 7 | 0.020534 | 0.020534 |
| 27 | 1927 | 3 | 0.003 | 8 | 0.00907 | 0.00907 |
| 28 | 1927 | 3 | 0.003 | 9 | -0.000505 | -0.000505 |
| 29 | 1927 | 3 | 0.003 | 10 | 0.060651 | 0.060651 |
| ... | ... | ... | ... | ... | ... | ... |
| 11010 | 2018 | 10 | 0.0019 | 1 | -0.137266 | -0.08918 |
| 11011 | 2018 | 10 | 0.0019 | 2 | -0.073184 | -0.066046 |
| 11012 | 2018 | 10 | 0.0019 | 3 | -0.063881 | -0.052297 |
| 11013 | 2018 | 10 | 0.0019 | 4 | -0.046592 | -0.066841 |
| 11014 | 2018 | 10 | 0.0019 | 5 | -0.063844 | -0.042312 |
| 11015 | 2018 | 10 | 0.0019 | 6 | -0.059006 | -0.063958 |
| 11016 | 2018 | 10 | 0.0019 | 7 | -0.059502 | -0.057795 |
| 11017 | 2018 | 10 | 0.0019 | 8 | -0.073969 | -0.073276 |
| 11018 | 2018 | 10 | 0.0019 | 9 | -0.077667 | -0.073355 |
| 11019 | 2018 | 10 | 0.0019 | 10 | -0.169192 | -0.155975 |
| 11020 | 2018 | 11 | 0.0018 | 1 | -0.089414 | -0.007122 |
| 11021 | 2018 | 11 | 0.0018 | 2 | 0.016826 | 0.010207 |
| 11022 | 2018 | 11 | 0.0018 | 3 | 0.016105 | 0.015867 |
| 11023 | 2018 | 11 | 0.0018 | 4 | 0.016084 | 0.032113 |
| 11024 | 2018 | 11 | 0.0018 | 5 | 0.042792 | 0.04661 |
| 11025 | 2018 | 11 | 0.0018 | 6 | 0.038227 | 0.037397 |
| 11026 | 2018 | 11 | 0.0018 | 7 | 0.036529 | 0.030862 |
| 11027 | 2018 | 11 | 0.0018 | 8 | -0.008921 | -0.025627 |
| 11028 | 2018 | 11 | 0.0018 | 9 | -0.000128 | 0.014167 |
| 11029 | 2018 | 11 | 0.0018 | 10 | 0.025245 | 0.016331 |
| 11030 | 2018 | 12 | 0.0019 | 1 | -0.143062 | -0.120715 |
| 11031 | 2018 | 12 | 0.0019 | 2 | -0.122419 | -0.129939 |
| 11032 | 2018 | 12 | 0.0019 | 3 | -0.106922 | -0.094175 |
| 11033 | 2018 | 12 | 0.0019 | 4 | -0.099359 | -0.109982 |
| 11034 | 2018 | 12 | 0.0019 | 5 | -0.106238 | -0.094017 |
| 11035 | 2018 | 12 | 0.0019 | 6 | -0.103889 | -0.102173 |
| 11036 | 2018 | 12 | 0.0019 | 7 | -0.085488 | -0.087433 |
| 11037 | 2018 | 12 | 0.0019 | 8 | -0.084585 | -0.083863 |
| 11038 | 2018 | 12 | 0.0019 | 9 | -0.086423 | -0.089132 |
| 11039 | 2018 | 12 | 0.0019 | 10 | -0.096714 | -0.082738 |

**Question 4**

Replicate Table 1 in Daniel and Moskowitz (2016), except for α, t(α), β, and sk(d) rows, and

the Market column. Match the format and methodology to the extent possible.

1. : For each decile, use DM Ret – risk free rate and take mean. For WML, use decile 10 DM Ret minus decile 1 DM Ret within the same month and take mean. Annualize the returns by multiplying 12.
2. : For each decile, use DM Ret – risk free rate and take standard deviation. For WML, use decile 10 DM Ret minus decile 1 DM Ret within the same month and take standard deviation. Annualized the standard deviation by multiplying .
3. Sharpe Ratio: For each decile and WML, divide the mean of excess returns by the standard deviation of excess returns.
4. Skewness: get the skewness of log return (), not excess return) for each decile and WML.

Output of question 4:

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Decile 1** | **Decile 2** | **Decile 3** | **Decile 4** | **Decile 5** | **Decile 6** | **Decile 7** | **Decile 8** | **Decile 9** | **Decile 10** | **WML** |
| r-rf | -2.591369 | 2.983509 | 3.229266 | 6.738536 | 7.358823 | 7.369948 | 9.16303 | 10.398843 | 11.370146 | 15.41103 | 18.002398 |
| sigma | 36.29425 | 29.970158 | 25.397386 | 22.610608 | 21.086976 | 20.005442 | 19.052836 | 18.720591 | 20.006936 | 23.482116 | 29.707564 |
| SR | -0.071399 | 0.099549 | 0.12715 | 0.298025 | 0.348975 | 0.368397 | 0.480927 | 0.555476 | 0.56831 | 0.656288 | 0.605987 |
| sk(m) | 0.090863 | -0.112228 | -0.161372 | 0.12804 | -0.097117 | -0.213306 | -0.588894 | -0.528671 | -0.753682 | -0.809576 | -5.044175 |

**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.

1. Get the correlation of my replicated DM return with the data from Daniel’s website for each decile. And to the same for FRF.

Output for question 5

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Decile 1** | **Decile 2** | **Decile 3** | **Decile 4** | **Decile 5** | **Decile 6** | **Decile 7** | **Decile 8** | **Decile 9** | **Decile 10** | **WML** |
| DM correlation | 0.9981 | 0.9987 | 0.9987 | 0.9982 | 0.9980 | 0.9984 | 0.9987 | 0.9990 | 0.9987 | 0.9985 | 0.9964 |
| KRF correlation | 0.9979 | 0.9984 | 0.9980 | 0.9977 | 0.9981 | 0.9977 | 0.9976 | 0.9988 | 0.9985 | 0.9990 | 0.9960 |

**Question 6**

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

Yes, the momentum has worked anomaly in the past few years.



Suppose I had 0 investment on both Momentum WML and Market – RF, prior to 2008, momentum portfolio is much better than market portfolio. However, once the financial crisis happened, there was huge loss on momentum portfolio, and it continued underperform market portfolio.

**Question 7**

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

No, I would not implement this strategy. If it was in long time ago, I would consider this strategy. However, momentum has worked anomaly in recent few years, especially during the financial crisis.

The main implementation challenge is that the turnover is too frequent. The transaction cost will be too high. In addition, sometimes it’s difficult to short stocks for the expected price or volume.