# Financial Ratio Quantile Strategies

## Name: Qiqi Chen

## Student ID: 12249648

1. Universe Defining

   To choose at least 200 tickers of US equities that satisfy the requests, I did following steps to finally get 326 tickers.

   (1) Firstly, I downloaded all the tickers that ZACK/FC provides information, and chose tickers that are in 'NYSE' and 'NSDQ' and also have a status indicating they are active.

   (2) Since filtering tickers by sector and industry code is relatively easier, I used sector code from ZACK/FC to remove tickers from automotive, finance and insurance industry.

   (3) Because we need to find tickers that are actively traded from Jan 2012 through Jan 2019, I removed tickers that may be removed from the exchange before Jan 2012 and tickers that don't have any per_end_date later than Jan 2019.

   (4) Then I worked on the debt to market cap ratio from ZACK/FR. The tickers need to have tot_debt_tot_cap data from Jan 2012 through Jan 2019 and the ratio needs to be generally larger than 0.1.

   (5) After all those filtrations above, I obtained the tickers that EOD data provides and got the overlap between tickers from both sides. Then I removed tickers that didn't have EOD data earlier than Jan 2012.

   (6) The final step of tickers filtration occurred when I tried to calculate the debt to market cap ratio. I found there's mismatch of per_end_date for some tickers in the data ZACK/FC and ZACK/MKTV. So, I dropped those tickers.

2. Financial Ratios

   (1) Ratio Definition

   Debt to Market Cap:  It is total liability divided by total equity, a corporate finance concept. It measures the financial leverage of a company and reflects the company's financial structure. When the ratio is higher, the company has a higher leverage.

   Return on Investment:  It is net profit divided by the sum of market cap and long-term debt. It measures the company's profitability.

   Price to Earning: It is stock price per share divided by earnings per share. From my perspective, it reflects how much the market are willing to pay for the earnings behind one share stock.

   (2) Ratio Calculation

   The ratios need to be adjusted day by day since stock price is changing and market cap is also changing.

   For Debt to Market Cap, I used tot_debt_tot_cap and mkt_val from ZACKS/FR and ZACKS/MKTV to get quarterly total debt data. Then I calculated quarterly shares data by using fiscal end date price to divide the mkt_val. Since filing date is later than fiscal end date. For date between each two filing dates, the debt to market cap is calculated with the total debt corresponding to last filing date and daily updated market cap, which is shares * Adj_Close.

For <u>Return on Investment</u>, the process is similar. I used mkt_val and ret_invst from ZACKS/MKTV and ZACKS/FR to get quarterly total return. From ZACKS/FC, we have net_lterm_debt(when it's null, replaced by tot_lterm_debt). For date between each two filing date, the return on investment is calculated with quarterly total return and the sum of long-term debt and daily updated market cap.

For <u>Price to Earning</u>, I used eps_diluted_net from ZACKS/FC (when it's null, replaced by basic_net_eps). We only know the quarterly earnings per share data after filling date so I calculated it with daily updated price divided by lagged earnings per share.

(3) Ratio Change

Since we're required to not only rank the tickers by the value of ratios but also the change of the ratios, I analyzed the meaning of changing of the ratios. Basically, I think all the three ratio changes are related to the market price since they're daily adjusted. If Debt to Market Cap surges, the company may issue bonds to increase the leverage, but the influence to stock price is complex. If Return on Investment goes up, it can be an indicator that the company's profitability increases, which I think will be the good news to stock price. If Price to Earnings increases, it can be price is soaring or earnings is decreasing. The effect is still complex since we don't know whether price will follow a mean reversion pattern or a momentum pattern.

3. Analysis on Strategy Performance

(1) Strategy

I constructed the trading strategy on a monthly basis of position sizing. For trading only with the values of ratios, at the start of every month from Feb 2012 to Jan 2019, I calculated the average ratios for each tick last month, then ranked them by the averages, long the top decile and short the bottom decile, and got returns from this month's adjusted close price data. For trading with change of ratios, I calculated the change of ratios by using the last and first appearance of the ratios data in lagged month.

For trading of with combinations of indicators, I combined all three indicators. If a stock meets the rank criterion from all three indicators, it's in my portfolio. For example, trading with combinations of all three indicators, I'll long stocks in the overlap of top decile of debt to market cap, bottom decile of ROI and bottom decile of PE and short stocks in the overlap of bottom decile of debt to market cap, top decile of ROI and top decile of PE. This can result in a potential issue that in some months, there're no such stocks meet the criterion.

I basically assumed a same gross notional trading value over the whole period. And every ticker in the portfolio have the same weight. I chose equal weighted method since the effects of fundamentals can be more obvious in the result. I assumed a constant funding rate, but in the analysis below I use the raw return, not the excess return.

(2) Performance
I summarized the statistics of returns of totally 8 strategies in the tables below.

|  | debt to market cap | return on investment | price to earnings |
|---|---|---|---|
| count | 84 | 84 | 84 |
| mean | 0.004032 | -0.000062 | -0.000371 |
| std | 0.014225 | 0.022415 | 0.014027 |
| min | -0.047352 | -0.076408 | -0.033888 |
| 25% | -0.005171 | -0.014519 | -0.008674 |
| 50% | 0.004316 | -0.001975 | -0.000207 |
| 75% | 0.014179 | 0.013493 | 0.007757 |
| max | 0.037829 | 0.047880 | 0.036213 |

|  | d_dtc | d_roi | d_pe |
|---|---|---|---|
| count | 84 | 84 | 84 |
| mean | 0.001409 | 0.003855 | -0.000758 |
| std | 0.017595 | 0.015298 | 0.014919 |
| min | -0.072246 | -0.035744 | -0.048513 |
| 25% | -0.008428 | -0.006619 | -0.007262 |
| 50% | 0.000046 | 0.002020 | 0.001261 |
| 75% | 0.010039 | 0.011989 | 0.008364 |
| max | 0.046541 | 0.050806 | 0.028951 |

|  | combination of 3 ratios | combination of 3 ratios change |
|---|---|---|
| count | 61 | 67 |
| mean | 0.024100 | -0.007622 |
| std | 0.085930 | 0.065718 |
| min | -0.138063 | -0.398844 |
| 25% | -0.035798 | -0.017432 |
| 50% | 0.019803 | -0.004292 |
| 75% | 0.075553 | 0.014003 |
| max | 0.227833 | 0.141002 |

Firstly, we can notice that all the strategies based on single indicators don't have impressing performance since their t ratios of the mean is relatively very small. But it's worth mentioning that the leverage indicator itself can have a positive effect on the stock price, which means higher leverage may lead to higher stock return. Also, the up-moving ROI may also be the good news to stock data. The monthly Sharpe of the strategy ranking by debt to market cap only is 0.2834 with benchmark return to be 0. The monthly Sharpe of the strategy ranking by change of ROI only is 0.2520 with benchmark return to be 0.

Then from the table that shows the performance of combination of 3 ratios, we can see the mean of monthly return after implementing a combination of 3 ratios as ranking indicators is largely improved. That's how fundamental factors work in the stock portfolio managing and it's not surprising. Still, the Sharpe is not good, only 0.2805.

As to the combination of three ratio's changes, the mean return is not impressing probably there is no logic showing the changes of three ratios can affect the stock price simultaneously.
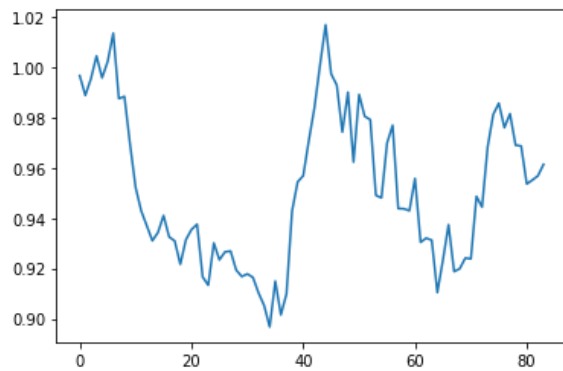
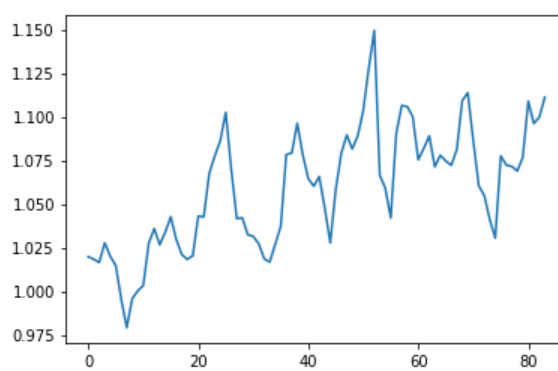Finally, I attached the cumulative return plot of all eight scores.
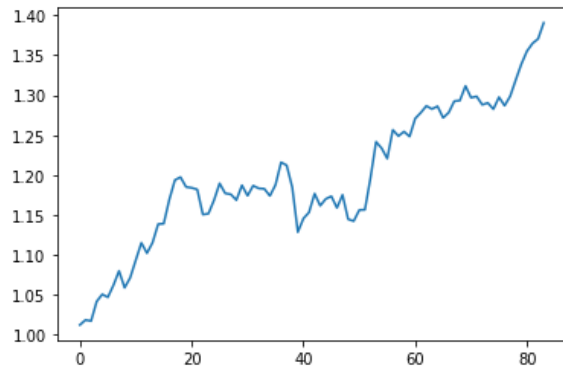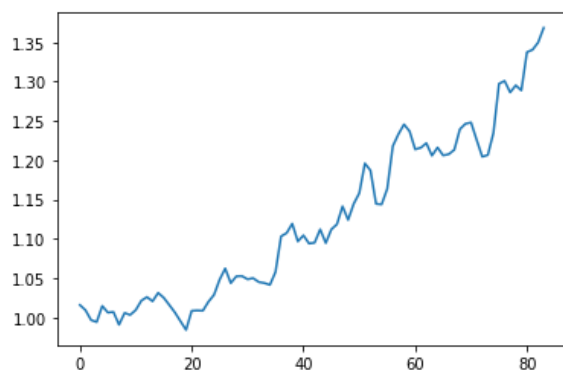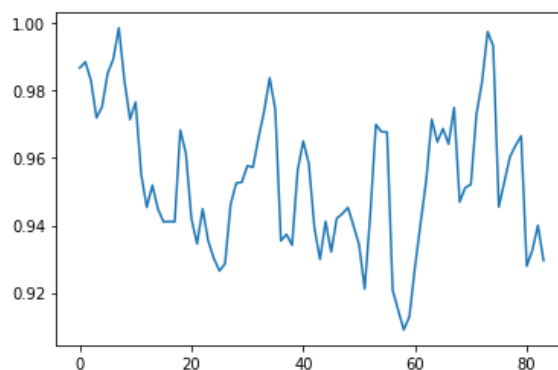


Debt to Market Cap
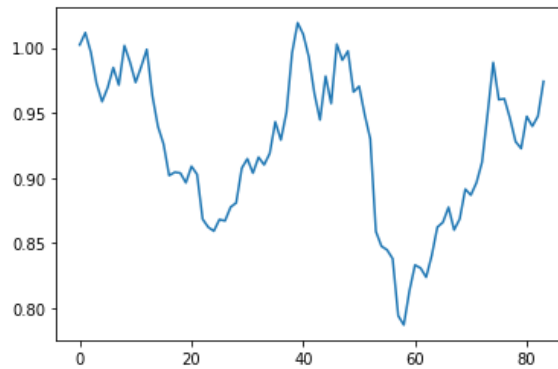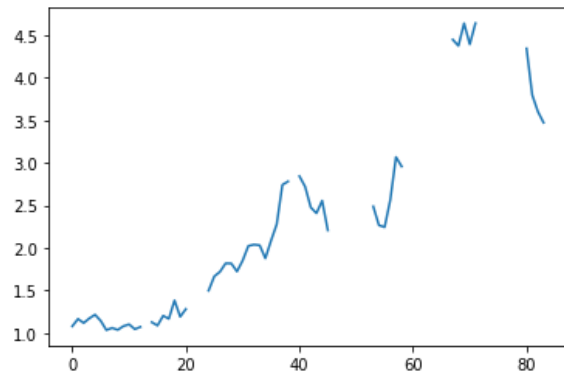
Return on Investment

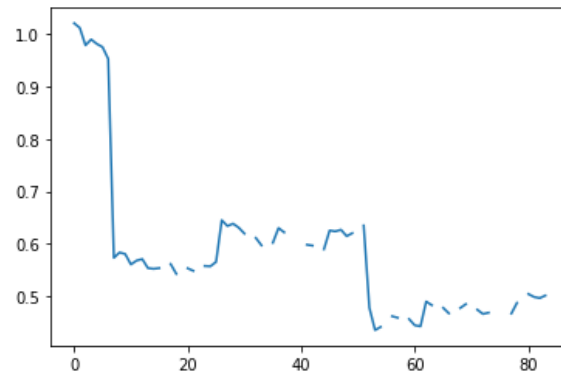Price to Earnings

Change of Debt to Market Cap

Change of Return on Investment

Change of Price to Earnings

| Combinations of three ratios | Combinations of three ratios change |

From all these plots, we can see when only use one indicator, the cumulative returns of Debt to Market Cap strategy and Change of ROI strategy are worth noticing because they are more steadily moving, which correspond to our statistics of the strategy returns.

We can notice there are lots of gaps between cumulative returns in the combination strategy. That's because in some months we may be not able to find stocks meeting our criterions to include it in our portfolio. And that's due to our small universe of only 326 tickers. But the cumulative return of Combination of three ratios strategy is also moving upward steadily.