HW: Financial Ratio Quantile Strategies

January 23, 2025

1 Introduction

Here you will consider a few financial accounting ratios, as an approximation of "quantamental" models that typically take much more numerous and carefully defined financial accounting into consideration. You will then investigate profit opportunity of a quantile-based long-short scheme.

2 Understand Your Data

Read all Nasdaq documentation webpages for *Zacks Fundamentals B*. You will see they supply 6 related tables, FC, FR, MT, MKTV, SHRC and HDM. The strategy coding for this assignment will be reasonably easy. The data assembly, deliberately, is the difficult part.

3 Define the Universe

Choose at least 200 tickers[1] of US equities such that[2] they satisfy the following:

- end-of-day adjusted closing prices are available , over the entire period Jan 2017 through Jun 2024

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[1]You can find the full list of available tickers online

[2]We will not concern ourselves with *selection bias* in this exercise.

- the market value (as reported in MKTV[3]) never dips below \$1MM, over the entire period Jan 2017 through Jun 2024

- debt/market_cap ratio is greater[4] than 0.1 somewhere in the period Jan 2017 through Jun 2024(preferably more than fleetingly)

- not in the automotive, financial or insurance sector , over the entire period Jan 2017 through Jun 2024[5]

- has feasible calculation of the ratios specified below , over the entire period Jan 2017 through Jun 2024, including for at least one `per_end_date` no more than one year old. A debt ratio of zero is OK.

You will find that these restrictions leave an "investable universe" of 1000+ companies.

4 Select Financial Ratios

For this assignment, we will work with the following ratios:

- debt to market cap[6].

- return on investment[7]

- price to earnings[8]

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[3]The table reports market values in units of thousands of dollars. The resriction here cuts our population to 4000+ companies.

[4]This is about 1000-2000 companies, including BOWL, GGG, PBF and VSAT.

[5]See the Nasdaq Zacks ZFB fields `zacks_sector_code`, `zacks_x_ind_code`, and the classification list

[6] `FR/tot_debt_tot_equity` in Nasdaq Zacks. In this homework we pretend that it is OK to treat market capitalization and book equity as equivalent, though they are not the same thing.

[7] Based on `FR/ret_invst`, `MKTV/mkt_val, FC/net_lterm_debt`, `FC/tot_lterm_debt`. Investment is defined here as market cap plus long term debt. Use net debt where available, total debt otherwise. Nasdaq Zacks will report debt as NaN if it was 0.0, but be careful about net versus tot debt.

[8] Compute this based on `FC/eps_diluted_net, basic_net_eps, SHRS/shares_out,` `MKTV/mkt_val`, use the basic version (GAAP) if no diluted number is available. Treat negative earnings per share as 0.001.

Note that these data items are reported (at best) quarterly. Use annual numbers *only* when quarterly ones do not exist. As the equity price changes day-to-day, each ratio changes accordingly[9], so ultimately the time series you have will be on daily data[10]. Recall that we did not know any of these numbers until the `FC/filing_date` .

As an example, consider V, return on investment. Say that our entity had successive report dates of March 31 and June 30, filing dates April 3 and July 6, so V^{3-31} and V^{6-30} were known the day after the filing dates, on April 4 and July 7. Our equity price series, which we take (also a bit problematically) as adjusted close prices, will be P^t. We have a debt number D for each report date as well.

We can infer the "return" R for a given report date as the unknown element in

$$V = \frac{R}{D + M}$$

and we assume it doesn't change day-to-day. Rather only the market value element M changes daily, and we estimate the corresponding $\tilde{V}$ values according to the filing dates. So for example our inferred values look like

$$\tilde{V}^{7\text{-}6} = \frac{R^{3\text{-}31}}{D^{3\text{-}31} + M^{7\text{-}6}}$$

but the next day is just after the filing date so we have

$$\tilde{V}^{7\text{-}7} = \frac{R^{6\text{-}30}}{D^{6\text{-}30} + M^{7\text{-}7}}$$

where

$$M^{7\text{-}6} = M^{3\text{-}31} \frac{P^{7\text{-}6}}{P^{3\text{-}31}}$$

and

$$M^{7\text{-}7} = M^{6\text{-}30} \frac{P^{7\text{-}7}}{P^{6\text{-}30}}.$$

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[9]In many cases `per_end_date` is not a trading day, so go ahead and forward fill equity price from the previous trading day.

[10]If you have memory errors when joining data, you are probably mistakenly creating a combinatorial explosion in your merging code.

5 Analysis

Study performance of weekly or monthly quantile trading strategies using each of these single ratios as well as your choice of least one nontrivial combination of them[11].

Set initial capital to be 10 times the gross notional of your first month's set of positions. You may assume zero trading costs, that trading fractional shares and arbitrary positions sizes are possible, that all securities are easy to borrow with a repo rate equal to your funding rate minus 100bp[12], and that the portfolio capital is equal to the initial capital, adjusted for all realized and unrealized PL to date. Choose either a constant funding rate, or rolling 3-month LIBOR/SOFR[13].

Analyze performance of a top-and-bottom decile trading strategy. Consider Sharpe ratios and associated metrics, risk metrics such as downside beta, tail metrics and maximum drawdown, and comparisons of PL to traded notional.

Now rank based on *changes* in your ratios rather than the ratios themselves. Play with the effects of sizing positions by rank, for example by doubling or halving the most "attractive" vigintiles, on the theory that they are either particularly attractive, or are untrustworthy outliers respectively.

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[11]That is to say, at least 4 types of scores.

[12]This repo rate may therefore sometimes become negative.

[13]Daily blended LIBOR/SOFR data is available on the class website.

6 Data Example

Here is recent sample data for Waste Management (ticker WM):

6.0.1 SEC Reports

per_end_date	2023-06-30	2023-09-30	2023-12-31	2024-03-31	2024-06-30	2024-09-30
filing_date	2023-07-26	2023-10-25	2024-02-13	2024-04-25	2024-07-25	2024-10-28
tot_revnu	5119.000000	5198.000000	5217.000000	5159.000000	5402.000000	5609.000000
eps_diluted_net	1.510000	1.630000	1.220000	1.750000	1.690000	1.880000
basic_net_eps	1.520000	1.640000	1.230000	1.760000	1.700000	1.890000
tot_lterm_debt	14855.000000	15133.000000	15895.000000	15762.000000	16501.000000	15977.000000
net_lterm_debt	282.000000	328.000000	912.000000	-158.000000	428.000000	295.000000
net_curr_debt	NaN	NaN	NaN	NaN	NaN	NaN
zacks_x_ind_code	287.000000	287.000000	287.000000	287.000000	287.000000	287.000000
zacks_sector_code	16.000000	16.000000	16.000000	16.000000	16.000000	16.000000
zacks_metrics_ind_code	NaN	NaN	NaN	NaN	NaN	NaN
tot_debt_tot_equity	2.218200	2.215000	2.353400	2.274400	2.247100	2.088900
ret_invst	2.814100	2.995600	2.057800	3.095400	2.839000	3.173400
free_cash_flow_per_share	2.192800	3.656100	4.482700	1.732300	2.941500	4.372500
shares_out	405.060000	402.770000	402.770000	401.080000	401.320000	401.370000
per_type	Q	Q	Q	Q	Q	Q
mkt_val	70245.410000	61399.090000	72137.080000	85490.860000	85616.500000	83323.490000

6.0.2 Ratios On Key Dates

(Using MKTV/mkt_val, FC/net_lterm_debt to infer operating income)

Date	Debt_To_Mkt_Cap	Return_On_Inv	Price_To_Earnings
2022-10-26	1.891277	2.634588	109.896458
2022-10-27	2.029799	3.106361	99.569072
2022-12-30	2.040269	3.122265	99.058098
2023-01-03	2.038320	3.119305	99.152812
2023-02-07	2.115096	3.235886	95.553684
2023-02-08	2.270112	2.423785	121.236072
2023-03-31	2.089139	2.234389	131.738209
2023-04-03	2.080215	2.225033	132.303367
2023-04-27	2.109044	2.255253	130.494863
2023-04-28	2.218444	2.393665	124.782115
2023-06-30	2.115070	2.282654	130.880818
2023-07-03	2.139997	2.309427	129.356315
2023-07-26	2.223811	2.399427	124.480925
2023-07-27	2.346040	2.975598	106.538755
2023-09-29	2.512278	3.185491	99.489084
2023-10-02	2.532714	3.211284	98.686332
2023-10-25	2.334197	2.960639	107.079336
2023-10-26	2.073791	2.805577	98.440449
2023-12-29	1.877599	2.541350	108.726575
2024-01-02	1.872267	2.534167	109.036182
2024-02-13	1.685688	2.282649	121.104771
2024-02-14	2.116358	1.852862	161.536257
2024-03-28	1.970425	1.726437	173.499906
2024-04-01	1.972646	1.728362	173.304551
2024-04-25	1.974594	1.730051	173.133615
2024-04-26	2.307417	3.140420	119.223466
2024-06-28	2.272374	3.092638	121.062038
2024-07-01	2.315573	3.151541	118.803545
2024-07-25	2.424912	3.300647	113.446717
2024-07-26	2.433978	3.073831	115.735094