

# Prompt: Piotroski Strategy

## Purpose

The purpose of this prompt is twofold. First, this prompt is meant to familiarize you with another aspect of systematic investing, which is using rules to evaluate the fundamental strength of companies. The leveraged ETF beta slippage strategy that we discussed earlier is heavily focused on quantitative analysis, and because diversification is an important way of limiting risk, deploying a strategy based on companies' fundamentals will provide an interesting variation to the quantitative approach.

Second, the simplicity of the strategy will serve as a good test for you, and it will allow you to easily manipulate the rules we are setting in place. Because these rules are limited in number and intuitive in understanding, you should have little trouble with it. I have explained all the rules and the thought process down below, so please feel free to text Amit or Ogni with any questions.

## Background

The Piotroski index is a ranking system for companies which measures a firm's financial strength based on a set of 9 criteria. These criteria can range from having positive profits and having positive operating cash flows (this is accounting terminology) to having low debt and lots of assets. For each criterion that the firm meets, the firm gets one point. Therefore, with 9 criteria listed by the index, the maximum number of points a company (and each stock by consequence) is 9.

Generally, when using the Piotroski index to evaluate a company, you want the company to be either an 8 or 9 on the index. This means that the company is in good financial health (not too much debt with many assets), is profitable (makes more money than it spends), and is efficient (has a healthy margin of profit for each product). Each of these categories (health, profitability, efficiency) have multiple requirements each on the index; these requirements will ensure the Piotroski index properly differentiates between bad, good, and great companies.

Now, here are the 9 criteria used in the Piotroski index.

### *Profitability*

1. Positive net income: A company still records positive profits after all expenses, including the cost to create the product, marketing and administrative expenses, and dividends issued to investors.
2. Positive return on assets in current year: This year, the assets that the company purchases (factory equipment, intellectual property, buildings) are cumulatively making positive returns for the business.
3. Positive operating cash flow in the current year: Operating cash flow focuses on how cash moves in the company's main business activities, without worrying about investing and financing (taking on debt). Precisely, having positive operating cash flow means the costs to make/sell the product are less than the money the business brings in.
4. Operating cash flows being greater than net income: Net income is generally low because depreciation (the cost of equipment wearing out) is subtracted. In operating cash flows, because this is added back, it should generally be higher than net income. If OCF is still lower, there is generally some issue with the company's profitability.

### *Leverage and Liquidity*

1. Lower ratio of long-term debt in current period than last year: The company is paying off the debt it currently has, or is taking less debt on.
2. Higher current ratio this year than last year: The current ratio is convertible assets / debt. Convertible assets are assets that can be converted into cash within 12 months. A higher current ratio means a company has enough convertible assets to pay off its debt quickly.
3. No shares were issued in the last year: The value of a share is the market capitalization of a company / # of shares outstanding. If more shares are issued to the public, the denominator of the fraction increases and the value of the share goes down.

### *Operating Efficiency*

1. A higher gross margin than last year: Gross margin is the (revenues - cost of goods sold) / revenues. Essentially, it measures how profitable selling a product is based solely on its production costs. Improving gross margins between years means the company is growing more profitable on a per-unit basis.
2. A higher asset turnover ratio compared to previous year: Asset turnover ratio measures a company's ability to generate sales from its assets. A higher turnover ratio means the assets can generate more sales.

An example of a company that fails to meet these criteria is [Tesla](#). Tesla ranks at a 2 on this index, since it is not profitable, has incredible amounts of debt, and is not yet very efficient. [General motors](#) also only ranks 3 on the Piotroski index, suggesting that it may not be financially sound enough for a solid investment. With thousands of stocks available on the NYSE, the Piotroski index is a fast way of determining which companies are growing while still being financially responsible.

The index strategy has been backtested by both Joseph Piotroski (the creator of this index) and others who have found it effective, and the strategy has proven to produce superior returns over the long run. When backtested by its founder from 1976 to 1996, the strategy generated approximately a 23% CAGR (compounded annual growth rate). Backtested in a more contemporary setting on Investoreedge.com, this [strategy](#) produced 18.82% CAGR from 2000 to 2016. This strategy is analogous to ours, so feel free to draw on its parameters for developing this.

## Strategy

In developing this strategy, there are 3 variables that we must define; as you develop this strategy, adjust these variables to see how the overall strategy is affected.

1. *Minimum ranking for validation* - This strategy should only invest in companies that meet the minimum ranking benchmark that we set. The strategy should only invest in companies with rankings of either 8 or 9. The index should start with companies of rank 9, and then implement rank 8 companies.
2. *Number of companies held* - Developers of the strategy must find the proper number of companies that offers enough diversification without choosing poorer-quality companies and being eaten on commissions (more companies = more trades). Start off with 10 companies held in the portfolio, but please adjust upwards to find the optimized balance.
3. *Frequency of rebalancing* - Frequency of rebalancing is also a balancing game. You must find the right balance which does not trade too frequently to unnecessarily take on commissions, but also enough to keep only companies that fulfill the rankings. Start off by rebalancing at the end of every month, but adjust the frequency to find the right balance. Studies have shown selling on the 31st of each month and buying on the 1st of the following month is a profitable setup.

Other requirements in order to avoid outliers include-

1. Companies should have a [market capitalization](#) > \$50 million.
2. Companies should be US equities.

## **Deliverable**

The development of this strategy should take no longer than four hours to complete. This should be developed entirely on the [Quantopian platform](#), using the [Pipeline API](#) as needed. This should ideally be completed by our scheduled call the Sunday, but due to the added complexity due to the financial terminology, we will consider an extension to the following Sunday. Prior to the call, share a private repository on Github with [ognig](#). This repository should contain:

- The strategy copied and pasted from Quantopian
- An autogenerated Quantopian notebook of a backtest from the earliest possible date available to the Friday prior to the call