AEM 5840 - Python Programming for Data Analysis and Business Modeling

Automated Investment Platform

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Sell Strategy

We plan to develop our investment strategy based on behavioral finance and fundamental analysis. In the first phase, focusing on behavioral finance, we will filter stocks with potential using medium-term momentum and prospect theory. In the second phase, focusing on fundamental analysis, we will assign scores to the stocks based on their performance. In the third phase, we will rank and select the stocks based on their scores from the previous phases, identifying the top-performing stocks for investment.

Part 1- medium-term momentum

In behavioral finance, we learned about medium-term momentum, which refers to the phenomenon where past returns over a 2-month to 1-year period predict subsequent returns with a positive correlation. Stocks that performed well in the recent past tend to continue performing well in the near future. (Jin)

One rational, frictional explanation for this momentum effect involves mutual fund flows. When a stock performs well and has positive past returns, fund inflows follow. Mutual funds or other institutional investors respond to this performance by purchasing more of the winning stock, reinforcing its upward momentum.

Mutual funds buying more of the winning stocks drive up the stock price, sustaining the stock's medium-term momentum. For losing stocks, mutual funds sell these stocks, leading to further price declines and sustaining negative momentum for those assets.

Overall, a stock's past performance is positively correlated with its future performance, meaning winners keep winning and losers keep losing. Investors may choose to invest in stocks with good past performance because they assume these stocks are likely to continue doing well.

We plan to develop the first step of our investment strategy based on medium-term momentum. We will track market prices from the past two months to one year. The slope is calculated using a linear regression fit on the stock's adjusted closing prices over the past year, from which the direction (positive or negative) indicates the stock's momentum. If the direction is positive, indicating upward momentum, we will consider that stock as one likely to continue rising, and it will be selected for further analysis in the second phase.

Part 2- prospect theory

We can use prospect theory to understand the cross-section of stock returns, and there are three key intuitions to consider. First, investors' loss aversion implies that “assets with more volatile returns should have higher average returns, all else equal.” Second, investors' probability weighting implies that “assets with more positively skewed returns should have lower average returns, all else equal.” Third, investors' diminishing sensitivity implies that “assets with a higher capital gain overhang should have higher average returns, all else equal.” (Jin)

The first intuition—that “assets with more volatile returns should have higher average returns, all else equal”—can be explained through loss aversion. Loss aversion means that investors are more sensitive to losses than to equivalent gains. With high volatility, assets can experience significant gains or losses, and loss-averse investors will demand higher returns to compensate for the risk of large losses. Therefore, higher volatility requires higher expected returns to make holding such assets attractive.

The second intuition suggests that assets with positively skewed returns tend to have lower average returns. Probability weighting explains this, as people tend to overweight low-probability events and underweight high-probability events. This affects how investors evaluate assets with positively skewed return distributions. A positively skewed asset is one that has a small chance of a very large positive return, while the majority of the returns are smaller. For positively skewed assets, investors tend to overweight the small probability of a large positive return, which leads them to find such assets more exciting and overvalue them. Investors focus too much on the unlikely large gain, making them overly optimistic about the asset. This optimism pushes up the price, thus lowering the average return.

The third intuition—that “assets with a higher capital gain overhang should have higher average returns, all else equal”—can be explained through diminishing sensitivity. This concept means that people are less sensitive to additional gains or losses as they move further from their reference point. In the case of capital gains (i.e., assets that have increased in value since their purchase), investors prefer certain gains over uncertain ones. For assets with a positive capital gain overhang, investors may sell to lock in their gains, causing temporary underpricing. This underpricing is corrected over time, leading to higher future returns.

On the other hand, assets with a negative capital gain overhang make investors hesitant to sell due to their preference for potential losses over certain losses. This leads them to hold onto these assets or even buy more, pushing the price up temporarily and causing the asset to be overvalued. As a result, the asset will have lower future returns when the overvaluation is corrected.

Overall, high beta stocks typically demand higher returns due to their higher volatility. Negatively skewed returns may result in higher compensation for risk due to loss aversion.

Positive capital gain overhang creates temporary underpricing, which could be corrected over time, resulting in higher future returns.

Based on the insights from prospect theory, selecting stocks with high beta, negatively skewed returns, and higher capital gain overhang could indicate potentially good investment opportunities.

To incorporate prospect theory into our investment strategy, we filter stocks based on their beta, skewness, and capital gain overhang. If a stock meets any of the three characteristics (high beta, negatively skewed returns, or higher capital gain overhang), we assign it a score of one. We will then retain stocks with a score of two points or higher.

A beta greater than 1.0 indicates that the stock is more volatile than the market, while a beta less than 1.0 indicates that the stock is less volatile. If the stock's beta is greater than 1.0, it will receive one point.

To examine negatively skewed returns, we calculate the daily percentage change in stock prices over the past year and compute the skewness of these returns using *scipy.stats.skew.* A negative skewness value indicates that the stock has negatively skewed returns. If the stock has a negative skewness value, we assign it a score of one.

The capital gain overhang is calculated by comparing the current stock price with the price 12 months ago. If the stock price has increased,indicating a positive capital gain overhang, it receives one point.

Part 3- fundamental analysis

In the second phase, we plan to execute fundamental analysis and focus on a set of financial metrics to evaluate the health, performance, and valuation of the stocks that passed the behavioral screening. We will assign scores to each stock based on its performance, using metrics retrieved from Yahoo Finance and compared to predefined thresholds. (Radhakrishna)

For profitability, we examine the Price-to-Earnings ratio (P/E), Price-to-Book ratio (P/B), EPS growth, and return on equity (ROE).

The P/E ratio determines if a stock is overvalued or undervalued relative to its earnings. If the stock's P/E ratio ≥ 20, this indicates that the stock is potentially overvalued, and no points are assigned. If the stock's P/E ratio ≤ 10, this indicates that the stock is potentially undervalued, and 1 point is assigned. If the stock's P/E ratio is between 10 and 20, this is considered neutral, indicating neither overvaluation nor undervaluation, and 0.5 points are assigned.

The P/B ratio helps investors assess if a stock is trading at a premium or discount relative to its book value. If the P/B ratio ≤ 1, this indicates that the stock is potentially undervalued, as the

market price is lower than the company's book value, and 1 point is assigned. If the P/B ratio ≥ 3, this suggests that the stock is potentially overvalued, and no points are assigned. If the P/B ratio is between 1 and 3, this is considered neutral, with no clear indication of overvaluation or undervaluation, and 0.5 points are assigned.

EPS Growth determines how a company's earnings are growing year over year. If the stock's EPS growth ≥ 10% YoY, this indicates that the company is experiencing strong earnings growth, and 1 point is assigned. If the stock's EPS growth ≤ 0% YoY, this indicates that the company is experiencing a decline in earnings, and no points are assigned. If the stock's EPS growth is between 0% and 10% YoY, this is considered neutral, indicating moderate earnings growth, and 0.5 points are assigned.

ROE measures a company's profitability relative to its equity. If the stock's ROE ≥ 15%, this indicates that the company is generating a high return on equity, and 1 point is assigned. If the stock's ROE ≤ 10%, this indicates that the company is generating a low return on equity, and no points are assigned. If the stock's ROE is between 10% and 15%, this is considered neutral, indicating a moderate return on equity, and 0.5 points are assigned.

For liquidity, we examine the Current Ratio, which measures a company's ability to cover short-term liabilities with short-term assets. If the stock's Current Ratio ≥ 2, this indicates that the company has enough assets to cover its short-term liabilities, which is considered favorable, and 1 point is assigned. If the stock's Current Ratio ≤ 1, this indicates that the company does not have enough assets to cover its short-term liabilities, which is unfavorable, and no points are assigned. If the stock's Current Ratio is between 1 and 2, this is considered neutral, indicating a balanced ability to cover short-term liabilities, and 0.5 points are assigned.

For leverage metrics, we examine the Debt-to-Equity ratio (D/E) and Debt-to-Asset ratio (D/A). The D/E ratio compares total debt to equity. If the D/E ratio ≤ 1, this indicates that the company has relatively low debt compared to its equity, which is generally considered less risky, and 1 point is assigned. If the D/E ratio ≥ 2, this indicates that the company has a high level of debt relative to equity, which may be riskier, and no points are assigned. If the D/E ratio is between 1 and 2, this indicates a moderate level of debt, which is considered neutral in terms of risk, and 0.5 points are assigned.

The D/A ratio shows the proportion of a company's assets that is financed by debt. If the D/A ratio ≤ 0.25, this indicates that the company has a low level of debt relative to its assets, implying financial strength and minimal risk, and 1 point is assigned. If the D/A ratio ≥ 0.50, this suggests that the company is heavily reliant on debt, increasing its financial risk, especially during economic downturns, and no points are assigned. If the D/A ratio is between 0.25 and 0.50, this represents moderate debt usage, indicating that the company is leveraging debt but not excessively, showing a balanced level of risk, and 0.5 points are assigned.

Part 4- Rank

In the first phase of the behavioral finance analysis and the second phase of fundamental analysis, we filter stocks and assign scores based on their performance and metrics. In the final phase, we sum the scores of all stocks that have not been eliminated and rank them according to their scores, with the stock having the highest score being considered the best. Our Automated Investment Platform will then select this stock for purchase.

In case of a tie, we use the ROE as a tiebreaker to select the stock with the highest ROE. Among the metrics for evaluating profitability, ROE is the most directly related to it. It measures how effectively a company utilizes shareholders' equity to generate profit, focusing on what matters most to shareholders. A higher ROE indicates a better-performing stock, so we will buy the stock with the highest ROE.

Sell Strategy

In the sell strategy, we reverse the logic of the buy strategy. We begin by conducting fundamental analysis, followed by medium-term momentum analysis, and then use prospect theory to filter stocks to sell.

We first execute fundamental analysis and assign scores based on performance and metrics, as fundamental analysis helps identify financially weak or overvalued stocks, making them good candidates for selling since they are more likely to underperform. We sum the scores of all stocks and rank them accordingly. If there is only one stock with the lowest score, we sell that stock. If there are multiple stocks with the lowest score, we then apply our behavioral filter.

We examine the slope of momentum and pick the stocks exhibiting negative momentum, which refers to stocks with a declining price trend over time, indicating they are likely to continue losing value in the near future. If there is only one stock with negative momentum, we sell that stock. If there are multiple stocks with negative momentum, we then apply the prospect theory filter.

We want to sell stocks with low beta, positively skewed returns, and lower capital gain overhang. Stocks with low beta tend to be less volatile than the market, positively skewed returns indicate that the stock has a high chance of experiencing small, consistent gains, while lower capital gain overhang suggests the stock is closer to its maximum potential and may face limited upside. Each stock receives one point if its beta > 1.0, skewness value < 0, or capital gain overhang > 0. We sell the stock with the lowest total points.

If multiple stocks are tied with the same lowest points, we apply Capital Gain Overhang as a final filter, selling the stock with the lowest capital gain, which is more likely to underperform. Among the metrics being considered, Capital Gain Overhang is most directly related to

identifying a "bad stock" because it reflects unrealized gains in the stock. A low or negative Capital Gain Overhang could signal selling pressure, as investors may sell the stock to realize profits. Therefore, stocks with lower overhang are more likely to underperform. We will sell the stock with the lowest Capital Gain Overhang as a final step.

Conclusion

Our investment strategy combines quantitative analysis and psychological insights to systematically select and manage stocks for both buying and selling. By leveraging fundamental and behavioral metrics, stocks with the highest potential are purchased, and stocks with the least promise are efficiently sold. This automated investment platform ensures optimal portfolio performance based on a logical and well-justified strategy, minimizing risks and maximizing returns.

Reference

Jin, Lawrence. *AEM 5230 - Behavioral Finance*. Cornell University, 2024.

Radhakrishna, Radha B. *NBA 5060 - Financial Statement Analysis*. Cornell University, 2024.