Programming Assignment 3: Research Report

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November 2, 2025

Problem Description

This assignment focuses on testing both mean-reversion and momentum-based trading strategies for the portfolio used in the final project. The portfolio I am using is a consumer staples ETF comprised of Coca-Cola ($KO), PepsiCo ($PEP), Walmart ($WMT), Costco ($COST), and Procter & Gamble ($PG). Testing these two trading strategies also includes thorough back testing as well as benchmarking against the S&P 500 through returns and other metrics.

Data Preparation and Pipeline

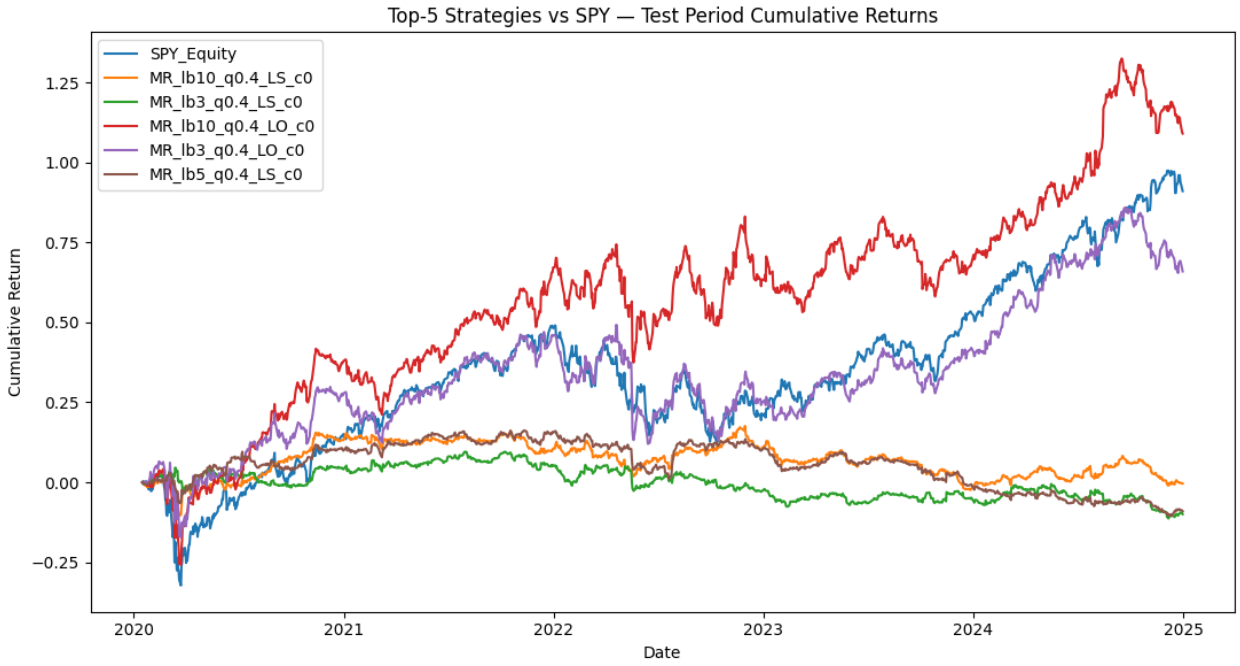
This assignment did not require significant data preparation prior to testing. The data was sourced from Yahoo! Finance using the yfinance [1] Python package.

Research Design

After loading the price data for the equities in my portfolio and $SPY (an ETF that tracks the S&P 500), I split the data into training and testing data to ensure that the parameters I determine are most effective are not overfitting on the dataset. For the split, the training set contains price data from 2000 through 2019, and the test set contains price data from 2020 through 2024.

Then, I defined the set of parameters I wanted to look through for mean-reversion and momentum. For mean reversion, I tuned the lookback period that is used to determine the mean price, the number of equities that get sold/bought per trading day, and whether short positions are allowed. For momentum, there was similarly a lookback period for price direction, the short position feature, but also a parameter to determine when the price is within a neutral band that should not be traded. Lastly, I also determine that I want to chase after the best Sharpe ratio since this portfolio is intended to be more defensive.

After searching through this set of parameters, I pulled the top 5 best strategies based on their performance against the training set and deployed them against the test data to determine how they performed against the unseen data. In testing these top 5 strategies against the S&P 500 benchmark, one of the strategies outperformed the S&P 500 by 3% CAGR and a Sharpe ratio .10 greater.



This is particularly interesting because this strategy has outperformed the S&P 500 over the past 5 years while the portfolio is designed to outperform consumer staples benchmarks which actually have returned a few full percentages less than the S&P 500 over the same period, indicating that this strategy has been particularly fruitful recently. The strategy outperforming the S&P 500 in both CAGR and Sharpe is also particularly interesting considering this portfolio is designed for a more defensive position compared to the S&P 500 which can be considered a growth portfolio.

Programming

I utilized an assortment of Python packages for this assignment:

NumPy: handles math and arrays [2]
Polars: data frames [3]
Matplotlib: basic charts and plots [4]
yfinance: downloads stock market data from Yahoo! [1]

Exposition

In this assignment, I compared two different trading strategies against the S&P 500 benchmark to determine the risk-free returns over a 5-year period. I split the data into training and testing in order to leave holdout data that the strategies were not tuned on, and determined that one of the strategies I investigated outperformed the benchmark during the testing period.

References

[1] “Yahoo Finance - Stock Market Live, Quotes, Business & Finance News.” Yahoo! Finance. https://finance.yahoo.com/.

[2] NumPy. https://numpy.org/.

[3] “Polars.” Polars -. https://pola.rs/.

[4] “Visualization with Python.” Matplotlib. https://matplotlib.org/.