Project 2: Optimize Something

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Abstract—This project implemented a long-only allocation optimizer that maximizes the portfolio's Sharpe ratio using SciPy.

1 INTRODUCTION

This project implements portfolio optimization to find allocations that maximize Sharpe ratio over a user-defined date range and symbol set. The code loads adjusted prices, uses SciPy's optimizer to search for the best allocations. It builds the portfolio value over time and returns cumulative return, average daily return, standard deviation of daily returns, and the Sharpe ratio (using 252 trading days and a risk-free rate of 0). When gen_plot=True, it saves Figure1.png comparing the normalized portfolio to SPY.

2 EXPERIMENTS

I optimized long-only allocations that sum to one and maximize the Sharpe ratio.

For each run, I loaded adjusted close prices, computed daily percentage returns, and used SciPy SLSQP with an equal-weight start, bounds [0,1]. I built the portfolio value by normalizing prices to 1.0 at the start date and taking the weighted sum. I then reported cumulative return, average daily return, standard deviation of daily returns, and Sharpe ratio (252 trading days, risk-free rate 0). When gen_plot=True, the code saves Figure1.png comparing the normalized portfolio to SPY.

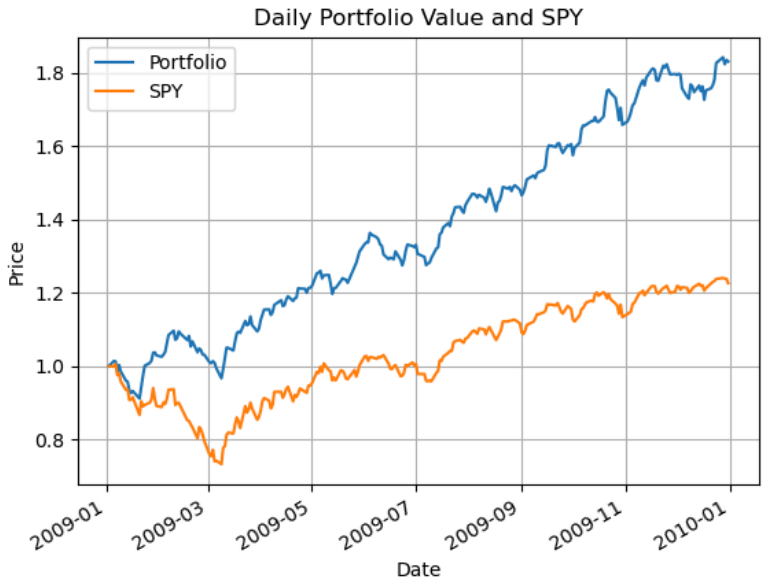

Figure 1—Daily portfolio value and SPY

Figure 1 shows normalized values (start = 1.0). The optimized portfolio falls less than SPY in early 2009, recovered sooner, and kept a steady lead. By year-end it is ~1.83 versus SPY ~1.23 (about +83% vs +23% cumulative). This aligns with its higher average daily return and lower volatility, yielding a stronger risk-adjusted result.

3 CONCLUSIONS

The optimizer finds allocations that maximize the Sharpe ratio and builds a normalized portfolio that outperforms SPY on the tested windows. The code enforces weights between 0 and 1 that sum to one, computes metrics from the portfolio return series, and saves the required chart. Results depend on the chosen symbols and dates and assume a zero risk-free rate and 252 trading days.