

The Laboratory Letters

- A Data-Driven Portfolio -

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Abstract

Hello and welcome to the Laboratory Letters. Here we will look at economic conditions quarterly and stock picks monthly. I hope to utilize this as both a way to express my opinion, delve deeper into topics that interest me, and also distribute them out into the world for as many (or as few) to hear.

This is a data-driven portfolio. In this letter, firstly, go over the Efficient Frontier for the portfolio using Modern Portfolio Theory, the performance projection of each stock from valuation indicators within a Random Forest, and lastly the stock allocation in the portfolio that was the result of the Efficient Frontier's Max Sharpe Ratio. I will explain the methodology in the paper and then the resulting portfolio.

The portfolio was created on 2024.07.09 but was generated with data from 2022.07.01 to 2024.07.01 because I wanted to work on it, and release it, alongside the quarterly newsletter. I did this without looking at the returns from last week so that it would not influence my decisions on what was to be included in the portfolio and their given weights.

I will rerun this code each month to generate a new portfolio and send it out to the subscribers of the newsletter.

Thank you!

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1 Portfolio

1.1 Efficient Frontier for Modern Portfolio Theory

The chart below illustrates the Efficient Frontier in the context of Modern Portfolio Theory, plotting portfolios' expected returns against their respective volatilities (standard deviations). Each point on the scatter plot represents a potential portfolio composed of the selected stocks, with the color indicating the Sharpe Ratio, a measure of risk-adjusted return.

Two prominent points are highlighted:

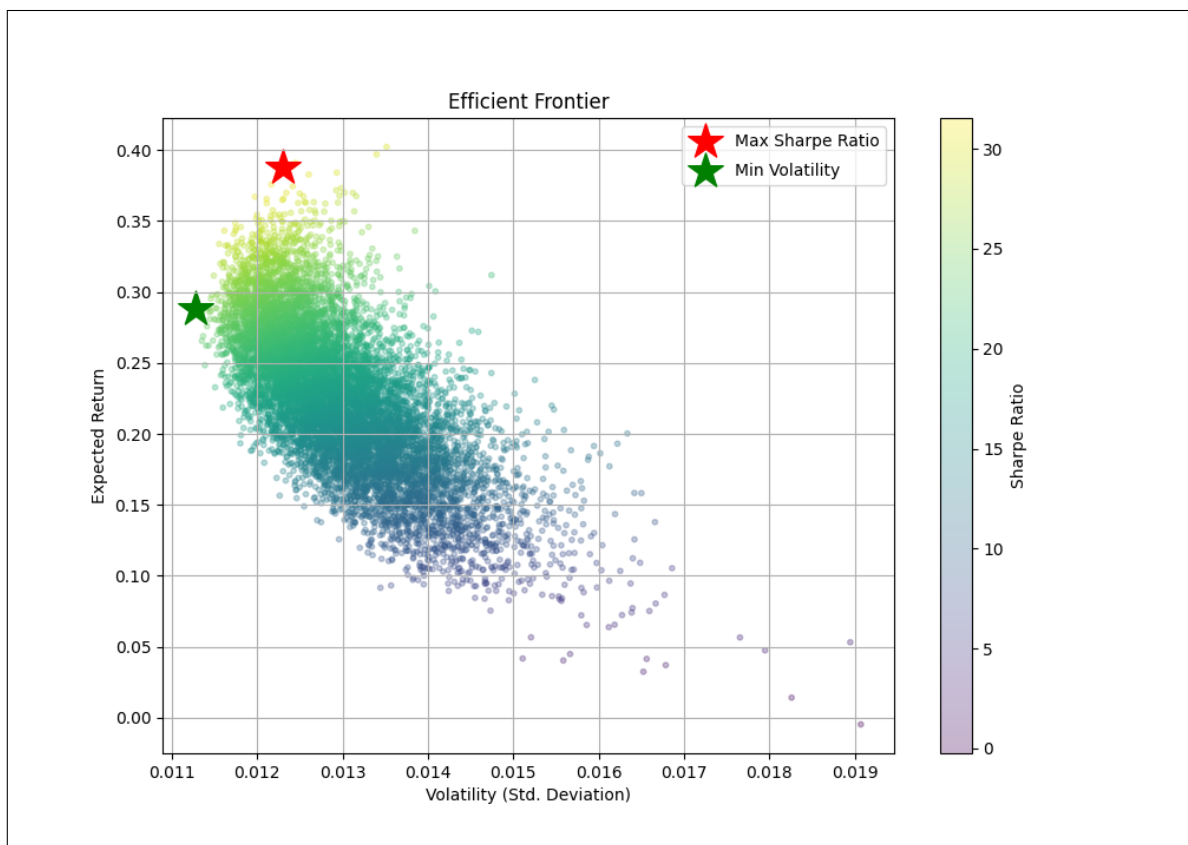
1. Max Sharpe Ratio (Red Star): This point represents the portfolio with the highest Sharpe Ratio, indicating the best risk-adjusted return. It offers an expected return of approximately 0.40 with a relatively low volatility of about 0.012, making it an optimal choice for investors seeking maximum

return per unit of risk.

2. Min Volatility (Green Star): This point signifies the portfolio with the lowest volatility, ideal for risk-averse investors. It achieves an expected return of approximately 0.30 with minimal volatility around 0.011, emphasizing stability over higher returns.

The gradient from green to yellow on the plot showcases the increasing Sharpe Ratios, indicating the balance between expected returns and risk, essential for constructing a diversified and efficient portfolio.

I will be chasing the Max Sharpe Ratio portfolio and its returns. We are not here to make money, we are here to make **MONEY**.



Given the Max Sharpe Ratio:	Return	0.421264
	Volatility	0.013248
	Sharpe Ratio	31.797608

1.2 Performance Projection

This Python script is designed to analyze and predict the next month's stock returns for S&P 500 companies using various financial metrics and a Random Forest regression model. To build the dataset, the script fetches the list of S&P 500 companies from Wikipedia and processes the ticker symbols to be compatible with yfinance. It then iterates through these tickers collecting valuation measures for each stock over the past two years. Next, the script prepares the data for machine learning by selecting relevant features and splitting the dataset into training and testing sets. A Random Forest regression model is trained on this data to predict the next month's returns. The model's performance is evaluated using Mean Squared Error. Following this, the script predicts the next month's returns for all stocks in the dataset. It calculates the mean values of the selected features for each stock and uses the trained model to make predictions. Finally, the script identifies the top 10 stocks with the highest predicted returns for the next month and displays them. This comprehensive approach

combines data retrieval, processing, and machine learning to provide actionable insights into potential stock performance.

Projections:

Stock	Name	Performance Projection %
AAPL	Apple Inc	11.39
CTRA	Coterra Energy Inc	08.71
EMN	Eastman Chemical Co	08.94
NTAP	NetApp Inc	09.83
ORCL	Oracle Corp	12.78
PARA	Paramount Global Class B	14.40
PWR	Quanta Services Inc	13.96
RL	Ralph Lauren Corp	09.92
VST	Vistra Corp	12.46
XOM	Exxon Mobil Corp	09.46

1.3 Stock Allocation

This Python script is designed to create and analyze a portfolio of selected stocks by simulating multiple portfolios to find the optimal ones based on the Sharpe Ratio and minimum volatility. The script defines a list of ten stocks and sets a timeframe from July 1, 2022, to July 1, 2024. It then uses the `yfinance` library to download the adjusted closing prices for these stocks within the specified timeframe. The adjusted closing prices are essential as they account for any corporate actions like stock splits or dividends. Next, the script calculates the log returns of the stock prices, which are used to measure the continuous compounding return of each stock. The covariance matrix of these log returns is computed to understand the variance and correlation between the stock returns, which is crucial for portfolio optimization. The annualized returns for each stock are calculated by multiplying the mean of the log returns by 250, assuming there are 250 trading days in a year. To generate random portfolios, the script defines a function `generate_portfolios` that creates a specified number of portfolios, each with randomly assigned weights to the stocks. The function calculates each portfolio's expected return, standard deviation (volatility), and Sharpe Ratio. The Sharpe Ratio is a measure of risk-adjusted return, calculated as the portfolio return divided by its standard deviation. The weights of the stocks in each portfolio are normalized to ensure they sum up to 1. The script then simulates 10,000 random portfolios using the `generate_portfolios` function and stores the results in a `DataFrame`. It identifies the portfolio with the maximum Sharpe Ratio (indicating the best risk-adjusted return). The script also prints the details of the optimal portfolios, including their expected returns, volatilities, and Sharpe Ratios. Additionally, it displays the weights of each stock in these portfolios, indicating the proportion of each stock that makes up the portfolio. Overall, the script combines data fetching, statistical analysis, and portfolio optimization techniques to identify the most efficient portfolios based on historical stock data.

Allocations:

Stock	Name	Allocation %
AAPL	Apple Inc	13.29
CTRA	Coterra Energy Inc	14.42
EMN	Eastman Chemical Co	19.36
NTAP	NetApp Inc	08.65
ORCL	Oracle Corp	00.41
PARA	Paramount Global Class B	14.00
PWR	Quanta Services Inc	00.42
RL	Ralph Lauren Corp	00.40
VST	Vistra Corp	19.38
XOM	Exxon Mobil Corp	09.68

If you would like to follow this portfolio's performance on the day-to-day, please go to my [portfolio tracker on my website](#).

2 Disclaimer

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