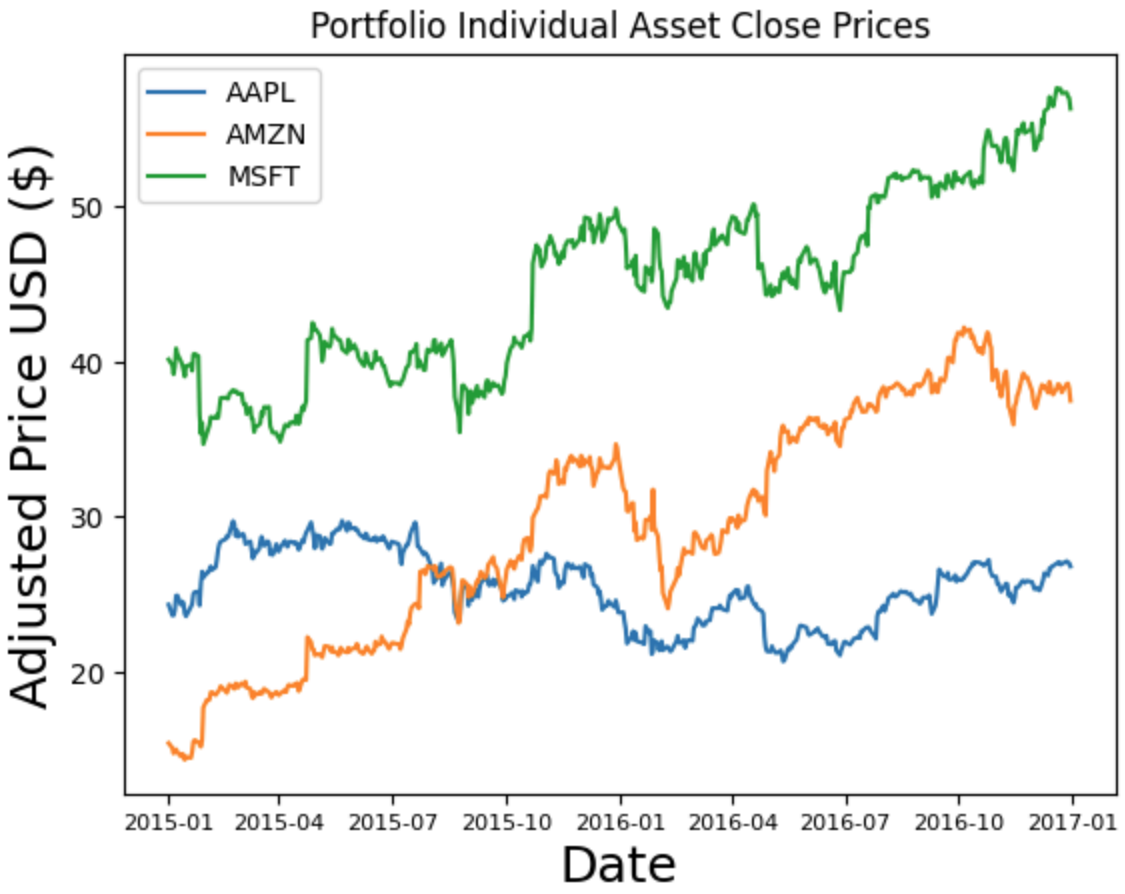
Isaar Chadha
Professor Kaufman
AMS 325
2024 December 2019

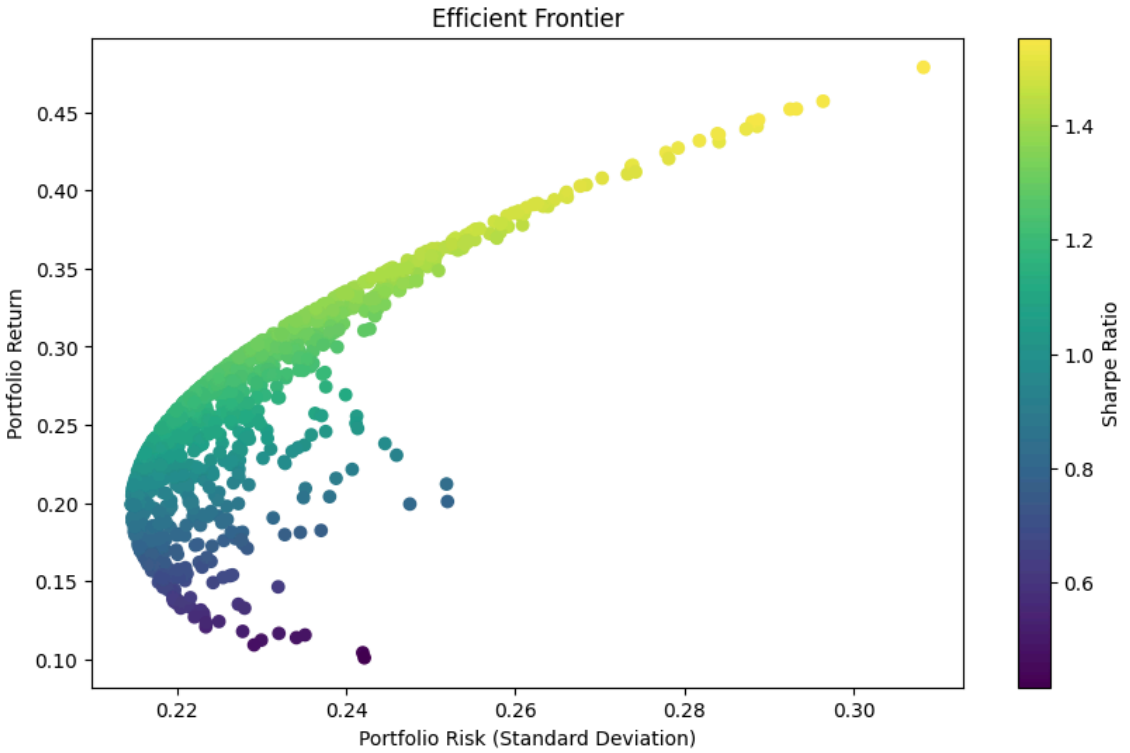
My team project with Aadithyaa Balasubramanian aimed to explore the world of finance. Our project aimed to create code that can take input stocks from a user over a given time frame and then simulate their stock performance over a given number of days. We wanted to include plots that visualize key parts of the code to users: a graph of their input stocks over the time frame they specified, a graph of the efficient frontier, which plots return versus risk for the portfolios that have the maximum return given their risk, and a graph of monte carlo simulations, which simulate possible portfolio values for a user set number of days after the stated end date. We also originally aimed to compare it with metrics like the S and P 100, but due to the higher-than-expected time spent debugging and working through our original goals, we did not have enough time to incorporate this. Our programming language of choice was Python.

The inspiration for this project was a combination of my interest in personal finance and Aadithyaa's interest in quantitative finance. I started a personal finance club in high school as I believe personal finance to be an important concept for individuals to grasp. I also recently spent three months studying predictive analytics as part of my journey to being a credentialed actuary. The combination of these factors motivated the idea to create a tool individual could use to predict their portfolio and serve as an exciting way to model one's finances.

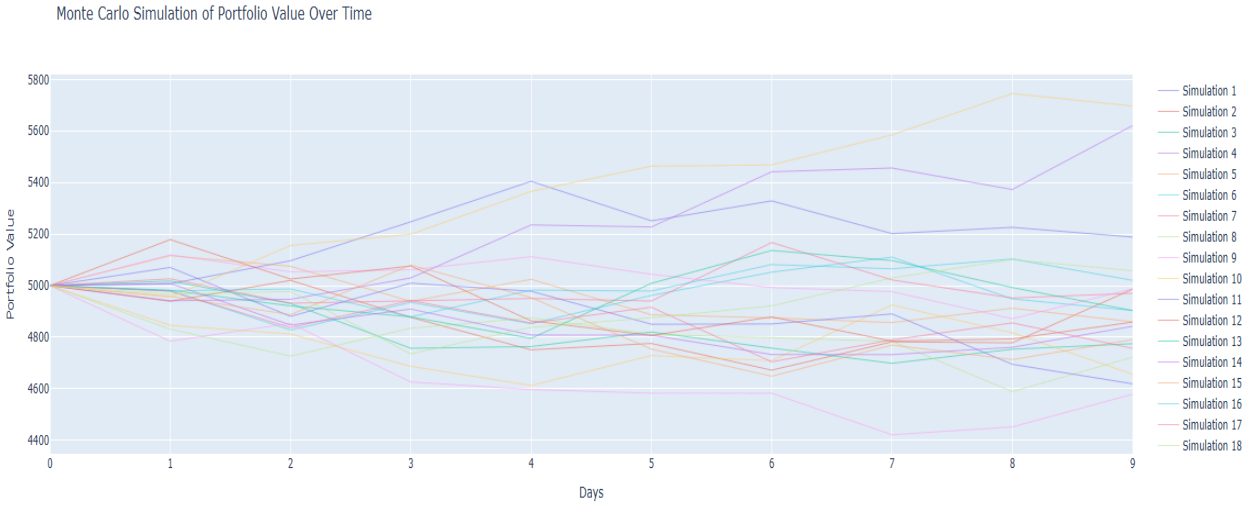
My partner and I researched quantitative finance and came across modern portfolio theory, which led to the idea of using the sharp ratio, return over volatility, and the efficient frontier as tools to optimize a portfolio. As for the coding, we leveraged many of the relevant libraries from class and imported Yahoo finance data. We broke our functions down into different tasks including retrieving stock data, calculating items such as annualized return, covariance matrix, and stock return volatility, and finding the optimal weights for the sharp ratio. Ultimately, calling on a function main to execute the code. We leveraged code from class, as well as learned how to code out other functions through YouTube and Google. The experience from class on how to create plots, helped us make our code easier for people to understand. See some of the images below:



This image shows asset prices from 2015 to 2017 for three stocks: Apple, Amazon, and Microsoft. It helps users visualize the returns.



This diagram of the efficient frontier is useful for individuals to see the portfolios that have the best return at each risk level.



Finally, the image of the 20 Monte Carlo simulations, captures the variability in how expected returns over the next 10 days may end up.

One observation of mine was that often our code, suggested weighing one stock as the sole choice. A useful, but challenging, consideration may be to research into the benefits of diversification and attempt to include a diversification strategy for keeping stocks, perhaps a diversification factor that is a result of how long into the future we want to hold our portfolio.

Overall the project taught me a lot about collaboration and working with a team. It was great brainstorming with my team member Aadithyaa. We had stimulating discussions on experience credibility and wanted to highlight that as a consideration when presenting to others how to use our tool. It was exciting to create a useful tool that combined my interest in finance and mathematics.

References:

Bazzi, A. (n.d.). *Stock Market Analysis & Markowitz Efficient Frontier on Python | Python # 11*. YouTube. https://www.youtube.com/watch?v=f2BCmQBCwDs&t=1321s

Compsci112358. (n.d.). *Python For Finance Portfolio Optimization*. YouTube. https://www.youtube.com/watch?v=9fjs8FeLMJk

Modern portfolio theory (MPT). Corporate Finance Institute. (2023, December 15). https://corporatefinanceinstitute.com/resources/career-map/sell-side/capital-markets/modern-portfolio-theory-mpt/#:~:text=The%20Modern%20Portfolio%20Theory%20(MPT)%20refers%20to%20an%20investment%20theory,prefer%20the%20less%20risky%20portfolio.

Sharpe ratio. Corporate Finance Institute. (2024, March 4). https://corporatefinanceinstitute.com/resources/career-map/sell-side/risk-management/sharpe-ratio-definition-formula/