**Portfolio Optimization R Project Report**

1. What is Portfolio Optimization
   1. Portfolio optimization is a critical aspect of financial management, enabling investors to maximize returns while minimizing risk. This report explains the process of optimizing a portfolio of three major tech stocks – Apple, Microsoft, Google, using historical stock data and statistical techniques using R.
   2. The goal is to identify the optimal asset allocation that achieves the highest expected return for a given level of risk.
2. Packages
   1. quantmod for downloading financial data
   2. PerformanceAnalytics for performance and risk analysis
   3. quadprog for quadratic programming and optimization
3. Data Collection
   1. Gather historical adj closing price data for the stocks from Yahoo Finance, using quantmod.
   2. Daily returns for each asset were calculated using the rate of change method, which measures the percentage change in price from one day to the next. This calculation is essential for understanding the stock’s historical performance and volatility.
4. Statistical Analysis
   1. The mean returns and the covariance matrix of the stock returns were computed to serve as inputs for the optimization model. The mean reutrn represents the average daily return for each stock, while the covariance matrix captures the relationship between the returns of the stocks, indicating how they move together
5. Optimization Model
   1. The optimization problem was made using quadratic programming. The objective was to minimize the portfolio’s risk while satisfying two constraints: full investment and no short selling. The quadprog package was used to solve this.
6. Results
   1. The optimal weights for the portfolio were calculated, indicating the proportion of total investment to allocate to each stock, The expected return and risk of the optimal portfolio were then evaluated. The expected return is the weighted average of the mean returns of the stocks, while the expected risk is the portfolio’s standard deviation, derived from the covariance matrix.
7. Conclusion
   1. This project was fun and interesting, and I learned a lot about quantitative analysis packages and how portfolio optimization works. This analysis serves as a foundational example for more complex portfolio management strategies, showing the power of quantitative methods in financial decision making.