

Project Description: Optimal Portfolio Construction with Nifty 50 Stocks Using Markowitz Model, Monte Carlo Simulation, and Risk Metrics

Project Title: Constructing an Optimal Portfolio of Nifty 50 Stocks with Risk and Value at Risk (VaR) Analysis

Objective:

Construct an optimal portfolio using the Markowitz model and Monte Carlo simulation for Nifty 50 stocks.

Then select any 5 stocks from and build a smaller optimal portfolio using the same methodology. The project requires incorporating the risk-free rate obtained from the RBI website. Students must provide a rationale for their stock selections and submit a Word document along with the Colab notebook.

Project Instructions:

1. Data Collection:

- Stock Data: Download historical daily stock price data for all Nifty 50 stocks over the last 3 years.
- Risk-Free Rate Data: Obtain the latest risk-free rate from the Reserve Bank of India (RBI) website. Use the 10-year Government Bond Yield as the risk-free rate in your calculations.

2. Data Preparation:

- Calculate daily returns for each stock.
- Compute the mean returns and the covariance matrix for the daily returns.

3. Constructing the Optimal Portfolio Using Markowitz Model:

- Use the Markowitz mean-variance optimization model to find the optimal weights for a portfolio of all Nifty 50 stocks.
- Adjust the Sharpe ratio calculation using the risk-free rate obtained from the RBI website.
- Perform the optimization to find the portfolio with the maximum Sharpe ratio (risk-adjusted return).

4. Monte Carlo Simulation:

- Generate random portfolio weights and calculate the expected returns and risks for a large number of portfolios (e.g., 10,000).
- Plot the Efficient Frontier using the results from the Monte Carlo simulation.
- Identify the portfolio with the maximum Sharpe ratio and minimum risk from the simulation results.

5. Risk Analysis:

- Risk Metrics: Calculate the standard deviation (volatility) of the optimal portfolio returns to measure overall risk.
- Value at Risk (VaR): Calculate the VaR for the optimal portfolio at a 95% confidence level.

6. Selecting a Subset of Stocks:

- Choose any 5 stocks from the Nifty 50 based on your preference and provide a rationale for your selection.
- Justify your selection based on factors such as past performance, industry trends, risk profiles, etc.
- Repeat the optimization, Monte Carlo simulation, and risk analysis process to find the optimal portfolio for these 5 stocks.
- Calculate the VaR for this smaller portfolio as well.

7. Visualization:

- Plot the Efficient Frontier for both the Nifty 50 optimal portfolio and the 5-stock portfolio using the Monte Carlo simulation results.
- Highlight the optimal portfolios on the Efficient Frontier.
- Show the distribution of expected returns and risks for the simulated portfolios.
- Visualize the Value at Risk (VaR) using histograms and normal distribution curves.

8. Word Document Report:

- Introduction: Explain the objective of the project and the methodology used (Markowitz model, Monte Carlo simulation, and VaR analysis).
- Data and Risk-Free Rate: Describe how you collected the stock data and obtained the risk-free rate from the RBI website.
- Rationale for Stock Selection: Provide a detailed explanation of why you selected the specific 5 stocks for the smaller portfolio. Discuss factors such as company fundamentals, industry trends, and risk-return characteristics.
- Optimization and Simulation: Explain the process of optimization and Monte Carlo simulation, including any assumptions made.
- Risk Analysis: Detail the risk and VaR analysis for both portfolios. Include interpretations of the calculated VaR values.
- Results: Present and interpret the results of the optimization and risk analysis for both portfolios. Include the optimal weights, expected returns, risks, Sharpe ratios, and VaR.
- Conclusion: Summarize your findings and discuss the implications of your results.
- Include relevant tables, charts, and references.

9. Google Colab Notebook:

- Submit a well-documented Colab notebook that includes:
 - Code for data collection, preparation, optimization, Monte Carlo simulation, and risk analysis.
 - Comments explaining each section of the code.
 - Visualization of results (e.g., Efficient Frontier, portfolio weights, Monte Carlo simulation results, VaR analysis).

10. Submission:

- Word Document: A comprehensive report (around 1500–2000 words) detailing your process, results, rationale for stock selection, and insights. Include relevant tables, charts, and references if any.
- Google Colab Notebook: A .ipynb file with all your code and outputs.

This enhanced project will help you deepen their understanding of portfolio construction and risk management, incorporating advanced techniques such as Monte Carlo simulations and Value at Risk analysis. If you need further customizations or additional instructions, feel free to ask!