Mean-Variance Optimization

MGMT 675: Generative AI for Finance

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Goals

- Compute and plot the **tangency portfolio**
- Compute and plot the **global minimum variance portfolio**
- Compute and plot the **efficient frontier** of risky assets
- Compute and plot the **capital allocation line**

Possible Constraints

- No short sales
- Minimum and maximum positions
- Margin requirements (sum of absolute values of longs and shorts ≤ 2)

Solution Methods

- **Solver**
  - Maximize Sharpe ratio
  - Minimize risk subject to achieving a target expected return
  - Minimize risk
- **Analytic/algebraic solution**
  - Solution of a system of linear equations for tangency portfolio
  - Solution of a system of linear equations for global minimum variance portfolio
  - Combining solutions of two systems of linear equations for efficient frontier
  - Available only when there are no constraints

Python Solver Options

- scipy.minimize
- cvxopt
- cvxpy

Ask Claude

Discuss methods to find the tangency portfolio when there are no short sales constraints.

Ask Claude

Discuss the advantages and disadvantages of these solver options for mean-variance analysis.