

Mean-Variance Analysis with AI

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.optimize.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.