15.467 Asset Management, Lifecycle Investing & Retirement Finance
Spring 2021
Homework 1, Portfolio Optimization
Due Feb 28, 2021

1. **Portfolio Optimization**

The market consists of a riskless asset with an annualized return of 4%, and five risky assets with returns that are uncorrelated with each other, each with 20% standard deviation of annualized return, and the expected returns are 8%, 9%, 10%, 11% and 12%, respectively, for securities A, B, C, D, and E. Short selling is allowed. Get familiar with the Excel spreadsheet (Portfolio Optimizer.xls) to answer the following questions:

(a) In the optimal portfolio of risky assets only ("OCRA" portfolio), what are the weights on each of the risky assets?

(b) A friend argues that the only risky asset that you should invest in is the one with a 12% expected return, because "they all have the same standard deviation and the 12% expected return clearly dominates the expected returns on other assets". Is he right or wrong? Explain.

(c) What will be the revised weights on these five risky assets, if the standard deviation of the security E (which has a 12% expected return) is 25% instead of 20%? Explain

2. **Optimal Combination of Risky Assets (use model from #1)**

(a) The market portfolio has an annualized expected return of 20% and annualized standard deviation of 30% per annum. Stock A has a standard deviation of 60% per annum and is uncorrelated with the market portfolio. Its alpha is 5% per annum. The risk-free rate of return is 5% per annum. Use the Portfolio Optimizer to find the optimal mix of risky assets when we construct the OCRA and give an intuitive explanation for why it is optimal to hold the stock.

(b) The market portfolio has an annualized expected return of 20% and annualized standard deviation of 30% per annum. Stock A has a market beta of –1, and a standard deviation of 60% per annum. Its expected return is 1% per annum. The risk-free rate of return is 5% per annum. Use the Portfolio Optimizer to find the optimal mix of risky assets when we construct the OCRA and give an intuitive explanation for why it is optimal to hold the stock.