BUFN402: Portfolio Management

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These are my notes for UMD's BUFN402: Portfolio Management, which is an elective ("live-TEX"-ed). This course is taught by Professor Seokwoo Lee.

Contents

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§1 Probability Theory

See Professor Lee's comprehensive slideshow on the probability theory concepts that we need to know.

§2 Portfolio Theory

§2.1 Review of Two Asset Case

Suppose we have two assets denoted as random variables R_1, R_2 and $E(R_1) = \mu_1, E(R_2) = \mu_2$. We also have $SD(R_1) = \sigma_1, SD(R_2) = \sigma_2$. Then we have the portfolio R_p as

$$R_p = w_1 R_1 + w_2 R_2 = w_1 R_1 + (1 - w_1) R_2$$

Now constucting a mean variance optimization,

$$\mathbb{E}(R_p) = w_1 \mu_1 + w_2 \mu_2$$

$$\sigma_p^2 = w_1^2 \sigma_1^2 + (1 - w_1)^2 \sigma_2^2 + 2w_1(1 - w_1)\rho_{12}\sigma_1\sigma_2$$

$$\sigma_p = \sqrt{\sigma_p^2}$$

We wish to maximize $\max(\mathbb{E}(R_p) - \mathrm{Var}(R_p))$ which we can doing by taking the derivative with respect to w_1 and setting this to zero.

$$w_1\mu_1 + (1 - w_1)\mu_2 - w_1^2\sigma_1^2 + (1 - w_1)^2\sigma_2^2 + 2w_1(1 - w_1)\rho_{12}\sigma_1\sigma_2$$

$$w_1\mu_1 + \mu_2 - w_1\mu_2 - w_1^2\sigma_1^2 + (1 - 2w_1 + w_1^2)\sigma_2^2 + 2w_1(1 - w_1)\rho_{12}\sigma_1\sigma_2$$

$$w_1\mu_1 + \mu_2 - w_1\mu_2 - w_1^2\sigma_1^2 + (1 - 2w_1 + w_1^2)\sigma_2^2 + (2w_1 - 2w_1^2)\rho_{12}\sigma_1\sigma_2$$

Taking partial derivative we get

$$\mu_1 - \mu_2 - 2\sigma_1^2 w_1 - 2\sigma_2^2 + 2w_1\sigma_2^2 + (2 - 4w_1)\rho_{12}\sigma_1\sigma_2 = 0$$