



Portfolio risk and return calculations

A problem set prepared by Pamela Peterson Drake

Formulas

$$\sigma_p = \sqrt{\sum_{i=1}^N w_i^2 \sigma_i^2 + \sum_{i=1}^N \sum_{j=1, j \neq i}^N w_i w_j \sigma_i \sigma_j \rho_{ij}}$$

or

$$\sigma_p = \sqrt{\sum_{i=1}^N w_i^2 \sigma_i^2 + \sum_{i=1}^N \sum_{j=1, j \neq i}^N w_i w_j \text{COV}_{ij}}$$

For a two-security portfolio,

$$\sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \sigma_1 \sigma_2 \rho_{1,2}}$$

or

$$\sigma_p = \sqrt{w_1^2 \sigma_1^2 + w_2^2 \sigma_2^2 + 2w_1 w_2 \text{COV}_{1,2}}$$

Problems

For each of the following two-security portfolios, calculate the portfolio's expected return, variance of returns, and the standard deviation of returns.

Portfolio	First security			Second security			Correlation between the two securities' returns
	Expected return	Standard deviation	Weight in portfolio	Expected return	Standard deviation	Weight in portfolio	
A	4%	2%	30%	10%	4%	70%	0.50
B	3%	5%	50%	10%	20%	50%	-0.10
C	10%	12%	40%	4%	2%	60%	0.10
D	6%	7%	60%	5%	5%	40%	0.00
E	6%	3%	40%	10%	10%	60%	-0.50
F	15%	20%	60%	15%	10%	40%	0.30
G	10%	6%	20%	20%	5%	80%	0.80

Solutions

Portfolio	Portfolio expected return	Portfolio variance	Portfolio standard deviation
A	8.20%	0.000988	3.14%
B	6.50%	0.010125	10.06%
C	6.40%	0.002563	5.06%
D	5.60%	0.002164	4.65%
E	8.40%	0.003024	5.50%
F	15.00%	0.01888	13.74%
G	18.00%	0.002512	5.01%