FN 201 : Lecture Note 7

Introduction to Risk and Return and Portfolio Theory

Dr. Winai Homsombat

Bachelor of Economics, International Program

Thammasat University

Outline

1. Measuring risk of individual security
2. Measuring risk of portfolio investment

1. Measuring risk of individual security

Individual Security Risk – Expected Return

Expected Return:

$$= \quad E(r) = r_1 p_1 + r_2 p_2 + \ldots + r_n p_n = \sum_{i=1}^{n} r_i p_i$$

Example: Consider the possible rates of return that you might earn next year on a $50,000 investment in stock A or on a $50,000 investment in stock B, depending upon the states of the economy. Based on information, which stock has higher return?

State of Economy	For stock A:		For stock B:	
	Return	Probability	Return	Probability
Recession	-5%	0.20	10%	0.20
Normal	20%	0.60	15%	0.60
Prosperity	40%	0.20	20%	0.20

Individual Security Risk – Variance

Variance:

$$= \sigma^2 = (r_1 - \bar{r})^2 p_1 + (r_2 - \bar{r})^2 p_2 + \ldots + (r_n - \bar{r})^2 p_n = \sum_{i=1}^{n} (r_i - \bar{r})^2 p_i$$

Example: Consider the possible rates of return that you might earn next year on a $50,000 investment in stock A or on a $50,000 investment in stock B, depending upon the states of the economy. Compute standard deviation for each stock?

State of Economy	For stock A:		For stock B:	
	Return	Probability	Return	Probability
Recession	-5%	0.20	10%	0.20
Normal	20%	0.60	15%	0.60
Prosperity	40%	0.20	20%	0.20

Individual Security Risk – Implication

Implication:

Statistically, if the probability distribution is *normal:*

... percent of the returns will lie between .....

... percent of the returns will lie between .....

... percent of the return will lie between .....

of the expected value.

Note:

= **Standard deviation** is only an **absolute measure** of dispersion (risk) and does **NOT** consider the dispersion of outcomes in relationship to an expected return

Individual Security Risk – Implication

Measure of Relative Risk: Coefficient of Variation (CV)

$$= \sigma / \bar{r}$$

Example: From previous example, which stock is more risky?

Measures	Stock A	Stock B
Return		
Standard Deviation		
Coefficient of Variation		

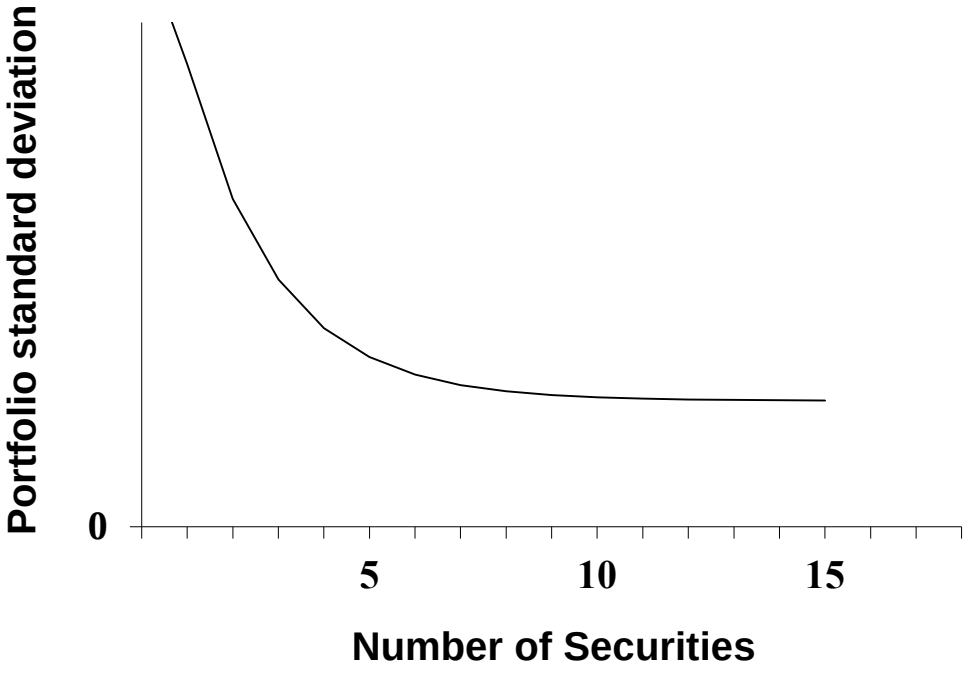
Measuring Risk

Diversification - Strategy designed to reduce risk by spreading the portfolio across many investments.

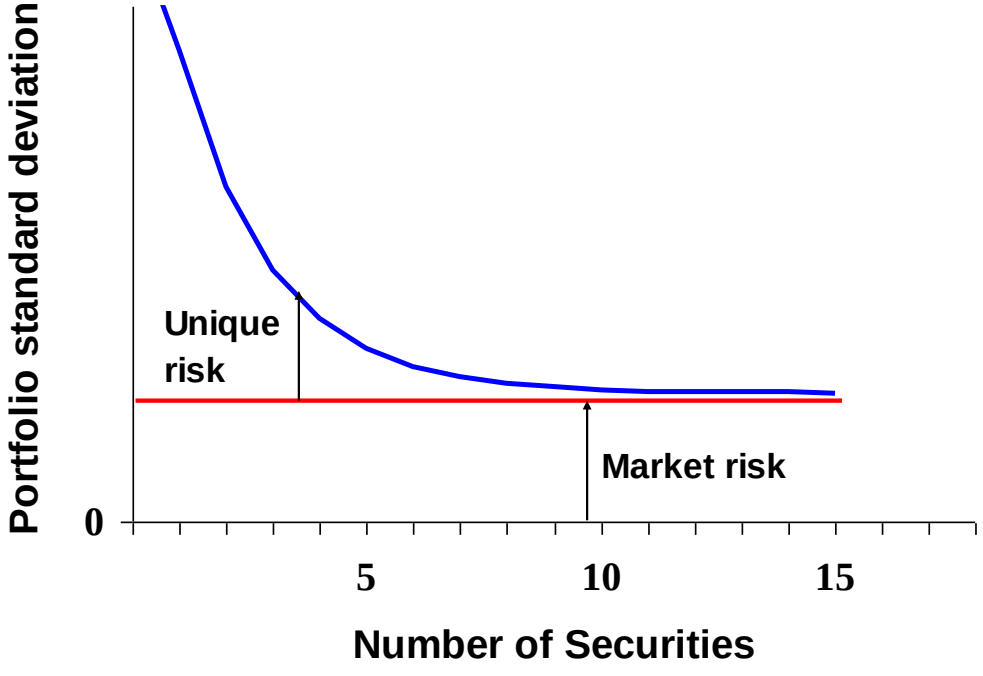
Unique Risk - Risk factors affecting only that firm. Also called "diversifiable risk."

Market Risk - Economy-wide sources of risk that affect the overall stock market. Also called "systematic risk."

Measuring Risk



Measuring Risk



2. Measuring risk of portfolio investment

Measuring Portfolio Return

$$\text{Portfolio rate of return} = \begin{pmatrix}\text{fraction of portfolio}\\ \text{in first asset}\end{pmatrix} \text{ x } \begin{pmatrix}\text{rate of return}\\ \text{on first asset}\end{pmatrix}$$

$$+ \begin{pmatrix}\text{fraction of portfolio}\\ \text{in second asset}\end{pmatrix} \text{ x } \begin{pmatrix}\text{rate of return}\\ \text{on second asset}\end{pmatrix}$$

Measuring Portfolio Risk

The variance of a two stock portfolio is the sum of these four boxes

	Stock 1	Stock 2
Stock 1	$x_1^2\sigma_1^2$	$x_1x_2\sigma_{12} = x_1x_2\rho_{12}\sigma_1\sigma_2$
Stock 2	$x_1x_2\sigma_{12} = x_1x_2\rho_{12}\sigma_1\sigma_2$	$x_2^2\sigma_2^2$

Portfolio Risk

$$\text{Expected Portfolio Return} = (x_1 r_1) + (x_2 r_2)$$

$$\text{Portfolio Variance} = x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + 2(x_1 x_2 \rho_{12} \sigma_1 \sigma_2)$$

Portfolio Risk

Example - 1

Suppose you invest 60% of your portfolio in Wal-Mart and 40% in IBM. The expected dollar return on your Wal-Mart stock is 10% and on IBM is 15%. The expected return on your portfolio is:

Portfolio Risk

Example - 1

Suppose you invest 60% of your portfolio in Wal-Mart and 40% in IBM. The expected dollar return on your Wal-Mart stock is 10% and on IBM is 15%. The standard deviation of their annualized daily returns are 19.8% and 29.7%, respectively. Assume a correlation coefficient of 1.0 and calculate the portfolio variance.

Portfolio Risk

Example - 1

Suppose you invest 60% of your portfolio in Wal-Mart and 40% in IBM. The expected dollar return on your Wal-Mart stock is 10% and on IBM is 15%. The standard deviation of their annualized daily returns are 19.8% and 29.7%, respectively. Assume a correlation coefficient of 1.0 and calculate the portfolio variance.

Portfolio Variance =

Standard Deviation =

Portfolio Risk

Example - 2

Suppose you invest 60% of your portfolio in Exxon Mobil and 40% in Coca Cola. The expected dollar return on your Exxon Mobil stock is 10% and on Coca Cola is 15%. The expected return on your portfolio is:

Portfolio Risk

Example - 2

Suppose you invest 60% of your portfolio in Exxon Mobil and 40% in Coca Cola. The expected dollar return on your Exxon Mobil stock is 10% and on Coca Cola is 15%. **The standard deviation of their annualized daily returns are 18.2% and 27.3%, respectively. Assume a correlation coefficient of 1.0 and calculate the portfolio variance.**

Portfolio Risk

Example - 2

Suppose you invest 60% of your portfolio in Exxon Mobil and 40% in Coca Cola. The expected dollar return on your Exxon Mobil stock is 10% and on Coca Cola is 15%. The standard deviation of their annualized daily returns are 18.2% and 27.3%, respectively. Assume a correlation coefficient of 1.0 and calculate the portfolio variance.

Portfolio Variance =

Standard Deviation =

Portfolio Risk

Example Correlation Coefficient = 0.4

Stocks	*s*	% of Portfolio	Avg Return
ABC Corp	28	60%	15%
Big Corp	42	40%	21%

Standard Deviation = weighted avg = ?

Standard Deviation = Portfolio = ?

Portfolio Risk

Let's Add stock New Corp to the portfolio!?

Example Correlation Coefficient = 0.3

Stocks	*s*	% of Portfolio	Avg Return
Portfolio	28.1	50%	17.4%
New Corp	30	50%	19%

NEW Standard Deviation = Portfolio = ?

NEW Return = weighted avg = Portfolio = ?

Question?