

FN 201 : Lecture Note 7
Introduction to Risk and Return
and Portfolio Theory

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Outline

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

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1. Measuring risk of individual security

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Individual Security Risk – Expected Return

Expected Return:

$$= E(r) = r_1p_1 + r_2p_2 + \dots + r_n p_n = \sum_{i=1}^n r_i p_i$$

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

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Individual Security Risk – Variance

Variance:

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

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

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Individual Security Risk – Implication

Measure of Relative Risk: Coefficient of Variation (CV)

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

= comparing securities that have different expected returns
 = the higher the coefficient, the more risky the security

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

Measures	Stock A	Stock B
Return		
Standard Deviation		
Coefficient of Variation		

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2. Measuring risk of portfolio investment

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Measuring Expected Portfolio Return

$$\begin{aligned} \text{Portfolio rate of return} &= \left(\begin{array}{l} \text{fraction of portfolio} \\ \text{in first asset} \end{array} \right) \times \left(\begin{array}{l} \text{rate of return} \\ \text{on first asset} \end{array} \right) \\ &+ \left(\begin{array}{l} \text{fraction of portfolio} \\ \text{in second asset} \end{array} \right) \times \left(\begin{array}{l} \text{rate of return} \\ \text{on second asset} \end{array} \right) \end{aligned}$$

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Portfolio Risk

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

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

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Portfolio Risk

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

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

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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:

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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.**

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Portfolio Risk

Example

Correlation Coefficient = 0.4

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

Return : r

Standard Deviation = Portfolio = $\underline{\quad}$

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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 = $\underline{\quad}$

NEW Return = weighted avg = Portfolio = $\underline{\quad}$

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Measuring Risk

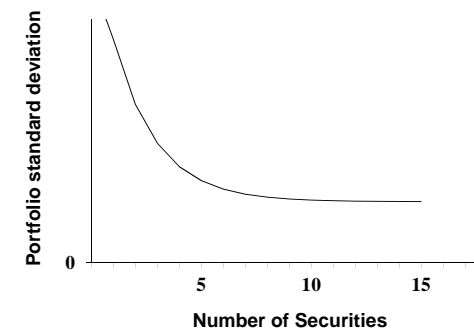
Diversification - Strategy designed to reduce risk by spreading the portfolio across many investments.

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.”

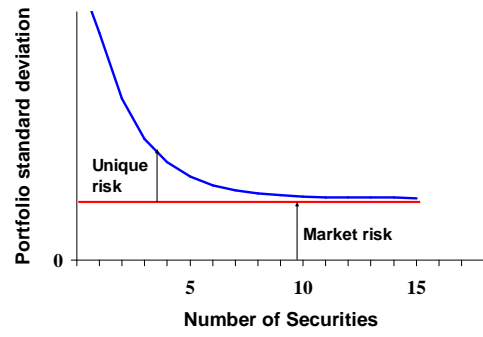
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Measuring Risk



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Measuring Risk



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Question?

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