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

1. Measuring risk of individual security

Individual Security Risk – Expected Return

Expected Return:

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

Variance:

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

Individual Security Risk – Expected Return

Example: David, a new graduate, is considering to invest in the stock market. Stocks he planned to invest have return patterns corresponding to economic conditions as the table below.

State of Economy	Probability of State of Economy	Rate of Return if State Occurs	
		Stock A	Stock B
Recession	**0.20**	**5%**	**-10%**
Normal	**0.50**	**8%**	**12%**
Boom	**0.30**	**10%**	**30%**
Expected Return		**?**	**?**
Variance		**?**	**?**
Standard Deviation		**?**	**?**

Which stock should you recommend David to invest? Why?

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		

2. Measuring risk of portfolio investment

Measuring Expected Portfolio Return

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

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

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

Portfolio Risk

Example (cont.):

Assume the other case that David has invested in stock A, he is now planning to include stock B into his investment. The portfolio would be 60% investing in stock A and the other 40% investing in stock B. What are David's new expected return, variance, and standard deviation of portfolio investment? *(Given correlation between stock A and stock B is 0.80.)*

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 = ?

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 = ?

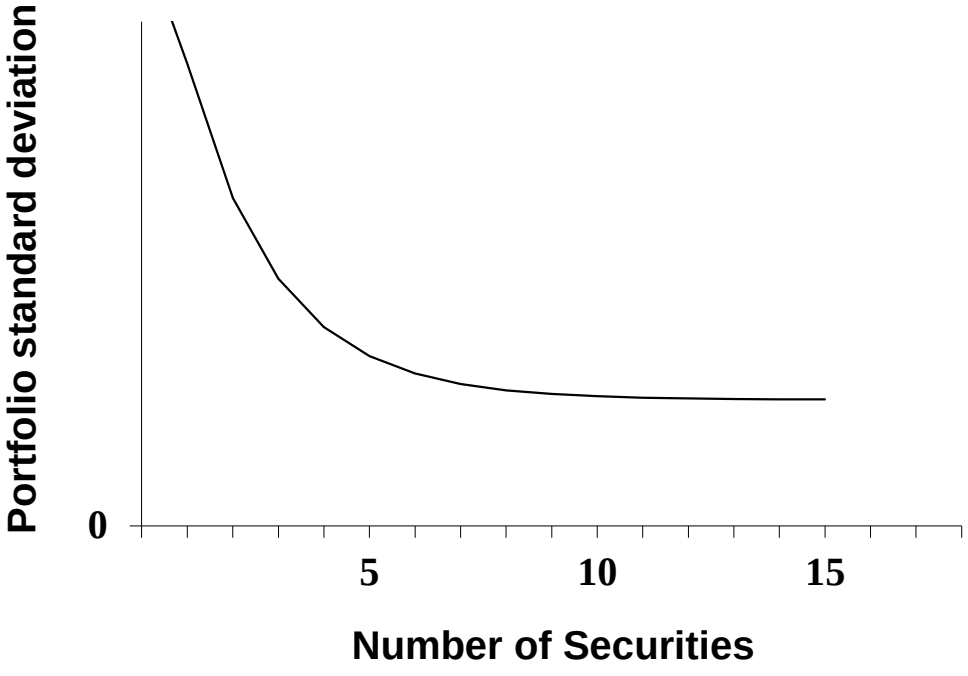
Measuring Risk

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

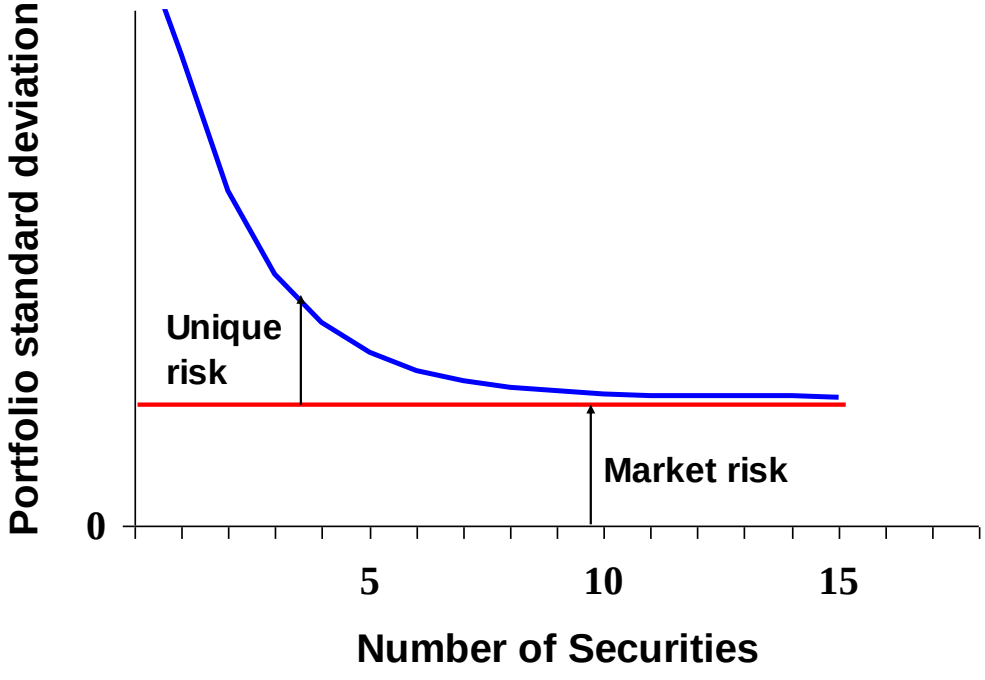
Unique Risk - Risk factors affecting only that firm. Also called "**diversifiable risk.**"

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

Measuring Risk



Measuring Risk



Question?