



FN211: Lecture Note 5

Risk and Return

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SET Index (^SET.BK)

Thailand - Thailand Delayed Price. Currency in THB

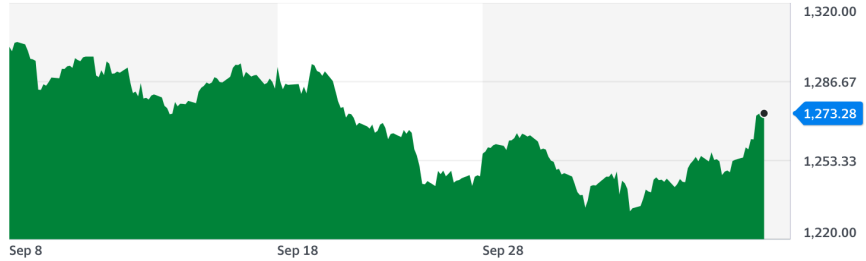
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1,274.16 +10.45 (+0.83%)

As of 11:06AM ICT. Market open.

[Summary](#) [Chart](#) [Conversations](#) [Historical Data](#) [Options](#) [Components](#)

1D 5D **1M** 6M YTD 1Y 5Y Max



Previous Close	1,263.71	Day's Range	1,269.50 - 1,276.02
Open	1,269.85	52 Week Range	1,269.50 - 1,276.02
Volume	0	Avg. Volume	N/A

Bangkok Bank Public Company Limited (BBL.BK)

Thailand - Thailand Delayed Price. Currency in THB

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96.25 +1.50 (+1.58%)

As of 10:51AM ICT. Market open.

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1D 5D **1M** 6M YTD 1Y 5Y Max

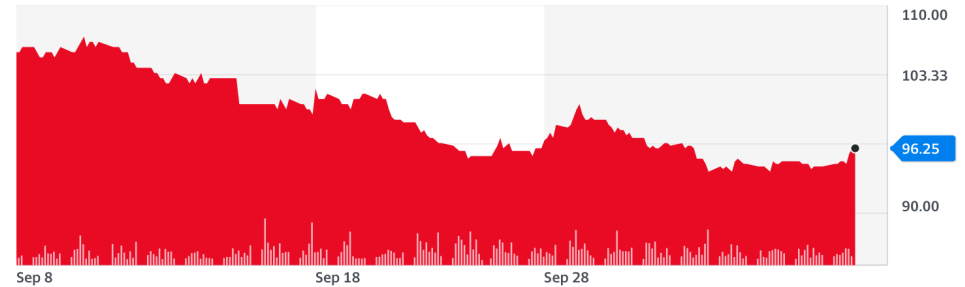


Chart Events
Neutral pattern detected
[View all chart patterns](#)

Performance Outlook

Short Term	Mid Term	Long Term
2W - 6W	6W - 9M	9M+

Previous Close	94.75	Market Cap	183.726B
Open	95.50	Beta (5Y Monthly)	0.60
Bid	96.00 x 0	PE Ratio (TTM)	6.51
Ask	96.25 x 0	EPS (TTM)	14.78
Day's Range	95.25 - 96.75	Earnings Date	Jul 17, 2018 - Jul 22, 2018
52 Week Range	88.00 - 180.00	Forward Dividend & Yield	7.00 (7.39%)
Volume	2,701,700	Ex-Dividend Date	Apr 20, 2020
Avg. Volume	8,439,046	1y Target Est	241.70

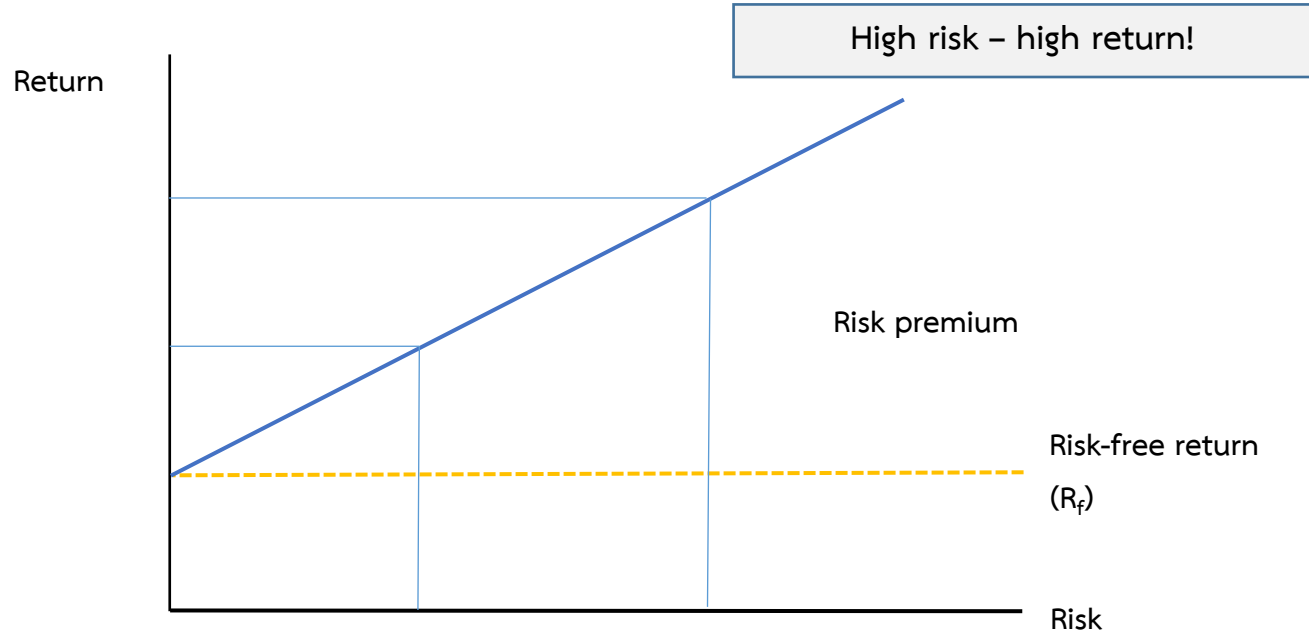
Fair Value
XX.XX

Related Research
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Example: An investment costs \$1,000 and is sold after 1 year for \$1,100.

Risk-Return Tradeoff

The relationship between risk and return



$$\begin{aligned}\text{Required rate of return} &= \text{Risk-free return} + \text{Risk premium} \\ &= R_f + \text{Risk premium}\end{aligned}$$

What is investment risk?

- Typically, investment returns are not known with certainty.
- Investment risk pertains to the probability of earning a return less than expected.
- Greater the chance of a return far below the expected return, greater the risk.

Stand-Alone Risk

Risk in Portfolio Context

Outline

- Asset Return and Stand-Alone Risk
- Return and Risk in Portfolio Context
- Diversification



Asset Return and Stand-Alone Risk

Expected Returns

- Expected returns are based on the probabilities of possible outcomes.
- In this context, “expected” means average if the process is repeated many times.
- The “expected” return does not even have to be a possible return.

$$E(R) = \sum_{i=1}^n p_i R_i$$

Example: Expected Return

- Consider the following information:

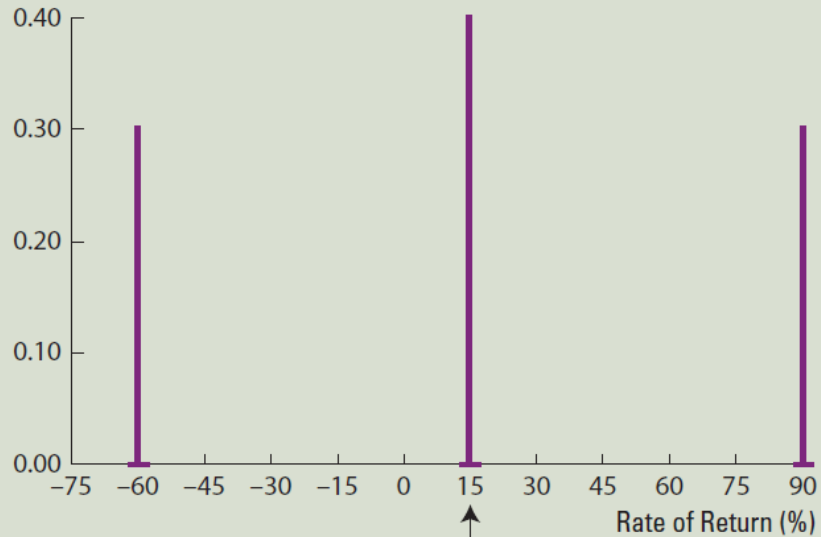
<u>State</u>	<u>Probability</u>	<u>ABC, Inc. Return</u>
Boom	.25	0.15
Normal	.50	0.08
Slowdown	.15	0.04
Recession	.10	-0.03

- What is the expected return?

Consider which is better?

Panel a. Sale.com

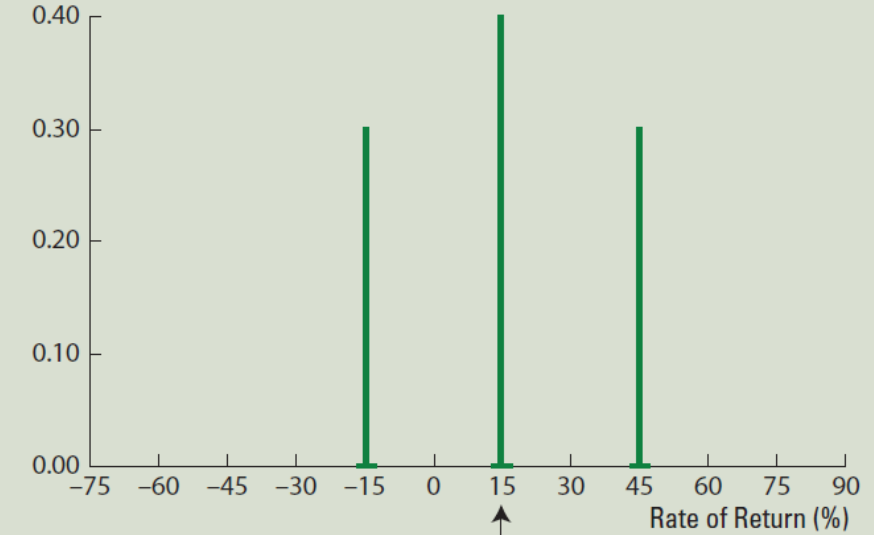
Probability of Occurrence



Expected Rate of Return

Panel b. Basic Foods

Probability of Occurrence



Expected Rate of Return

Variance and Standard Deviation

- Variance and standard deviation measure the volatility of returns.
- Using unequal probabilities for the entire range of possibilities
- Weighted average of squared deviations

$$\sigma^2 = \sum_{i=1}^n p_i (R_i - E(R))^2$$

Example: Variance and Standard Deviation

- Consider the following information:

<u>State</u>	<u>Probability</u>	<u>ABC, Inc. Return</u>
Boom	.25	0.15
Normal	.50	0.08
Slowdown	.15	0.04
Recession	.10	-0.03

- What is the variance?
- What is the standard deviation?

Example (2)

- Suppose you have predicted the following returns for stocks C and T in three possible states of the economy. What are the expected returns?

<u>State</u>	<u>Probability</u>	<u>C</u>	<u>T</u>
Boom	0.3	0.15	0.25
Normal	0.5	0.10	0.20
Recession	???	0.02	0.01

What are the variance and standard deviation for each stock?

The Reward-to-Volatility (Sharpe) Ratio

- ***Excess Return***: The difference in any particular period between the actual rate of return on a risky asset and the actual risk-free rate
- ***Risk Premium***: The difference between the expected HPR on a risky asset and the risk-free rate
- ***Sharpe Ratio*** =
$$\frac{\text{Risk premium}}{\text{SD of excess returns}}$$

Time Series Analysis of Past Rates of Return

- True means and variances are unobservable
 - Possible scenarios like the one in the examples are unknown
- Means and variances must be estimated

Returns Using Arithmetic and Geometric Averaging

- Arithmetic Average:
$$E(r) = \sum_{s=1}^n p(s)r(s) = \frac{1}{n} \sum_{s=1}^n r(s)$$
- Geometric (Time-Weighted) Average:
 - Terminal value of the investment: $TV_n = (1+r_1)(1+r_2)\dots(1+r_n)$
 - Geometric Average: $g = TV_n^{1/n} - 1$

Estimating Variance and Standard Deviation

- Estimated Variance
 - Expected value of squared deviations

$$\hat{\sigma}^2 = \frac{1}{n} \sum_{s=1}^n [r(s) - \bar{r}]^2$$

- Unbiased estimated standard deviation

$$\hat{\sigma} = \sqrt{\frac{1}{n-1} \sum_{j=1}^n [r(s) - \bar{r}]^2}$$

Covariance

Covariance and correlation are both measures of the extent to which two random variables move together.

- Covariance is the expected value of the product of each variable's deviation from its respective mean.

$$\sigma_{X,Y} = E\{[X - E(X)][Y - E(Y)]\}$$

$$\sigma_{R_i,R_j} = \sum_{i=1}^n P(R_i)[R_i - E(R_i)][R_j - E(R_j)]$$

Correlation

Covariance and correlation are both measures of the extent to which two random variables move together.

- Correlation is a scaled transformation of covariance wherein the extent of comovement is measured along a scale from exactly the same movement in the same direction to exactly the same movement in opposite directions.
 - When two variables move the same degree in opposing directions, they are said to be perfectly negatively correlated.
 - When two variables move the same degree in the same direction, they are said to be perfectly positively correlated.
 - When there is absolutely no commonality of movement, the variables are said to be uncorrelated.

$$\rho_{X,Y} = \frac{\sigma_{X,Y}}{\sigma_X \sigma_Y}$$

$$-1 \leq \rho_{X,Y} \leq 1$$

Example (2-continued)

- Suppose you have predicted the following returns for stocks C and T in three possible states of the economy.

<u>State</u>	<u>Probability</u>	<u>C</u>	<u>T</u>
Boom	0.3	0.15	0.25
Normal	0.5	0.10	0.20
Recession	???	0.02	0.01

What are covariance and correlation of stock C and T returns?



Return and Risk in Portfolio Context

Portfolios

- A portfolio is a collection of assets.
- An asset's risk and return are important in how they affect the risk and return of the portfolio.
- The risk-return trade-off for a portfolio is measured by the portfolio expected return and standard deviation, just as with individual assets.

Example: Portfolio Weights

- Suppose you have \$15,000 to invest and you have purchased securities in the following amounts. What are your portfolio weights in each security?
 - \$2000 of C
 - \$3000 of KO
 - \$4000 of INTC
 - \$6000 of BP

Portfolio Expected Returns

- The expected return of a portfolio is the weighted average of the expected returns of the respective assets in the portfolio.

$$E(R_P) = \sum_{j=1}^m w_j E(R_j)$$

- You can also find the expected return by finding the portfolio return in each possible state and computing the expected value as we did with individual securities.

Example: Expected Portfolio Returns

- Consider the portfolio weights computed previously. If the individual stocks have the following expected returns, what is the expected return for the portfolio?
 - C: 19.69%
 - KO: 5.25%
 - INTC: 16.65%
 - BP: 18.24%

Portfolio Variance

- Compute the portfolio variance and standard deviation using the same formulas as for an individual asset.

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

Example: Portfolio Variance

- Consider the following information on returns and probabilities:
 - Invest 50% of your money in Asset A.

<u>State</u>	<u>Probability</u>	<u>A</u>	<u>B</u>	<u>Portfolio</u>
Boom	.4	30%	-5%	12.5%
Bust	.6	-10%	25%	7.5%

- What are the expected return and standard deviation for each asset?
- What are the expected return and standard deviation for the portfolio?

Example (2): Portfolio Variance

- Consider the following information on returns and probabilities:

<u>State</u>	<u>Probability</u>	<u>X</u>	<u>Z</u>
Boom	.25	15%	10%
Normal	.60	10%	9%
Recession	.15	5%	10%

- What are the expected return and standard deviation for a portfolio with an investment of \$6,000 in asset X and \$4,000 in asset Z?

Example (3)

Use the following scenario analysis for Stocks X and Y to answer CFA Problems 3 through 6 (round to the nearest percent).

	Bear Market	Normal Market	Bull Market
Probability	0.2	0.5	0.3
Stock X	-20%	18%	50%
Stock Y	-15%	20%	10%

3. What are the expected rates of return for Stocks X and Y?
4. What are the standard deviations of returns on Stocks X and Y?
5. Assume that of your \$10,000 portfolio, you invest \$9,000 in Stock X and \$1,000 in Stock Y. What is the expected return on your portfolio?
6. Probabilities for three states of the economy and probabilities for the returns on a particular stock in each state are shown in the table below.

State of Economy	Probability of Economic State	Stock Performance	Probability of Stock Performance in Given Economic State
Good	0.3	Good	0.6
		Neutral	0.3
		Poor	0.1
Neutral	0.5	Good	0.4
		Neutral	0.3
		Poor	0.3
Poor	0.2	Good	0.2
		Neutral	0.3
		Poor	0.5

What is the probability that the economy will be neutral *and* the stock will experience poor performance?

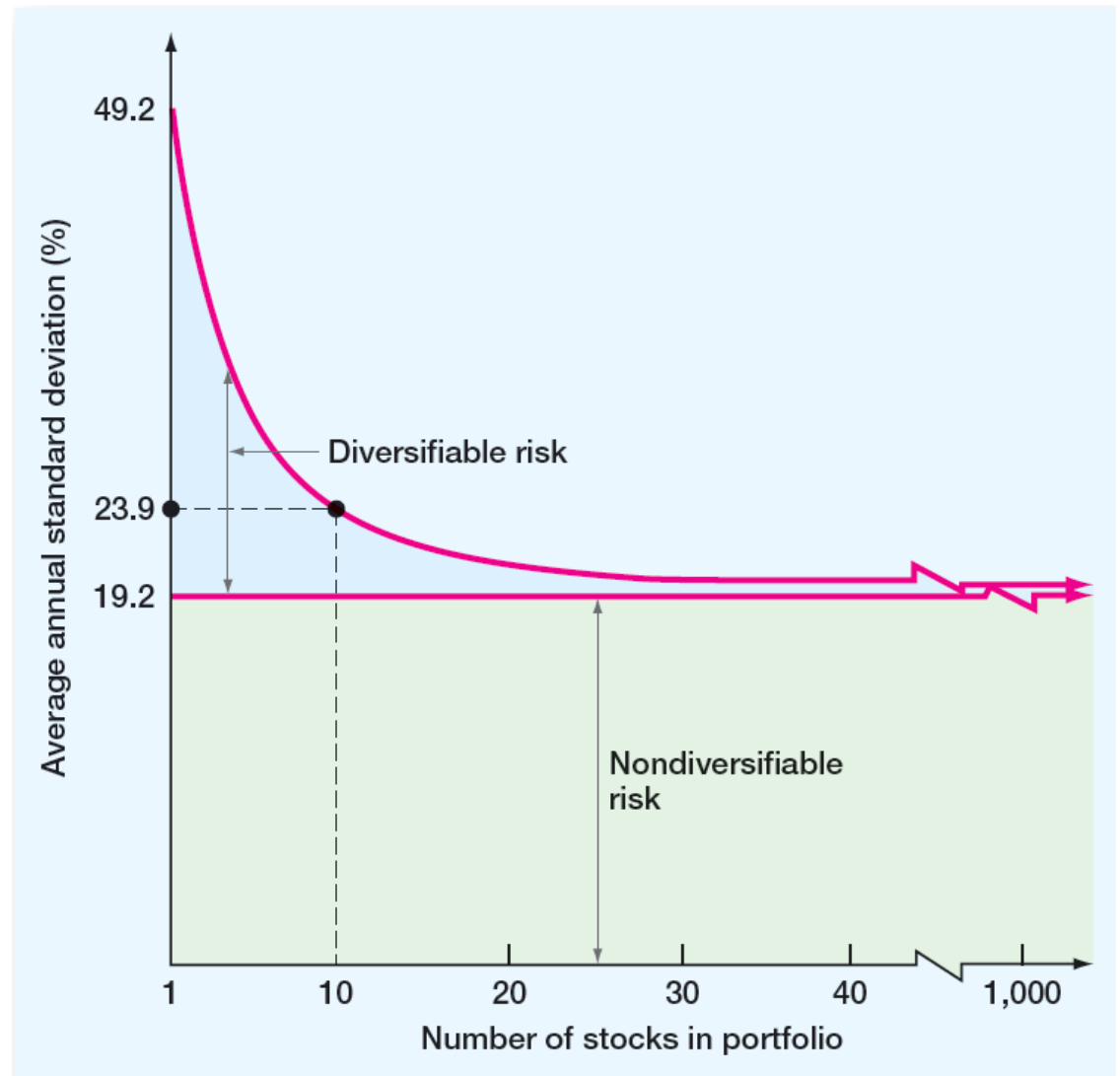


Diversification

The Principle of Diversification

- Diversification can substantially reduce the variability of returns without an equivalent reduction in expected returns.
- This reduction in risk arises because worse than expected returns from one asset are offset by better than expected returns from another.
- However, there is a minimum level of risk that cannot be diversified away and that is the systematic portion.

Portfolios



Total Risk

- Total risk = systematic risk + unsystematic risk
- The standard deviation of returns is a measure of total risk.
- For well-diversified portfolios, unsystematic risk is very small.
- Consequently, the total risk for a diversified portfolio is essentially equivalent to the systematic risk.

Do we have diversification benefits from the portfolio investment?

- Consider the following information on returns and probabilities:

<u>State</u>	<u>Probability</u>	<u>X</u>	<u>Z</u>
Boom	.25	15%	10%
Normal	.60	10%	9%
Recession	.15	5%	10%

- What are the expected return and standard deviation for a portfolio with an investment of \$6,000 in asset X and \$4,000 in asset Z?

Question?