

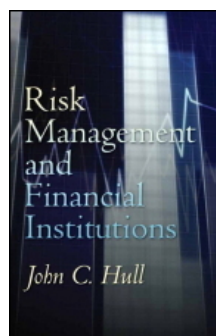



FN 201
BUSINESS FINANCE

Lecture 13
Risk and Return 2

Reference

- Excerpt from John C. Hull, *Risk Management and Financial Institutions*, Pearson International Edition, 2007



- Concerned with the way risks are managed by banks and other Fis, but many of the ideas and approaches are equally applicable to other types of firms

Beta and CAPM

Risk and Return of Stock

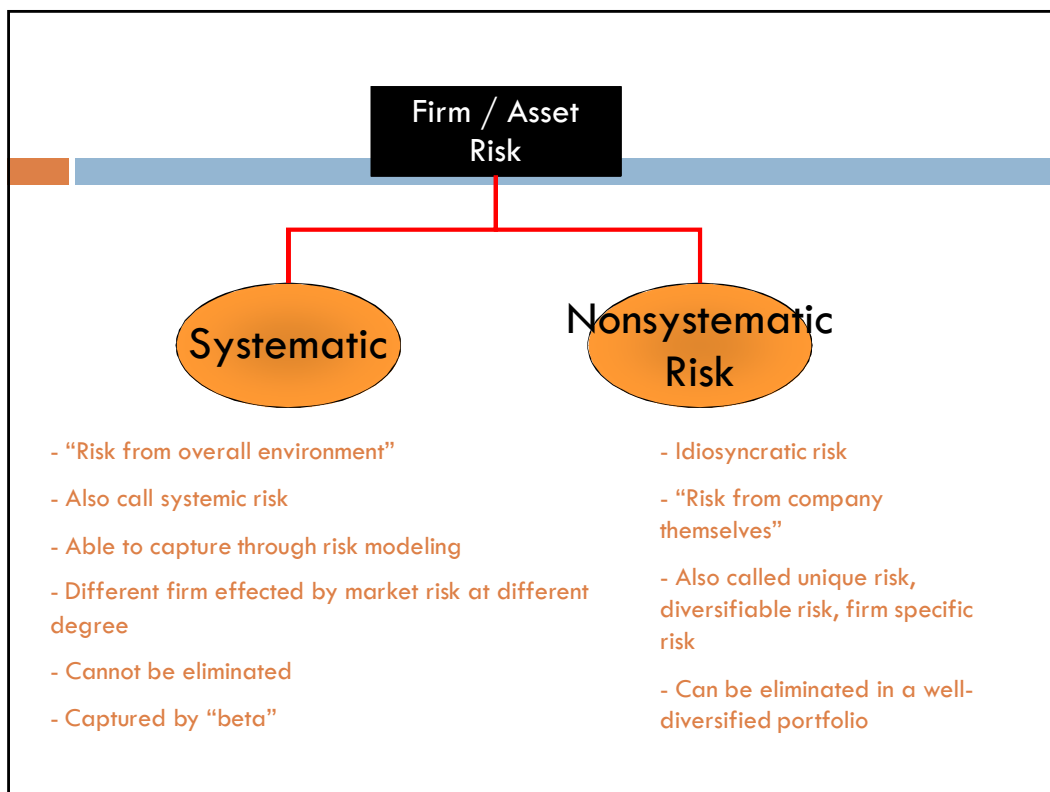
Systematic vs. Nonsystematic Risk

Risk and Return of Stock

- How do investors decide on the expected return required for individual investments?
- Which of these is more attractive?
- Case I:
 - Stock A with expected return of 5% and SD of return of 10%
 - Stock B with expected return of 5% and SD of return of 20%
- Case II:
 - Stock A with expected return of 5% and SD of return of 10%
 - Stock B with expected return of 10% and SD of return of 20%
- Direct comparison can be difficult
 - ▣ Benchmark is needed

Systematic vs. Nonsystematic Risk (2)

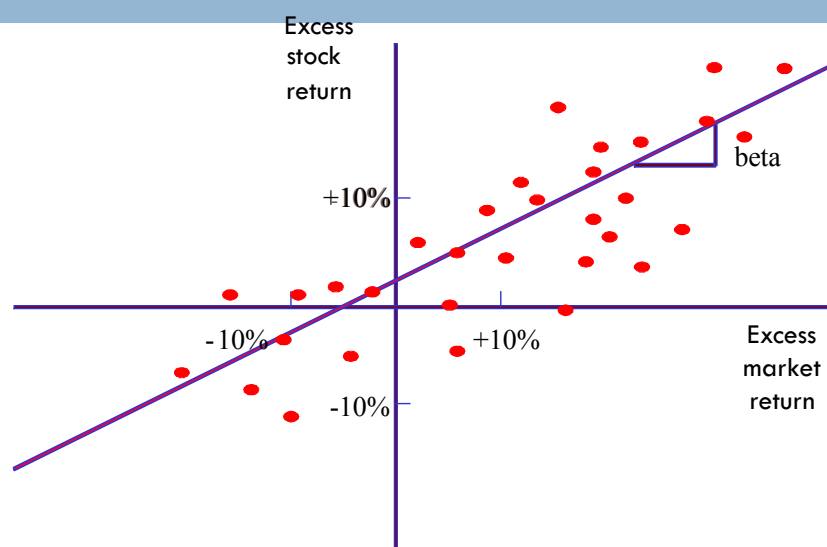
- As it turns out,
 - ▣ The expected return considered in relation to market portfolio
- For example
 - ▣ If asset has “sensitivity” about the same as the market -> expected return should be the same
 - ▣ If asset has higher “sensitivity” (higher risk) compared market return, return should be higher



Non-Systematic Risk

- ▣ “Risk of price change due to unique circumstances of specific security or company, as opposed to the overall market”
- ▣ Risk can mean good and bad outcomes
- ▣ For examples: Bad Risk
 - New regulation affecting particular group of companies
 - Sudden strike by employees / sudden loss of key management persons
 - Possible losses from law cases against company
 - Fire on exploration platform
- ▣ For examples: Good Risk
 - New regulation benefiting particular group of companies
 - Recruitment of key management persons
 - Possible win from law cases of company
 - Discover of natural resources

Estimating Beta from Historical Data



Estimating Beta from Historical Data (2)

$$B_i = \frac{\sigma_{im}}{\sigma_m^2}$$

Covariance with the market return

Variance of the market return

Capital Asset Pricing Model

- Proposed by William Shrape, John Lintner, and Jack Treynor in the mid-1960s - all Noble price winner
- “In the competitive market, the expected risk premium (return over risk free return) varies in direct proportional to beta”
- For example:
 - The expected risk premium on an investment with beta of 0.5 is, therefore, half the expected risk premium on the market
 - The expected risk premium on an investment with beta of 2 is, therefore, twice the expected risk premium on the market



Capital Asset Pricing Model (2)

$$E(R - R_f) = \beta \cdot [E(R_m) - R_f]$$

$$\beta = \frac{\sigma_{im}}{\sigma_m^2}$$

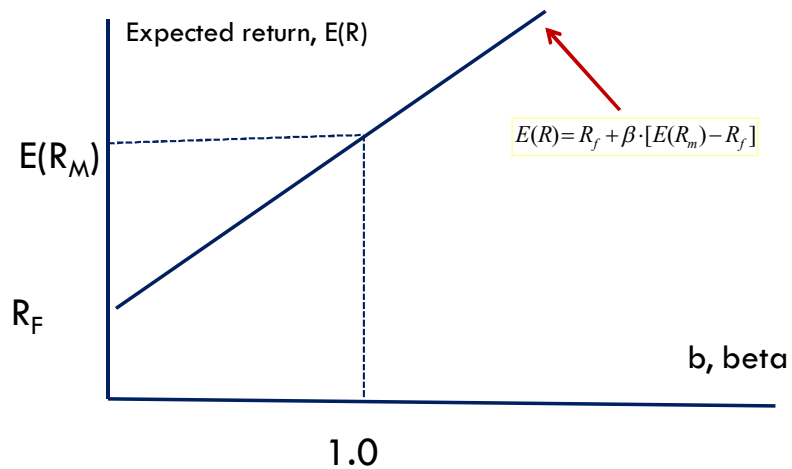
$$E(R) = R_f + \beta \cdot [E(R_m) - R_f]$$

Expected risk premium on asset = beta x expected risk premium on market

Expected return on asset = risk free + (beta x expected risk premium on market)



Capital Asset Pricing Model (3)



Ex4. CAPM example

Stock	Beta	Expected Return $r_f = 5\%, r_m - r_f = 7\%$
Amazon	2.20	20.40
IBM	1.59	16.13
Disney	1.26	13.82
Microsoft	1.13	12.91
Boeing	1.09	12.63
Starbuck	0.69	9.83
ExxonMok	0.65	9.55
Wal-Mart	0.57	8.99
Pfizer	0.55	8.85
Heinz	0.56	8.92

Beta β

- Beta is sensitivity / elasticity of asset return to market return
- Beta of market portfolio is 1
- Theoretically beta of stock ranges from negative infinity to positive infinity
- In actual world beta of stock is usually a small positive number around 1
- Beta > 1 : asset tends to amplify overall market movements
- 0 > Beta > 1 : asset tends to move in the same direction as the market, but not as much

Ex. Test of Concepts

- 1) The correlation between the efficient portfolio and the risk-free asset is:
a. +1 b. -1 c. 0 d. Cannot be calculated
- 2) Beta of Treasury bills is:
a. +1.0 b. +0.5 c. -1.0 d. 0
- 3) Beta of the market portfolio is:
a. Zero b. +0.5 c. -1.0 d. +1.0

Ex. Test of Concepts

- 4) The correlation coefficient between stock A and the market portfolio is +0.6. The standard deviation of return of the stock is 30% and that of the market portfolio is 20%. Calculate the beta of the stock.
a. 1.1 b. 1.0 c. 0.9 d. 0.6
- 5) The correlation coefficient between stock B and the market portfolio is 0.8. The standard deviation of the stock B is 35% and that of the market is 20%. Calculate the beta of the stock.
a. 1.0 b. 1.4 c. 0.8 d. 0.7

Ex5. Beta of selected US companies

□ July 2001 – June 2006

Stock	Beta	Stock	Beta
Amazon	2.20	Starbuck	0.69
IBM	1.59	ExxonMobil	0.65
Disney	1.26	Wal-Mart	0.57
Microsoft	1.13	Pfizer	0.55
Boeing	1.09	Heinz	0.56

Ex6. CAPM(1)

- 1) The capital asset pricing model (CAPM) states that:
 - a. The expected risk premium on an investment is proportional to its beta
 - b. The expected rate of return on an investment is proportional to its beta
 - c. The expected rate of return on an investment depends on the risk-free rate and the market rate of return
 - d. The expected rate of return on an investment is dependent on the risk-free rate
- 2) The main shortcoming of CAPM is that it
 - a. Ignores the return on the market portfolio
 - b. Uses too many factors
 - c. Requires a single risk measure of systematic risk
 - d. Ignores risk-free rate of return

Ex7. CAPM(2)

- 1) If the beta of Microsoft is 1.13, risk-free rate is 3% and the market risk premium is 8%, calculate the expected return for Microsoft.
a. 12.04% b. 15.66% c. 13.94% d. 8.65%
- 2) If the beta of Amazon.com is 2.2, risk-free rate is 5.5% and the market risk premium is 8%, calculate the expected rate of return for Amazon.com stock:
a. 15.8% b. 14.3% c. 35.2% d. 23.1%
- 3) A stock with a beta of 1.25 would be expected to:
a. Increase in returns 25% faster than the market in up markets
b. Increase in returns 25% faster than the market in down markets
c. Increase in returns 125% faster than the market in up markets
d. Increase in returns 125% faster than the market in down markets

Underlying assumptions

- 1) Investors care only about the expected return and SD of return
- 2) The error term of one asset are independent
- 3) Investor focus on returns over just one period and this length is the same for all investors
- 4) Investor can borrow and lend at the same risk-free rate
- 5) There are no tax considerations
- 6) All investors make the same estimates of expected returns, SD of returns and correlation

How realistic can it be?

- 1) Investors have a complex set of risk preferences, involve more than the first two moments of return distribution. Satisfaction also depends on relative performance
- 2) Correlation between returns from two assets can not arise only from their correlations with market portfolio. Error term of firms in the same sector of the economy also tends to correlate
- 3) Investors have different time horizon
- 4) There is spread in borrowing
- 5) Tax do influence portfolio choices
- 6) Expectations are not homogeneous

CAPM in practice

- ▣ CAPM still proved to be a useful tool for portfolio manager
- ▣ Estimate of betas of stocks can be estimated and hence the expected return on a portfolio is commonly used benchmark for assessing performance of the portfolio manager
- ▣ A firm level, financial manager also use CAPM to estimate cost of equity in weighted average cost of capital (WACC)

CAPM in practice (2)

- ▣ From J.R. Graham and C.R. Harvey, “The Theory and Practice of Corporate Finance: Evidence from the Field”, “Journal of Financial Economics 61 (2001), pp. 187-243.
- ▣ Financial managers use for more than one method to estimate cost of capital – expected rate of return on stock
 - 72% use CAPM
 - 39% use average historical stock return
 - 34% use CAPM model with some extra risk factors

Arbitrage Pricing Theory (APT)

- ▣ A more general analysis moves us away from the first two assumption is APT model
- ▣ It said “the return from asset is assumed to depend on several (more than one) factors
- ▣ Each factor is a separate source of systematic risk
- ▣ Model by E.F. Fama & K.R. French proposes more factors, namely
 - Size and Book-to-Market Factors



The idea of portfolio theory can be applied to corporation as well (2)

- Let's consider trade-off between risk and return made by a company
- How should a company decide whether expected return is sufficient compensation for its risks?
 - ▣ New project undertaken by company should be viewed as "additional asset" to its shareholder's portfolio
 - ▣ Company should calculate project beta, find required return from CAPM, use it as discount rate, if NPV is greater than zero -> it is a good deal for shareholders -> company should accept it
 - ▣ Non-systemic risks should not be considered
- In practice, companies are concerned about nonsystematic as well as systematic risk

The idea of portfolio theory can be applied to corporation as well (3)

- For example
 - ▣ Risk of building being burned down -> completely nonsystematic and can be diversified by shareholders thru capital market
- In practice, earning stability and survival of the company are important
- Shareholder prefer to invest in companies with solid growth and meeting earning forecast with low volatility
 - ▣ They like companies to manage risks carefully – both systematic and nonsystematic

Q & A