SPROTT
SCHOOL OF BUSINESS

BUSI 2505e - Business Finance

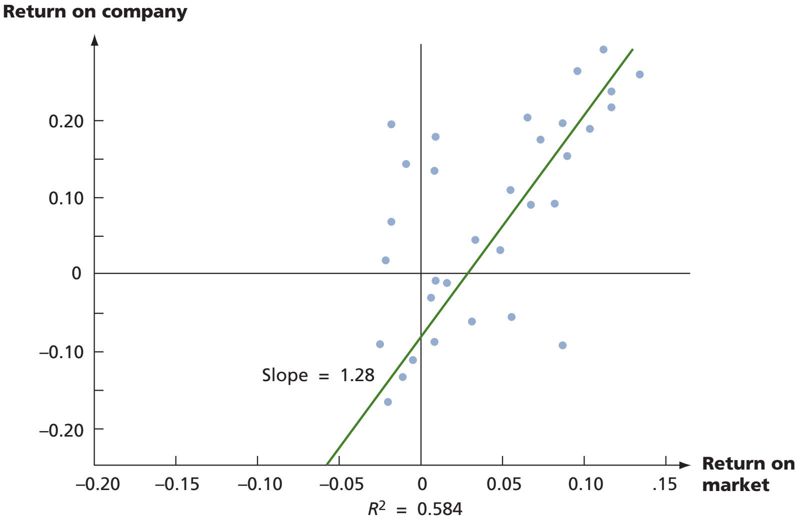
Monday, February 1, 2010

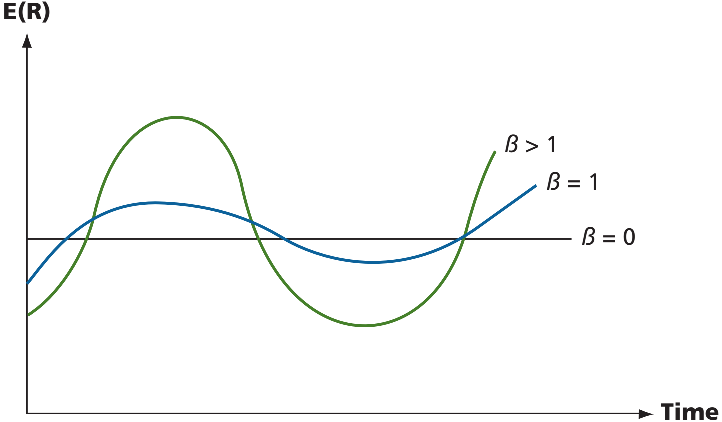
§13.6, 13.7	beta, security market line, capm
§14	cost of capital

- marked quiz #1
- in-class quiz #2 next week
  - **30 min at beginning of class** - 8:45-9:15
  - chapters 7, 8, 13 and 14
  - 40% multiple choice and 60% written problems
  - suggested exercises (with solutions) `http://lemma.ca/2505e/quizzes.html`

- There is a reward for bearing risk
- There is not a reward for bearing risk unnecessarily
- The expected return on a risky asset depends only on that asset's systematic risk since unsystematic risk can be diversified away

- How do we measure systematic risk?
  - We use the beta coefficient (β) to measure systematic risk
- What does beta tell us?
  - $\beta = 1$ - the asset has the same systematic risk as the overall market
  - $\beta < 1$ - the asset has less systematic risk than the overall market
  - $\beta > 1$ - the asset has more systematic risk than the overall market

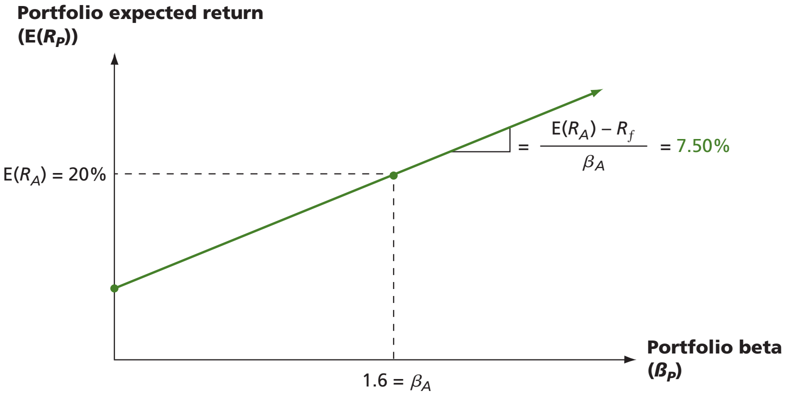

Return on company
0.20
0.10
0
–0.10
–0.20
Slope = 1.28
–0.20
–0.15
–0.10
–0.05
0
0.05
0.10
.15
Return on market
R^2 = 0.584

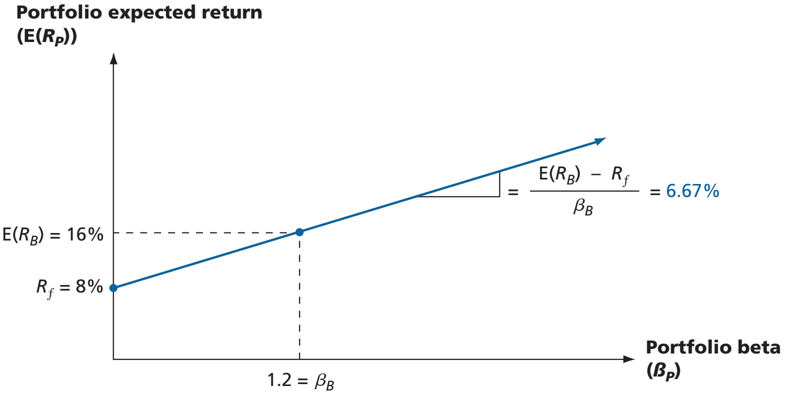

E(R)
ß > 1
ß = 1
ß = 0
Time

- Remember that the risk premium = expected return - risk-free rate, ie. $E(R_{asset}) - R_f$
- The higher the beta, the greater the risk premium should be
- the relationship between risk premium and beta is known as the **reward-to-risk ratio**

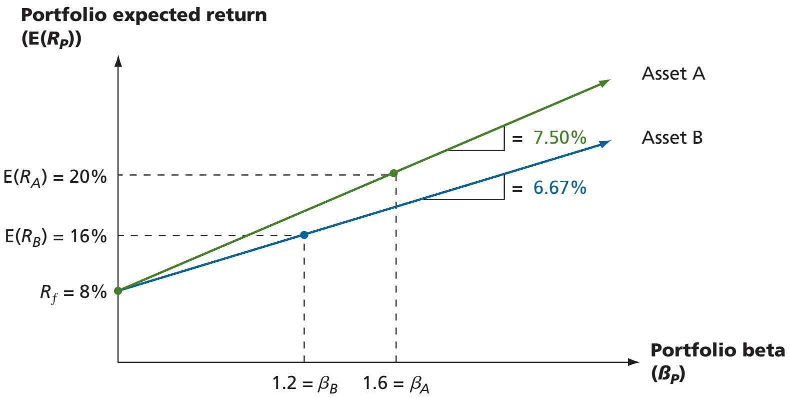
$$\frac{E(R_{asset}) - R_f}{\beta_{asset}}$$

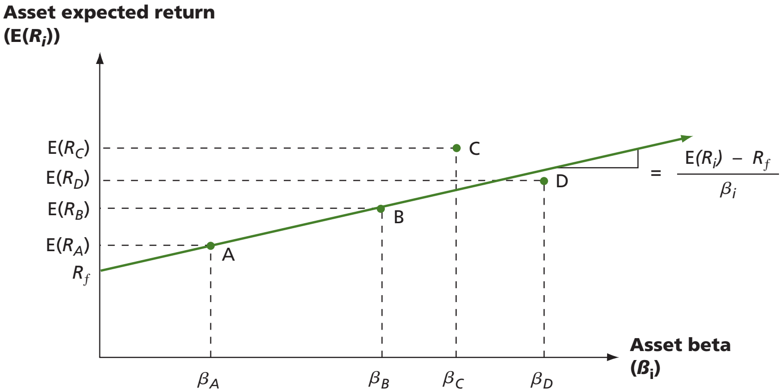
which is the slope of the line on the following 3 figures


Portfolio expected return
(E(R_P))
E(R_A) = 20%
= $\frac{E(R_A) - R_f}{\beta_A}$ = 7.50%
1.6 = β_A
Portfolio beta
(β_P)


Portfolio expected return
(E(R_P))
E(R_B) = 16%
R_f = 8%
E(R_B) − R_f
β_B
= 6.67%
1.2 = β_B
Portfolio beta
(β_P)

13.7: portfolio expected returns and betas - both assets (figure 13.8c, p.393)





The fundamental relationship between beta and expected return is that all assets must have the same reward-to-risk ratio $[E(R_i) - R_f]/\beta_i$. This means they would all plot on the same straight line. Assets A and B are examples of this behaviour. Asset C's expected return is too high; Asset D's is too low.

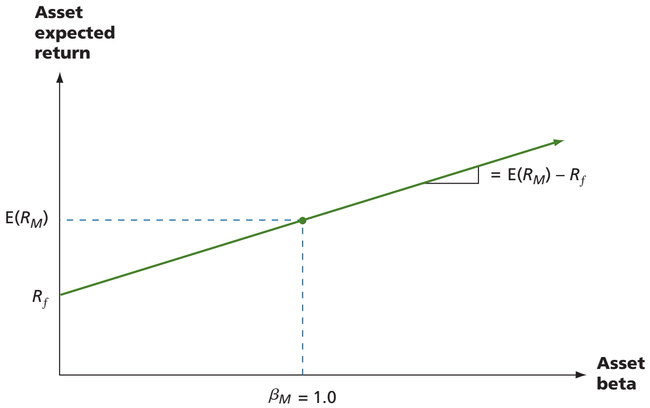
A stock has a beta of 1.4 and an expected return of 16%. The risk-free rate is 5%. What is the reward to risk ratio?

answer: 7.86%

- **What if an asset has a reward-to-risk ratio of 8 (above the line)?** Investors will want to buy the asset. This will drive the price up and the return down until the reward-to-risk ratio reaches 7.5.
- **What if an asset has a reward-to-risk ratio of 7 (below the line)?** Investors will want to sell the asset. This will drive the price down and the return up until the reward-to-risk ratio reaches 7.5.
- In market equilibrium, all assets and portfolios must have the same reward-to-risk ratio and they all must equal the reward-to-risk ratio for the market

$$\frac{E(R_{asset}) - R_f}{\beta_{asset}} = \frac{E(R_{market}) - R_f}{\beta_{market}}$$

- The security market line (SML) is the representation of market equilibrium
- The slope of the SML is the reward-to-risk ratio: $(E(R_M) - R_f)/\beta_M$
- But since the beta for the market is ALWAYS equal to one, the slope can be rewritten
- Slope = $E(R_M) - R_f$ = market risk premium



The slope of the security market line is equal to the market risk premium, ie. reward for bearing an average amount of systematic risk. The equation describing the SML can be written $E(R_i) = R_f + \beta_i \times [E(R_M) - R_f]$ which is the **capital asset pricing model (CAPM)**.

- The capital asset pricing model defines the relationship between risk and return

$$E(R_{asset}) = R_f + \beta_{asset}\left(E(R_{market}) - R_f\right)$$

- If we know an asset's systematic risk, we can use the CAPM to determine its expected return
- This is true whether we are talking about financial assets or physical assets

The stock of Martin Industries has a beta of 1.43. The risk-free rate of return is 3.6% and the market risk premium is 9%. What is the expected rate of return on Martin Industries stock?

answer: 16.5%

- §14.1 - Cost of Capital: Some Preliminaries
- §14.2 - The Cost of Equity
- §14.3 - The Costs of Debt and Preferred Stock
- §14.4 - The Weighted Average Cost of Capital
- §14.5 - Divisional and Project Costs of Capital
- §14.6 - Flotation Costs and the Weighted Average Cost of Capital

- We know that the return earned on assets depends on the risk of those assets
- The return to an investor is the same as the cost to the company
- Our cost of capital provides us with an indication of how the market views the risk of our assets
- Knowing our cost of capital can also help us determine our required return for capital budgeting projects

- The required return is the same as the appropriate discount rate and is based on the risk of the cash flows
- We need to know the required return for an investment before we can compute the NPV and make a decision about whether or not to take the investment
- We need to earn at least the required return to compensate our investors for the financing they have provided

- The cost of equity is the return required by equity investors given the risk of the cash flows from the firm
- There are two major methods for determining the cost of equity
  - Dividend growth model (DGM)
  - SML or CAPM

- Start with the dividend growth model formula and rearrange to solve for R_E

P_0: price of stock today, D_1: dividend next year, D_0: dividend this year, g: dividend growth rate, R_E: cost of equity

$$P_0 = \frac{D_1}{R_E - g} = \frac{D_0(1+g)}{R_E - g}$$

$$\Rightarrow \quad R_E = \underbrace{\frac{D_1}{P_0}}_{\text{dividend yield}} + \underbrace{g}_{\text{capital gains yield}}$$

Suppose that your company is expected to pay a dividend of $1.50 per share next year. There has been a steady growth in dividends of 5.1% per year and the market expects that to continue. The current price is $25. What is the cost of equity?

answer:

$$R_E = \frac{D_1}{P_0} + g = \frac{1.50}{25} + .051 = .111 = \mathbf{11.1\%}$$

One method for estimating the growth rate is to use the historical average.

answer:

Year	Dividend	Percent Change
1995	1.23	
1996	1.30	(1.30 - 1.23) / 1.23 = 5.7%
1997	1.36	(1.36 - 1.30) / 1.30 = 4.6%
1998	1.43	(1.43 - 1.36) / 1.36 = 5.1%
1999	1.50	(1.50 - 1.43) / 1.43 = 4.9%

$$\textit{Average} = (5.7 + 4.6 + 5.1 + 4.9)/4 = 5.1\%$$

- **Advantage** - easy to understand and use
- **Disadvantages**
  - Only applicable to companies currently paying dividends
  - Not applicable if dividends aren't growing at a reasonably constant rate
  - Extremely sensitive to the estimated growth rate, an increase in g of 1% increases the cost of equity by 1%
  - Does not explicitly consider risk
  - no allowance for the uncertainty about the growth rate

- Use the following information to compute our cost of equity
  - Risk-free rate, R_f
  - Market risk premium, $E(R_M) - R_f$
  - Systematic risk of asset, β

$$R_E = R_f + \beta_E \left(E(R_M) - R_f \right)$$

- Suppose your company has an equity beta of .58 and the current risk-free rate is 6.1%. If the expected market risk premium is 8.6%, what is your cost of equity capital?

$$R_E = 6.1 + .58(8.6) = 11.1\%$$

- Since we came up with similar numbers using both the dividend growth model and the SML approach, we should feel pretty good about our estimate

- Advantages
  - Explicitly adjusts for systematic risk
  - Applicable to all companies, as long as we can compute beta
- Disadvantages
  - Have to estimate the expected market risk premium, which does vary over time
  - Have to estimate beta, which also varies over time
  - We are relying on the past to predict the future, which is not always reliable

Suppose our company has a beta of 1.5. The market risk premium is expected to be 9% and the current risk-free rate is 6%. We have used analysts estimates to determine that the market believes our dividends will grow at 6% per year and our last dividend was $2. Our stock is currently selling for $15.65. What is our cost of equity?

answer:

Using SML:

$$R_E = 6\% + (1.5)(9\%) = 19.5\%$$

Using DGM:

$$R_E = \frac{D_0(1+g)}{P_0} + g = \frac{2(1.06)}{15.65} + .06 = 19.55\%$$

- The cost of debt is the required return on our company's debt
- We usually focus on the cost of long-term debt or bonds
- The required return is best estimated by computing the yield-to-maturity on the existing debt
- We may also use estimates of current rates based on the bond rating we expect when we issue new debt
- The cost of debt is NOT the coupon rate

Suppose we have a bond issue currently outstanding that has 25 years left to maturity. The coupon rate is 9% and coupons are paid semiannually. The bond is currently selling for $908.72 per $1,000 bond. What is the cost of debt?

answer:

$$50\ \boxed{\text{N}};\quad 45\ \boxed{\text{PMT}};\quad 1,000\ \boxed{\text{FV}};\quad -908.75\ \boxed{\text{PV}};$$

$$\boxed{\text{CPT}}\ \boxed{\text{I/Y}} = 5\% \ \Rightarrow\ YTM = 2 \times 5\% = \mathbf{10\%}$$

- Preferred stock generally pays a constant dividend every period
- Dividends are expected to be paid every period forever
- Preferred stock is a perpetuity, so we take the perpetuity formula, rearrange and solve for R_P

$$P_0 = \frac{D}{R_P} \quad \Rightarrow \quad R_P = \frac{D}{P_0}$$

Your company has preferred stock that has an annual dividend of $3. If the current price is $25, what is the cost of preferred stock?

answer:

$$R_P = \frac{3}{25} = \mathbf{12\%}$$

- We can use the individual costs of capital that we have computed to get our "average" cost of capital for the firm.
- This "average" is the required return on our assets, based on the market's perception of the risk of those assets
- The weights are determined by how much of each type of financing that we use

- Notation
  - E = market value of equity = # outstanding shares times price per share
  - D = market value of debt = # outstanding bonds times bond price
  - P = market value of preferred = # outstanding preferred shares times price per preferred share
  - V = market value of the firm = E + D + P
- Weights
  - $w_E = E/V =$ percent financed with equity
  - $w_D = D/V =$ percent financed with debt
  - $w_P = D/V =$ percent financed with preferred stock

Suppose you have a market value of equity equal to $500 million and a market value of debt = $475 million. What are the capital structure weights?

answer:

$$V = 500\ million + 475\ million = 975\ million$$

$$w_E = E/D = 500/975 = .5128 = 51.28\%$$
$$w_D = D/V = 475/975 = .4872 = 48.72\%$$

Given the following information, what is the value of XYZ Corporation?

Common Stock	14.2 million shares outstanding, price = $35 per share
Bond Issue 1	$500 million total face value, price = 102% of face value
Bond Issue 2	$175 million total face value, price = $850 per bond

answer: $1,155.75 million

A firm has a debt-equity ratio of .25. What weight should be given to the equity for the WACC computation?

answer: 80%

- We are concerned with after-tax cash flows, so we need to consider the effect of taxes on the various costs of capital
- Interest expense reduces our tax liability
  - This reduction in taxes reduces our cost of debt
  - After-tax cost of debt $= R_D(1 - T_C)$
- Dividends are not tax deductible, so there is no tax impact on the cost of equity and preferred

$$WACC = w_E R_E + w_P R_P + w_D R_D(1 - T_C)$$

- Equity Information: 50 million shares, $80 per share, Beta = 1.15, Market risk premium = 9%, Risk-free rate = 5%. What is the cost of equity?

$$R_E = 5 + 1.15(9) = \mathbf{15.35\%}$$

- Debt Information: $1 billion in outstanding debt (face value), Current quote = 110, Coupon rate = 9% (semiannual coupons), 15 years to maturity. What is the cost of debt?

$$30\ \boxed{\text{N}};\quad 45\ \boxed{\text{PMT}};\quad 1,000\ \boxed{\text{FV}};\quad -1,100\ \boxed{\text{PV}};$$

$$\boxed{\text{CPT}}\ \boxed{\text{I/Y}} = 3.93\% \Rightarrow YTM = 2 \times 3.93\% = \mathbf{7.86\%}$$

- Tax rate = 40%. What is the after-tax cost of debt?

$$R_D(1 - T_C) = 7.86(1 - .4) = \mathbf{4.71\%}$$

- What are the capital structure weights?

$$E = (50\ \textit{million})(80) = 4\ \textit{billion}$$

$$D = (1\ \textit{billion})(1.10) = 1.1\ \textit{billion}$$

$$V = 4 + 1.1 = 5.1\ \textit{billion}$$

$$w_E = \frac{E}{V} = \frac{4}{5.1} = .7843; \quad w_D = \frac{D}{V} = \frac{1.1}{5.1} = .2157$$

- What is the WACC?

$$WACC = .7843(15.35\%) + .2157(4.71\%) = \mathbf{13.06\%}$$

- Using the WACC as our discount rate is only appropriate for projects that have the same risk as the firm's current operations
- If we are looking at a project that is NOT the same risk as the firm, then we need to determine the appropriate discount rate for that project
- Divisions also often require separate discount rates because they have different levels of risk

- What would happen if we use the WACC for all projects regardless of risk? Assume the WACC = 15%

Project	Required Return	IRR
A	20%	17%
B	15%	18%
C	10%	12%

- Which projects would be accepted if you used the WACC for the discount rate? A and B.
- Which projects should be accepted if you use the required return based on the risk of the project? B and C.
- So, what happened when we used the WACC? We accepted a risky project that we shouldn't have and rejected a less risky project that we should have accepted. What will happen to the overall risk of the firm if the company does this on a consistent basis? The firm will become riskier.

Jeb's Automotive has a beta of 1.0 and a cost of equity of 14 percent. The risk-free rate of return is 5 percent. Jeb's is considering a project with a beta of .75. An appropriate discount rate for the project is:

answer: 11.75%

- Find one or more companies that specialize in the product or service that we are considering
- Compute the beta for each company
- Take an average
- Use that beta along with the CAPM to find the appropriate return for a project of that risk
- Often difficult to find pure play companies

The Delta Co. owns retail stores that market home building supplies. Largo, Inc. builds single family homes in residential developments. Delta has a beta of 1.22 and Largo has a beta of 1.34. The risk-free rate of return is 4 percent and the market risk premium is 6.5 percent. What should Delta use as its cost of equity if it decides to purchase some land and create a new residential community?

answer: 12.71%

- Consider the project's risk relative to the firm overall
- If the project is more risky than the firm, use a discount rate greater than the WACC
- If the project is less risky than the firm, use a discount rate less than the WACC
- You may still accept projects that you shouldn't and reject projects you should accept, but your error rate should be lower than not considering differential risk at all

Risk Level	Discount Rate
very low risk	WACC -8%
low risk	WACC -3%
same risk as firm	WACC
high risk	WACC +5%
very high risk	WACC +10%

- The required return depends on the risk, not how the money is raised
- However, the cost of issuing new securities should not just be ignored either
- Basic Approach
  - Compute the weighted average flotation cost
  - Use the target weights because the firm will issue securities in these percentages over the long term

14.6: npv and flotation costs - example

- Your company is considering a project that will cost $1 million. The project will generate after-tax cash flows of $250,000 per year for 7 years. The WACC is 15% and the firm's target D/E ratio is .6 The flotation cost for equity is 5% and the flotation cost for debt is 3%. What is the NPV for the project after adjusting for flotation costs?
  - D/E = 0.6 - therefore, D/V = 6/16 = 0.375 and E/V = 10/16 = 0.625
  - f_A = (.375)(3%) + (.625)(5%) = 4.25%
  - True cost is $1 million / (1-0.0425) = $1,044,386
  - PV of future cash flows = 1,040,105
  - NPV = 1,040,105 - 1,044,386 = -4,281
- The project would have a positive NPV of 40,105 without considering flotation costs
- Once we consider the cost of issuing new securities, the NPV becomes negative

A firm needs to raise \$165 million for a project. If external financing is used, the firm faces flotation costs of 8% for equity and 2.5% for debt. If the project is to be financed 60% with equity and 40% with debt, how much cash must the firm raise in order to finance the project?

answer: \$175.2 million

The Lingo Co. has a debt-equity ratio of .60. The firm is analyzing a new project which requires an initial cash outlay of $450,000 for new equipment. The flotation cost for new equity is 10 percent and for debt 5 percent. What is the initial cost of the project including the flotation costs?

answer: $489,796