

CHAPTER

13

Risk, Cost of Capital, and Valuation

Key Concepts and Skills

- Know how to determine a firm's cost of equity capital
- Understand the impact of beta in determining the firm's cost of equity capital
- Know how to determine the firm's overall cost of capital – WACC
- Understand the impact of flotation costs on capital budgeting

Chapter Outline

- 13.0 General Concepts on Cost of Capital
- 13.1 The Cost of Equity Capital
- 13.2 Estimating the Cost of Equity Capital with CAPM
- 13.3 Estimation of Beta
- 13.4 Determinants of Beta
- 13.5 Dividend Discount Model
- 13.6 Cost of Capital for Divisions and Projects
- 13.7 Cost of Fixed Income Securities
- 13.8 The Weighted Average Cost of Capital (WACC)
- 13.9 Firm Valuation with WACC
- 13.10 Estimating International Paper's Cost of Capital
- 13.11 Flotation Costs and the WACC

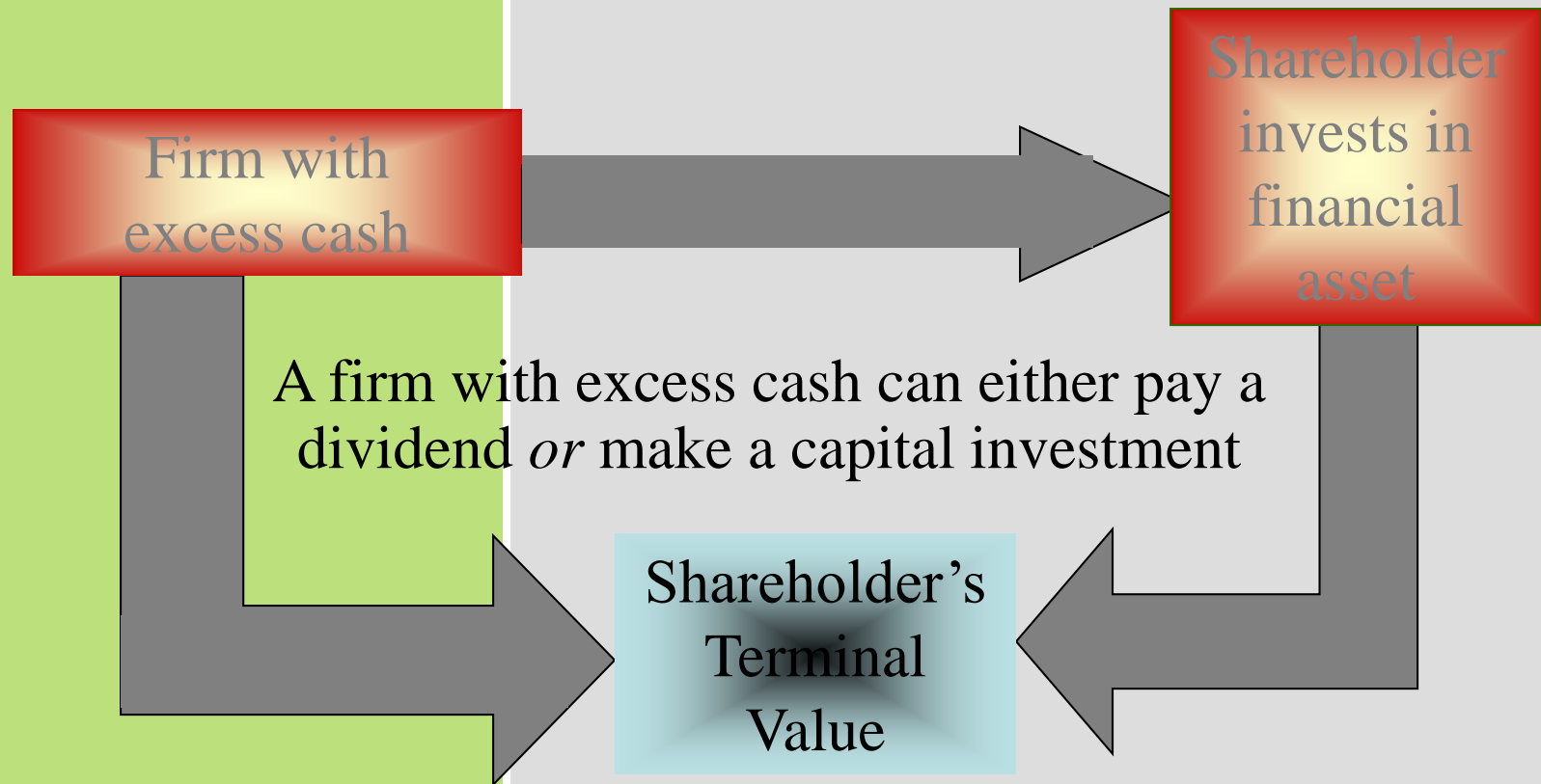
Where Do We Stand?

- Earlier chapters on capital budgeting focused on the appropriate size and timing of cash flows.
- This chapter discusses the appropriate discount rate when cash flows are risky.
 - Assumption – Securities are fairly priced and at equilibrium, i.e., $E(R) = \text{Required Return or Discount Rate!}$

13.0 General Concepts on Cost of Capital

- The cost of capital is an opportunity cost. It must reflect the best investment opportunity of equal risk available to suppliers of the firm's capital in the financial markets, i.e., The Opportunity Cost Principle (Chapter 4)!
- The cost of capital should reflect the risk of the investment which is financed by the capital raised, i.e., the use of the funds (rather than the source of the funds). It is also called the investment's required return and the appropriate discount rate.
- Since risk averse investors are the suppliers of capital, the required return that is demanded and received by investors on a security is the cost of that security to the firm that issues it, adjusted for any flotation cost and tax effects.

13.1 The Cost of Equity Capital



Because stockholders can reinvest the dividend in risky financial assets, the expected return on a capital-budgeting project should be at least as great as the expected return on a financial asset of comparable risk.

13.2 The Cost of Equity Capital

- From the firm's perspective, the required return is the Cost of Equity Capital:

$$\bar{R}_i = R_F + \beta_i (\bar{R}_M - R_F)$$

- To estimate a firm's cost of equity capital, we need to know three things:

1. The risk-free rate, R_F

2. The market risk premium, $\bar{R}_M - R_F$

3. The company beta, $\beta_i = \frac{Cov(R_i, R_M)}{Var(R_M)} = \frac{\sigma_{i,M}}{\sigma_M^2}$

Example

- Suppose the stock of Stansfield Enterprises, a publisher of PowerPoint presentations, has a beta of 2.5. The firm is 100% equity financed.
- Assume a risk-free rate of 5% and a market risk premium of 10%.
- What is the appropriate discount rate for an expansion of this firm?

$$\bar{R} = R_F + \beta_i (\bar{R}_M - R_F)$$

$$\bar{R} = 5\% + 2.5 \times 10\%$$

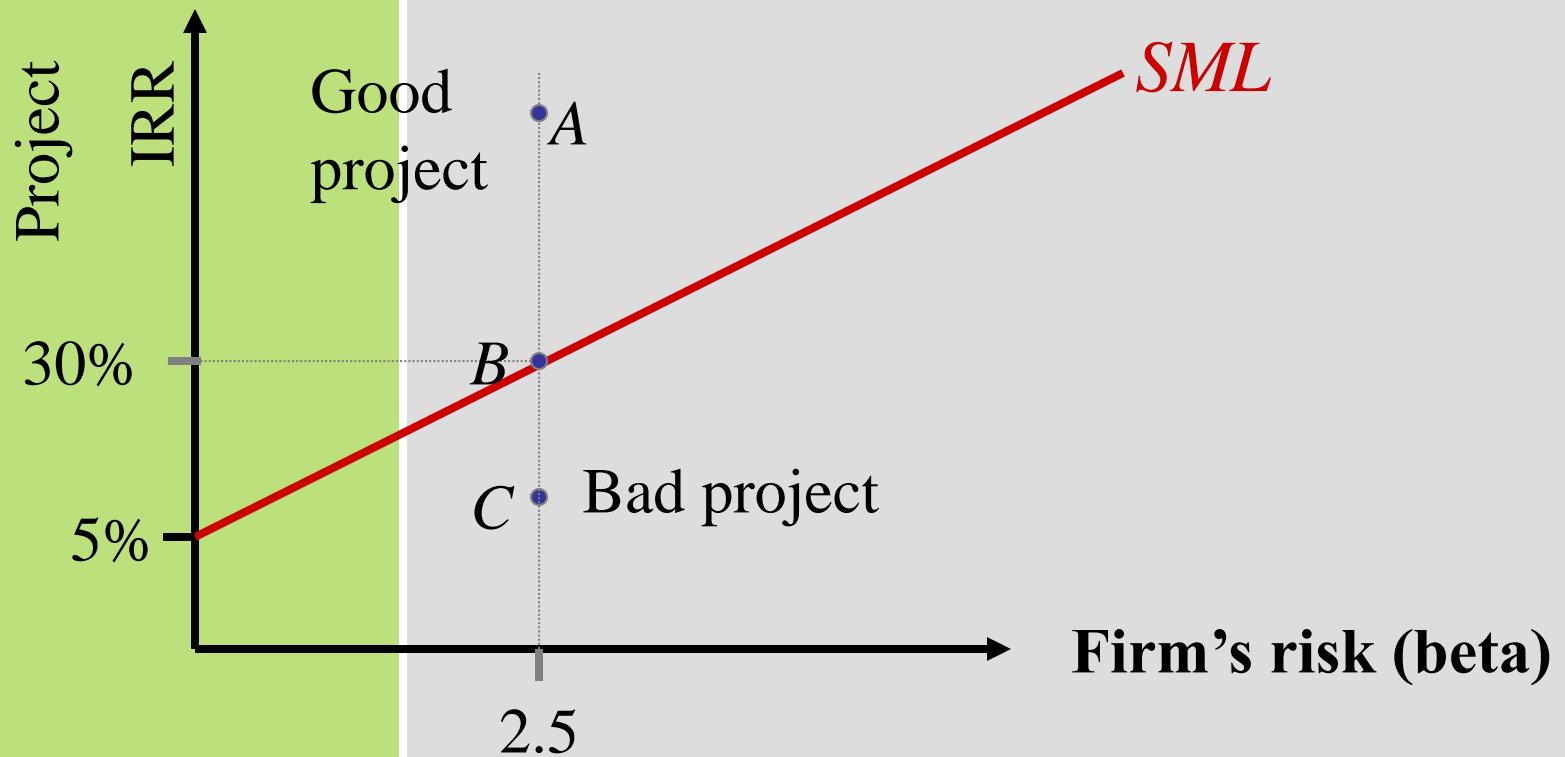
$$\bar{R} = 30\%$$

Example

Suppose Stansfield Enterprises is evaluating the following independent projects. Each costs \$100 and lasts one year.

Project	Project β	Project's Estimated Cash Flows Next Year	IRR	NPV at 30%
A	2.5	\$150	50%	\$15.38
B	2.5	\$130	30%	\$0
C	2.5	\$110	10%	-\$15.38

Using the SML



An all-equity firm should accept projects whose IRRs exceed the cost of equity capital and reject projects whose IRRs fall short of the cost of capital.

The Risk-free Rate

- Treasury securities are close proxies for the risk-free rate.
- The CAPM is a period model. However, projects are long-lived. So, average period (short-term) rates need to be used.
- The historic premium of long-term (20-year) rates over short-term rates for government securities is 2%.
- So, the risk-free rate to be used in the CAPM could be estimated as 2% below the prevailing rate on 20-year treasury securities.

The Market Risk Premium

- Method 1: Use historical data
- Method 2: Use the Dividend Discount Model

$$R = \frac{D_1}{P} + g$$

- Market data and analyst forecasts can be used to implement the DDM approach on a market-wide basis

13.3 Estimation of Beta

Market Portfolio - Portfolio of all assets in the economy. In practice, a broad stock market index, such as the S&P Composite, is used to *represent* the market.

Beta - Sensitivity of a stock's return to the return on the market portfolio.

Estimation of Beta

$$\beta = \frac{Cov(R_i, R_M)}{Var(R_M)} = \frac{\sigma_i^2}{\sigma_M^2}$$

- Problems
 1. Betas may vary over time.
 2. The sample size may be inadequate.
 3. Betas are influenced by changing financial leverage and business risk.
- Solutions
 - Problems 1 and 2 can be moderated by more sophisticated statistical techniques.
 - Problem 3 can be lessened by adjusting for changes in business and financial risk.
 - Look at average beta estimates of comparable firms in the industry.

Stability of Beta

- Most analysts argue that betas are generally stable for firms competing in the same industry.
- That is not to say that a firm's beta cannot change.
 - Changes in product line
 - Changes in technology
 - Deregulation
 - Changes in financial leverage

Using an Industry Beta

- It is frequently argued that one can better estimate a firm's beta by involving the whole industry.
- If you believe that the operations of the firm are similar to the operations of the rest of the industry, you should use the industry beta.
- If you believe that the operations of the firm are **fundamentally different** from the operations of the rest of the industry, you should use the firm's beta.
- Do not forget about adjustments for financial leverage!

Beta, Covariance and Correlation

$$\beta_i = \frac{Cov(R_i, R_M)}{\sigma^2(R_M)} = \rho \frac{\sigma(R_i)}{\sigma(R_M)}$$

- Beta is qualitatively similar to the covariance since the denominator (market variance) is a constant.
- Beta and correlation are related, but different. It is possible that a stock could be highly correlated to the market, but it could have a low beta if its standard deviation were relatively small.

13.4 Determinants of Beta

- Business Risk
 - Cyclicity of Revenues
 - Operating Leverage
- Financial Risk
 - Financial Leverage

Cyclicalilty of Revenues

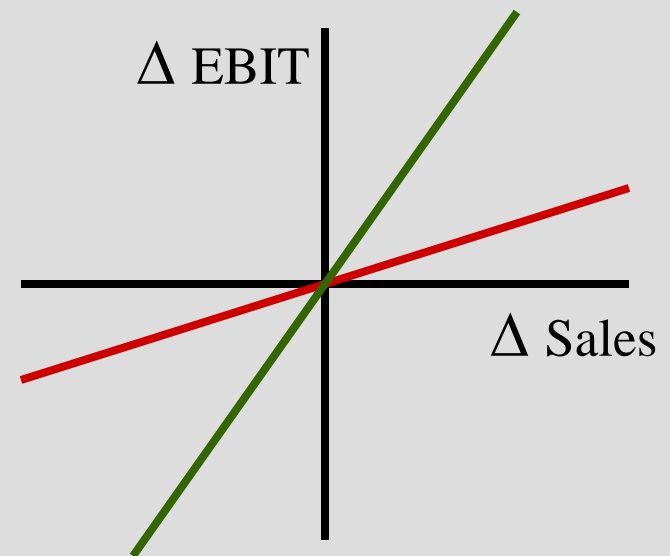
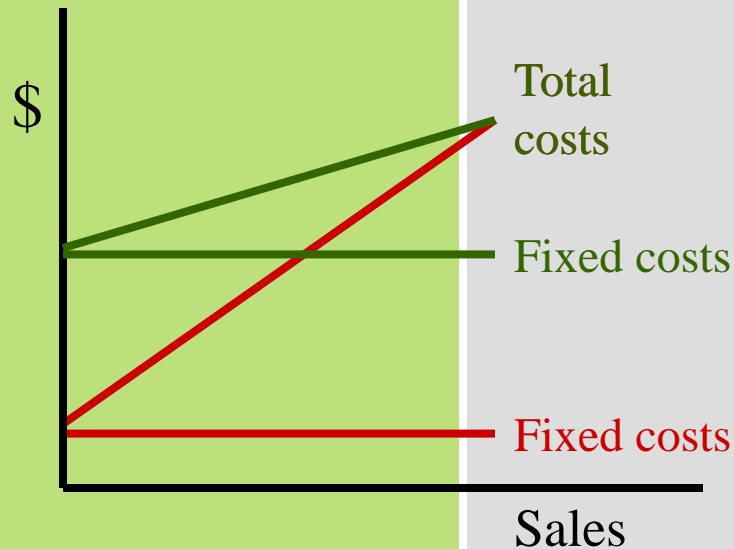
- Highly cyclical stocks have higher betas.
 - Empirical evidence suggests that retailers and automotive firms fluctuate with the business cycle.
 - Transportation firms and utilities are less dependent upon the business cycle.
- Note that cyclicalilty is not the same as variability—stocks with high standard deviations need not have high betas.
 - Movie studios have revenues that are variable, depending upon whether they produce “hits” or “flops,” but their revenues may not be especially dependent upon the business cycle.

Operating Leverage

- The degree of operating leverage measures how sensitive a firm (or project) is to its fixed costs.
- Operating leverage increases as fixed costs rise and variable costs fall.
- Operating leverage magnifies the effect of cyclicalities on beta.
- The degree of operating leverage is given by:

$$DOL = \frac{\Delta \text{EBIT}}{\text{EBIT}} \times \frac{\text{Sales}}{\Delta \text{Sales}}$$

Operating Leverage



Operating leverage increases as fixed costs rise and variable costs fall.

Financial Leverage and Beta

- Operating leverage refers to the sensitivity to the firm's fixed costs of *production*.
- Financial leverage is the sensitivity to a firm's fixed costs of *financing*.
- The relationship between the betas of the firm's debt, equity, and assets is given by:

$$\beta_{Asset} = \frac{Debt}{Debt + Equity} \times \beta_{Debt} + \frac{Equity}{Debt + Equity} \times \beta_{Equity}$$

- Financial leverage always increases the equity beta relative to the asset beta.

Example

Consider Grand Sport, Inc., which is currently all-equity financed and has a beta of 0.90.

The firm has decided to lever up to a capital structure of 1 part debt to 1 part equity.

Since the firm will remain in the same industry, its asset beta should remain 0.90.

However, assuming a zero beta for its debt, its equity beta would become twice as large:

$$\beta_{Asset} = 0.90 = \frac{1}{1 + 1} \times \beta_{Equity}$$

$$\beta_{Equity} = 2 \times 0.90 = 1.80$$

13.5 Dividend Discount Model (SS)

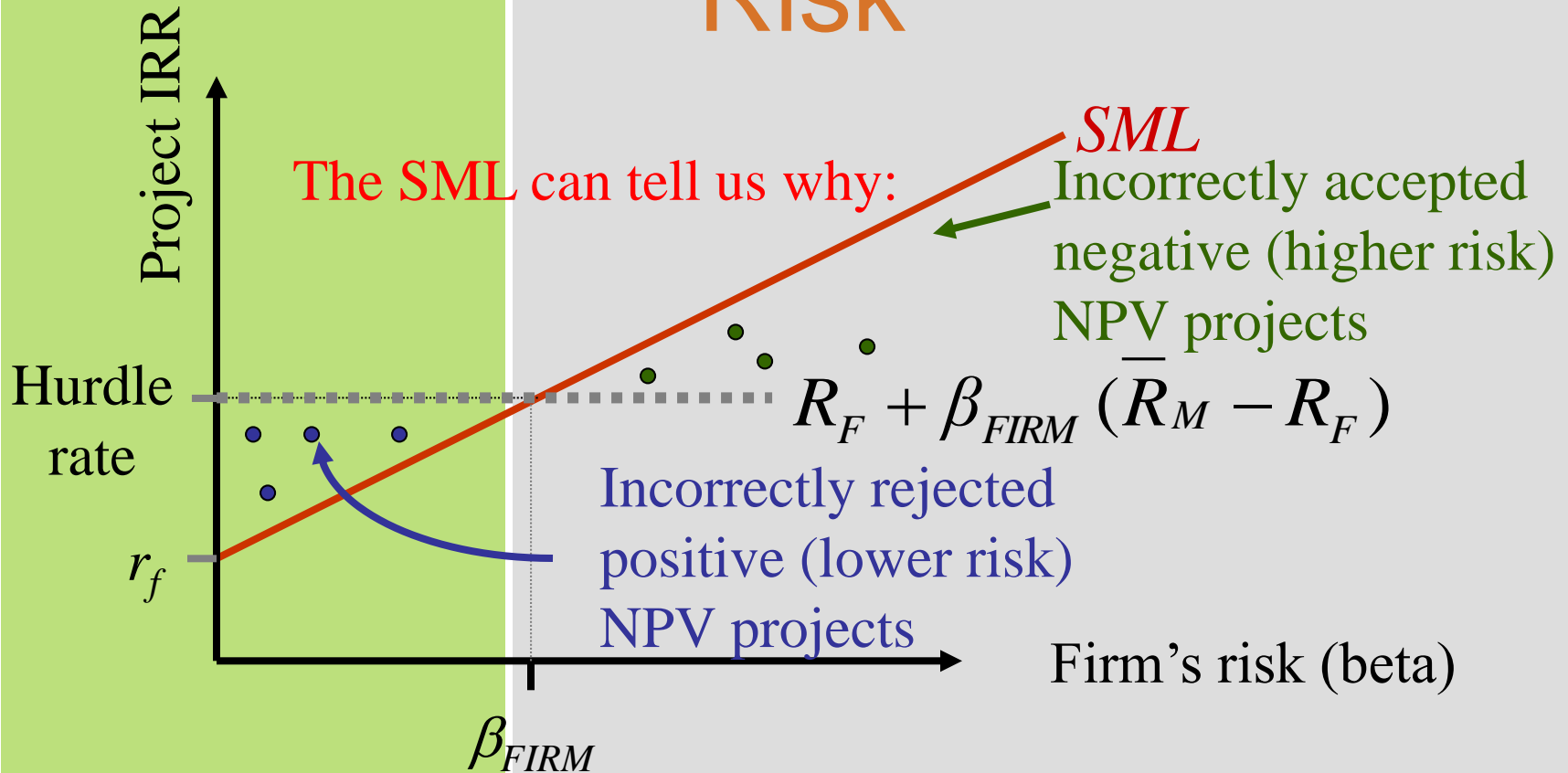
$$R = \frac{D_1}{P} + g$$

- The DDM is an alternative to the CAPM for calculating a firm's cost of equity, **assuming that the stock is fairly priced at equilibrium!**
- The DDM and CAPM are internally consistent, but academics generally favor the CAPM and companies seem to use the CAPM more consistently.
 - This may be due to the measurement error associated with estimating company growth.

13.6 Cost of Capital for the Firm versus the Project

- Any project's cost of capital depends on the use to which the capital is being put—not the source.
- Therefore, it depends on the *risk of the project* and not the *risk of the company*.
- The use of the risk of the company to determine the same hurdle rate for all projects may **INCORRECTLY**
 - ACCEPT NPV < 0 projects that are riskier than the company.
 - REJECT NPV > 0 projects that are less risky than the company.

Capital Budgeting & Project Risk



A firm that uses one discount rate for all projects may over time increase the risk of the firm while decreasing its value.

Capital Budgeting & Project Risk

Suppose the Conglomerate Company has a cost of capital, based on the CAPM, of 17%. The risk-free rate is 4%, the market risk premium is 10%, and the firm's beta is 1.3.

$$17\% = 4\% + 1.3 \times 10\%$$

This is a breakdown of the company's investment projects:

1/3 Automotive Retailer $\beta = 2.0$

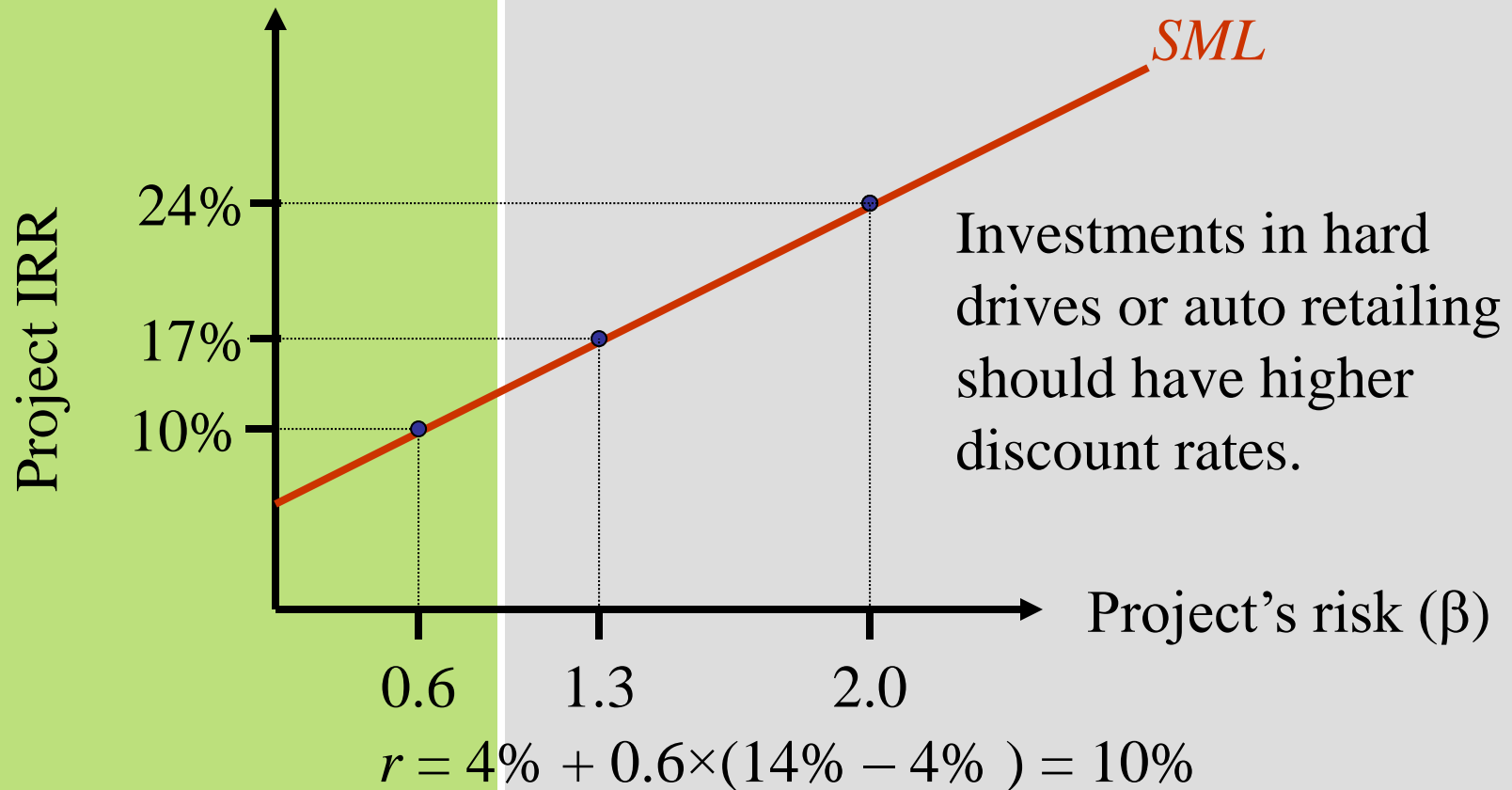
1/3 Computer Hard Drive Manufacturer $\beta = 1.3$

1/3 Electric Utility $\beta = 0.6$

average β of assets = 1.3

When evaluating a new electrical generation investment, which cost of capital should be used?

Capital Budgeting & Project Risk



10% reflects the opportunity cost of capital on an investment in electrical generation, given the unique risk of the project.

13.7 Cost of Fixed Income Securities - Debt

- Interest rate required on new debt issuance (i.e., yield to maturity on outstanding debt)
 - Hence, $R_B = \text{YTM!}$
 - Reference: Chapter 8!
- Adjust for the tax deductibility of interest expense

Cost of Fixed Income Securities - Preferred Stock

- Preferred stock is a perpetuity, so its price is equal to the coupon paid divided by the current required return.
- Rearranging, the cost of preferred stock is:
 - $R_P = C / PV$
 - Reference: Chapter 9!

13.8 The Weighted Average Cost of Capital (WACC)

- The Weighted Average Cost of Capital is given by:

$$r_{WACC} = \frac{\text{Equity}}{\text{Equity} + \text{Debt}} \times r_{\text{Equity}} + \frac{\text{Debt}}{\text{Equity} + \text{Debt}} \times r_{\text{Debt}} \times (1 - T_C)$$

$$r_{WACC} = \frac{S}{S + B} \times r_S + \frac{B}{S + B} \times r_B \times (1 - T_C)$$

- Because interest expense is tax-deductible, we multiply the last term by $(1 - T_C)$.

The Weighted Average Cost of Capital (WACC)

- The Weighted Average Cost of Capital (WACC) -
- ALWAYS use market value in computing the WACC!
 - The WACC should be computed on the AFTER-TAXES basis, i.e. use after-tax cost of debt, $r_B \times (1 - T_C)$
 - The capital structure weight of each component capital in the target capital structure is a similar concept as the portfolio weight of each risky asset in a portfolio. Thus, the capital structure weight of each component capital is defined as the market value of the component capital, S or B, divided by the combined market value, S+B.

13.9 Firm Valuation with WACC

- The value of the firm is the present value of expected future (distributable) cash flow discounted at the WACC
 - Reference: What's Dell Worth article (Ch. 9)!
- To find equity value, subtract the value of the debt from the firm value
- To find equity value, subtract the value of the debt from the enterprise value and add back cash

13.10 Example: International Paper (Self-Study)

- First, we estimate the cost of equity and the cost of debt.
 - We estimate an equity beta to estimate the cost of equity.
 - We can often estimate the cost of debt by observing the YTM of the firm's debt.
- Second, we determine the WACC by weighting these two costs appropriately.

Example: International Paper

- The industry average beta is 0.82, the risk free rate is 3%, and the market risk premium is 8.4%.
- Thus, the cost of equity capital is:

$$\begin{aligned}r_S &= R_F + \beta_i \times (\bar{R}_M - R_F) \\&= 3\% + 0.82 \times 8.4\% \\&= 9.89\%\end{aligned}$$

Example: International Paper

- The yield on the company's debt is 8%, and the firm has a 37% marginal tax rate.
- The debt to value ratio is 32%

$$\begin{aligned}
 r_{WACC} &= \frac{S}{S+B} \times r_S + \frac{B}{S+B} \times r_B \times (1 - T_C) \\
 &= 0.68 \times 9.89\% + 0.32 \times 8\% \times (1 - 0.37) \\
 &= 8.34\%
 \end{aligned}$$

8.34% is International's cost of capital. It should be used to discount any project where one believes that the project's risk is equal to the risk of the firm as a whole and the project has the same leverage as the firm as a whole.

13.11 Flotation Costs

- Flotation costs represent the expenses incurred upon the issue, or float, of new bonds or stocks.
- The weighted average flotation cost, f_A , based on the weighted average cost of issuance for each funding source, f_E and f_D , and the firm's target capital structure:

$$\rightarrow f_A = (E/V) * f_E + (D/V) * f_D$$

- These are incremental cash flows of the project, which typically reduce the NPV since they increase the initial project cost (i.e., CF_0), i.e., the total amount of capital to be raised for financing the initial outlay (IO) of the project

$$\text{i.e., Adjusted Initial Investment} = IO / (1 - f_A)$$

Quick Quiz

- How do we determine the cost of equity capital?
- How can we estimate a firm or project beta?
- How does leverage affect beta?
- How do we determine the cost of capital with debt?
- How do flotation costs affect the capital budgeting process?