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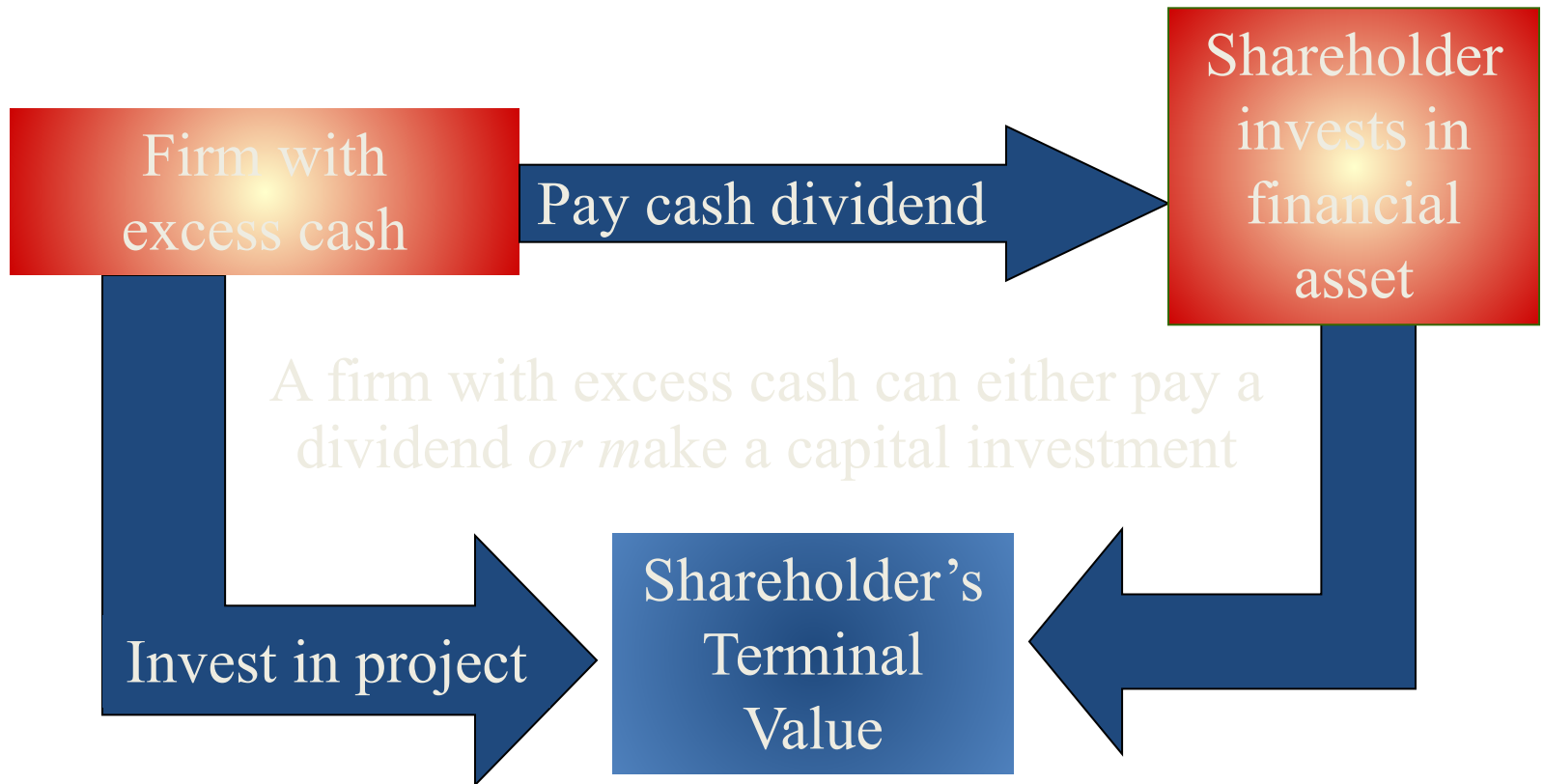
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12.7 Summary and Conclusions

What's the Big Idea?

- 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.

12.1 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.

The Cost of Equity

- From the firm's perspective, the expected 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-percent equity financed.
- Assume a risk-free rate of 5-percent and a market risk premium of 10-percent.
- What is the appropriate discount rate for an expansion of this firm?

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

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

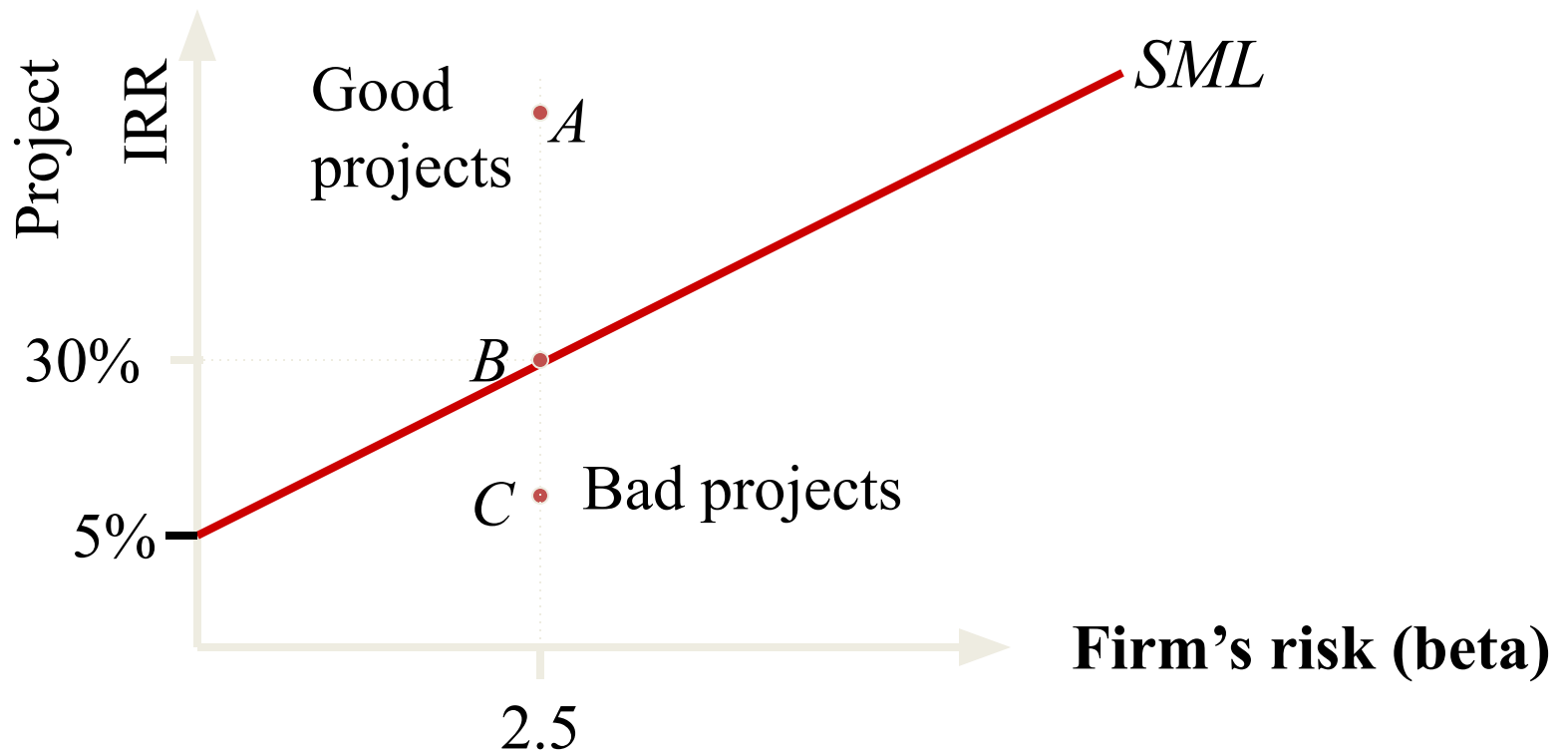
$$\bar{R} = 30\%$$

Example (continued)

Suppose Stansfield Enterprises is evaluating the following non-mutually exclusive projects. Each costs \$100 and lasts one year.

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

Using the SML to Estimate the Risk-Adjusted Discount Rate for Projects



An all-equity firm should accept a project whose IRR exceeds the cost of equity capital and reject projects whose IRRs fall short of the cost of capital.

12.2 Estimation of Beta: Measuring Market Risk

Market Portfolio - Portfolio of all assets in the economy. In practice a broad stock market index, such as the TSE 300 index, is used to *represent* the market.

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

12.2 Estimation of Beta

- Theoretically, the calculation of beta is straightforward:

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

- 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 (above) 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 remaining in the same industry.
- That's not to say that a firm's beta can't 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.
- Don't forget about adjustments for financial leverage.

12.3 Determinants of Beta

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

Cyclicalities of Revenues

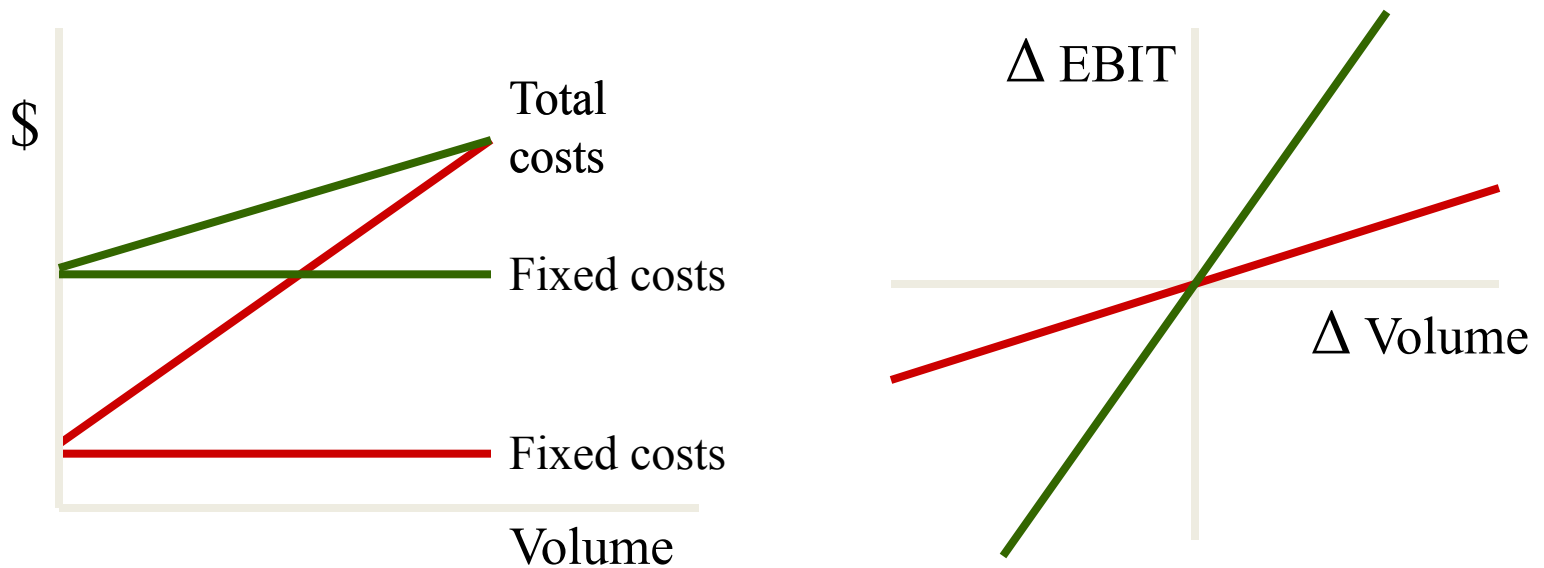
- Highly cyclical stocks have high betas.
 - Empirical evidence suggests that retailers and automotive firms fluctuate with the business cycle.
 - Transportation firms and utilities are less dependent upon the business cycle.
- Note that cyclicalities is not the same as variability—stocks with high standard deviations need not have high betas.
 - Movie studios have revenues that are variable, depending upon whether they produce “hits” or “flops,” but their revenues are not 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 cyclicity on beta.
- The degree of operating leverage is given by:

$$DOL = \frac{\text{Change in } EBIT}{EBIT} \times \frac{\text{Sales}}{\text{Change in Sales}}$$

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 of 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.

Financial Leverage and Beta: Example

Consider Grand Sport, Inc., which is currently all-equity 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:

$$\beta_{\text{Equity}} = \beta_{\text{Asset}} \times \left(1 + \frac{\text{Debt}}{\text{Equity}} \right) = 0.90 \times \left(1 + \frac{1}{1} \right) = 1.80$$

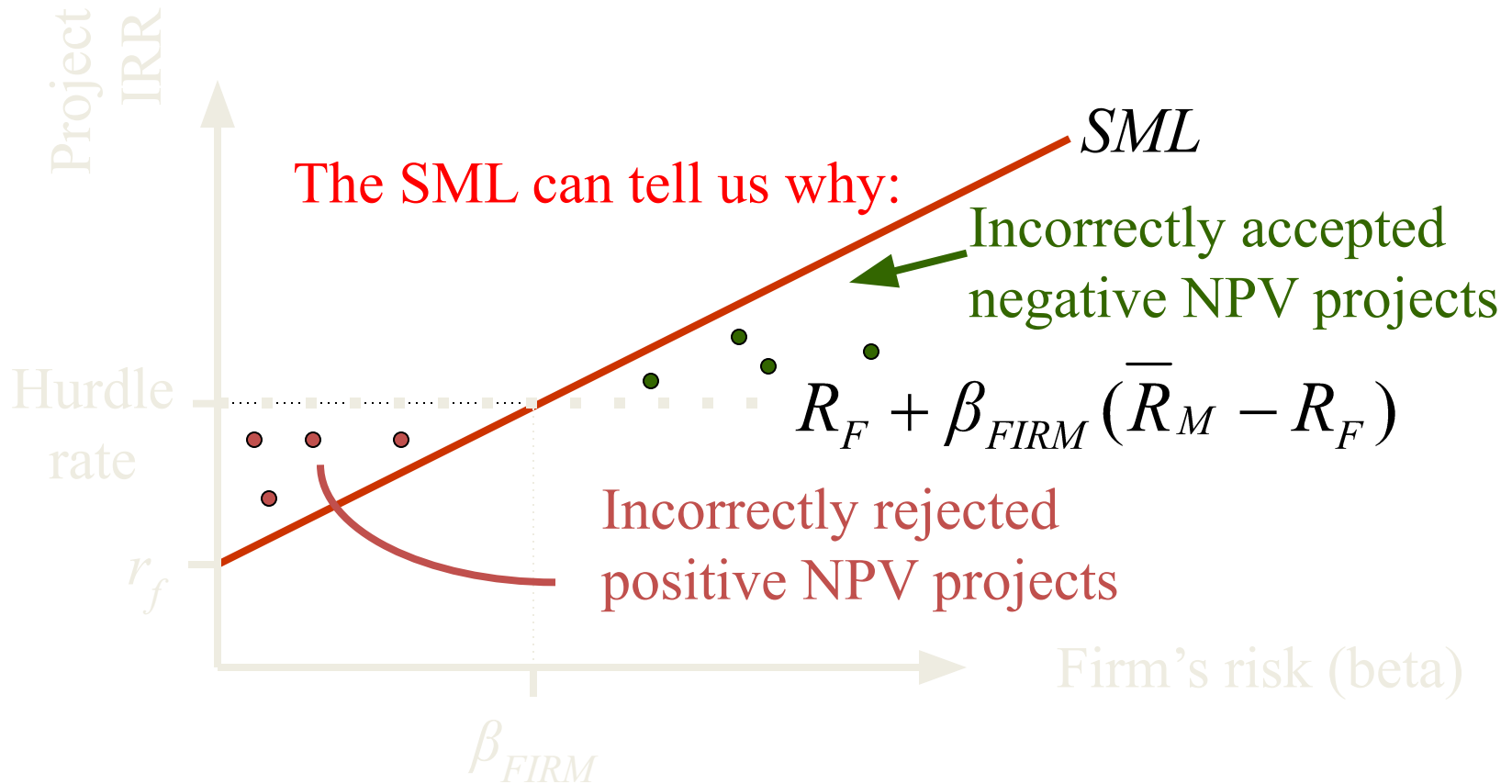
12.4 Extensions of the Basic Model

- The Firm versus the Project
- The Cost of Capital with Debt

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*.

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.

$$17\% = 4\% + 1.3 \times [14\% - 4\%]$$

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

1/3 Automobile Mfr. $\beta = 1.3$

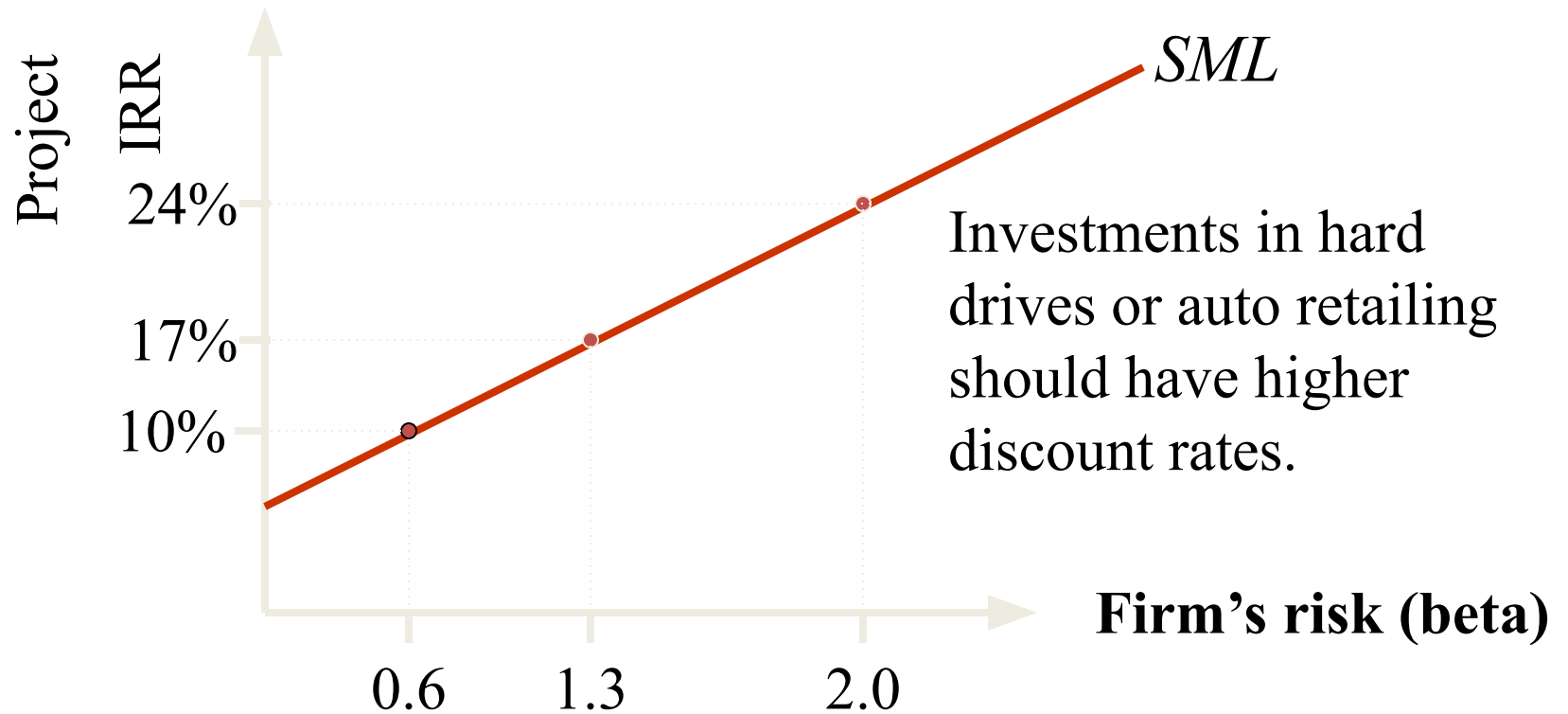
1/3 Computer Hard Drive Mfr. $\beta = 1.3$

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



$$r = 4\% + 0.6 \times (14\% - 4\%) = 10\%$$

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

The Cost of Capital with Debt

- The Weighted Average Cost of Capital is given by:

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

- It is because interest expense is tax-deductible that we multiply the last term by $(1 - T_C)$

12.5 Estimating Bombardier's Cost of Capital

- We aim at estimating Bombardier's cost of capital, as of June 15, 2001.
- 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.

12.5 Estimating Bombardier's Cost of Capital

- Bombardier's beta is 0.79; the (current) risk-free rate is 4.07%, and the (historical) market risk premium is 6.89%.
- Thus the cost of equity capital is

$$\begin{aligned}r_e &= R_F + \beta_i(\bar{R}_M - R_F) \\ &= 4.07\% + 0.79 \times 6.89\% \\ &= 9.51\%\end{aligned}$$

12.5 Estimating Bombardier's Cost of Capital

- The yield on the company's 6.6% 29 Nov 04 bond is 5.73% and the firm is in the 40% marginal tax rate.
- Thus the cost of debt is

$$r_B \times (1 - T_C) = 5.73\% \times (1 - 0.40) = 3.44\%$$

12.5 Estimating Bombardier's Cost of Capital

- To calculate the cost of capital, we need to estimate the value weights for equity and debt:

Security	Market Price	Shares Outstanding	Market Value (millions)	Weight (%)
Debt (book value)	-	-	\$ 6,131	16.07%
Preferred stock	25.75	12,000,000	\$ 309	0.81%
Class A Common	23.09	347,426,000	\$ 8,022	21.02%
Class B Common	23.27	1,018,625,000	<u>\$ 23,703</u>	<u>62.10%</u>
		Total	3816547%	100.00%

- We simplify, and combine preferred stock with common stock:

$$\frac{S}{S + B} = 83.93\%, \text{ and } \frac{B}{S + B} = 16.07\%$$

12.5 Estimating Bombardier's Cost of Capital

- Bombardier's WACC as of June 15, 2001, is given by:

$$\begin{aligned}r_{WACC} &= \left(\frac{S}{S+B} \right) \times r_S + \left(\frac{B}{S+B} \right) \times r_B \times (1 - T_C) \\ &= 0.8393 \times 9.51\% + 0.1607 \times 5.73\% \times (1 - 0.4) \\ &= 8.53\%\end{aligned}$$

8.53-percent is Bombardier'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.

12.6 Reducing the Cost of Capital

- What is Liquidity?
- Liquidity, Expected Returns, and the Cost of Capital
- Liquidity and Adverse Selection
- What the Corporation Can Do

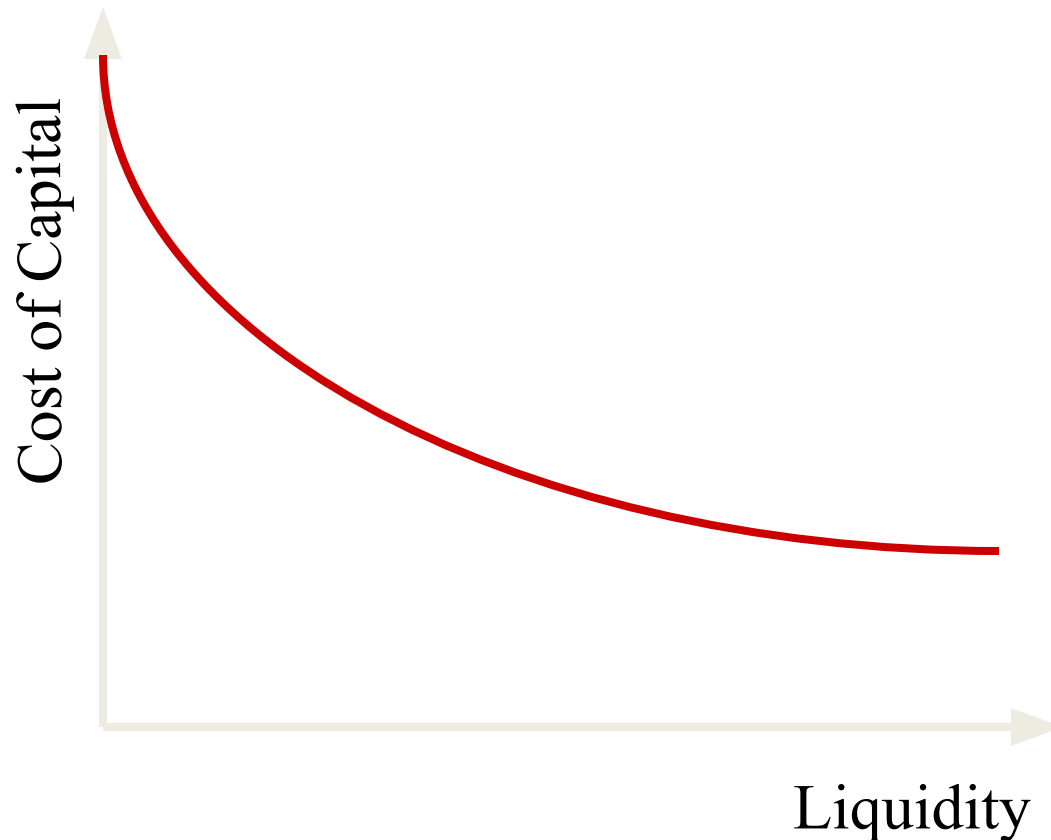
What is Liquidity?

- The idea that the expected return on a stock and the firm's cost of capital are positively related to risk is fundamental.
- Recently a number of academics have argued that the expected return on a stock and the firm's cost of capital are negatively related to the liquidity of the firm's shares as well.
- The trading costs of holding a firm's shares include brokerage fees, the bid-ask spread, and market impact costs.

Liquidity, Expected Returns, and the Cost of Capital

- The cost of trading an illiquid stock reduces the total return that an investor receives.
- Investors thus will demand a high expected return when investing in stocks with high trading costs.
- This high expected return implies a high cost of capital to the firm.

Liquidity and the Cost of Capital



An increase in liquidity, *i.e.*, a reduction in trading costs, lowers a firm's cost of capital.

Liquidity and Adverse Selection

- There are a number of factors that determine the liquidity of a stock.
- One of these factors is *adverse selection*.
- This refers to the notion that traders with better information can take advantage of specialists and other traders who have less information.
- The greater the heterogeneity of information, the wider the bid-ask spreads, and the higher the required return on equity.

What the Corporation Can Do

- The corporation has an incentive to lower trading costs since this would result in a lower cost of capital.
- A stock split would increase the liquidity of the shares.
- A stock split would also reduce the adverse selection costs thereby lowering bid-ask spreads.
- This idea is a new one and empirical evidence is not yet in.

What the Corporation Can Do

- Companies can also facilitate stock purchases through the Internet.
- Direct stock purchase plans and dividend reinvestment plans handled on-line allow small investors the opportunity to buy securities cheaply.
- The companies can also disclose more information, especially to security analysts, to narrow the gap between informed and uninformed traders. This should reduce spreads.

12.7 Summary and Conclusions

- The expected return on any capital budgeting project should be at least as great as the expected return on a financial asset of comparable risk. Otherwise the shareholders would prefer the firm to pay a dividend.
- The expected return on any asset is dependent upon β .
- A project's required return depends on the project's β .
- A project's β can be estimated by considering comparable industries or the cyclical nature of project revenues and the project's operating leverage.
- If the firm uses debt, the discount rate to use is the r_{WACC} .
- In order to calculate r_{WACC} , the cost of equity and the cost of debt applicable to a project must be estimated.