

Chapter 10 – Making Choices: The Method, MARR, and Multiple Attributes

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Comparing Mutually Exclusive Alternatives by Different Evaluation Methods

- Different problem types lend themselves to different engineering economy methods
- Different information is available from different evaluation methods
- Primary criteria for what method to apply
 - Speed
 - Ease of performing the analysis
- See Tables 10-1 & 10-2 for a summary

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Evaluation Times

- Equal lives of the alternatives
- LCM of lives
- Specified study period
- Infinity (capitalized cost)

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Decision Guidelines

- Select the alternative with:
 - Numerically largest
 - PW, FW, or AW value
 - For ROR and B/C
 - Apply the incremental analysis approach

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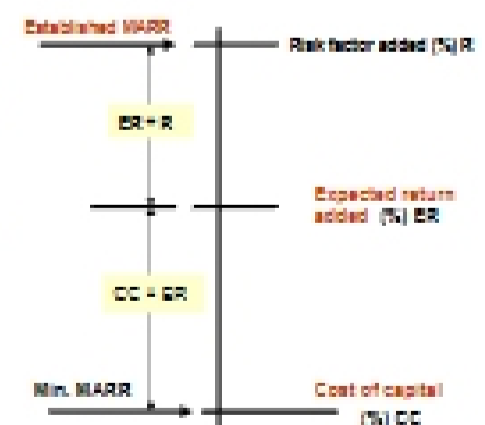
MARR Relative to the Cost of Capital

- Establishing the MARR within the enterprise requires:
 - Cost of equity capital (cost of corporate funds)
 - Cost of debt capital (cost of borrowed funds)
- Debt Capital
 - \$\$ acquired from borrowing outside of the firm
- Equity Capital
 - \$\$ acquired from the owners and retained earnings

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Cost of Capital and the MARR

- Established MARR is the sum of: (expressed as a % cost)
 - Cost of capital +
 - Expected return +
 - Risk factor
- MARR will vary from firm to firm and from project to project



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Factors Impacting the MARR

- Perceived project risk
 - Higher the risk – higher the MARR for that project
- Investment opportunity
 - Expansion opportunity – may set a lower MARR
- Tax structure
 - Higher tax rate – higher MARR
- Limited capital
 - Tighter constraints on capital – higher MARR
- Market rates of other firms
 - Competitors alter their MARR - the firm could follow suit

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Debt-Equity Mix and WACC

- D/E ratio (Debt to Equity mix)
 - Ex.: 40-60 DE = {40% from debt, 60% from equity}
- Weighted Average Cost of Capital (WACC)
 - $WACC = (\text{equity fraction})(\text{cost of equity capital}) + (\text{debt fraction})(\text{cost of debt capital})$
 - Example: $WACC = 0.4(4\%) + 0.6(9\%) = 7.8\%$
- A variety of "models" exist that will approximate the WACC for a given firm

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WACC: Example 10.3

Source of Capital	Amount (\$)	Cost (%)
Common Stock	\$5 million	13.7%
Retained Earnings	\$2 million	8.9%
Debt from bonds	\$3 million	7.5%

CS = 50%; RE = 20%; Bonds = 30%

$WACC = (0.50)(13.7) + (0.20)(8.9) + (0.30)(7.5) = 10.88\%$

This firm's MARR must be > 10.88%

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Tax Implications (Details in Chap.17)

- WACC values are computed:
 - Before-tax basis
 - After-tax basis
- $\text{After-tax cost of debt} = (\text{before-tax cost})(1 - T_e)$
 - Where T_e represents the effective tax rate composed of: Federal rate, State rate and Local rate(s)

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Determining Cost of Debt Capital

Debt financing

- Loans
- Issuance of bonds
- Interest on loans and bonds are tax deductible in the US
 - Interest payments from the firm to the lenders is tax deductible – important cost consideration

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Tax Savings from Debt Financing

- The cost of financing by debt is lower than the actual interest rate charged because of the tax deductibility of the interest payments
- Assume T_e = the effective tax rate (%)
- $\text{Tax Savings} = (\$ \text{ expenses})(T_e)$
- $\text{Net Cash Flow} = \{\$ \text{ expenses} - \$ \text{ tax savings}\}$
 - $NCF = \text{expenses} (1 - T_e)$

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EXAMPLE 10.4

AT&T will generate \$5 million in debt capital by issuing five thousand \$1000 8% per year 10-year bonds. If the effective tax rate of the company is 30% and the bonds are discounted 2% for quick sale, compute the cost of debt capital (a) before taxes and (b) after taxes from the company perspective. Obtain the answers by hand and by computer.

Solution by Hand

- (a) The annual bond dividend is $\$1000(0.08) = \80 , and the 2% discounted sales price is \$980 now. Using the company perspective, find the i^* in the PW relation

$$0 = 980 - 80(P/A, i^*, 10) - 1000(P/F, i^*, 10)$$
$$i^* = 8.3\%$$

The before-tax cost of debt capital is $i^* = 8.3\%$, which is slightly higher than the 8% bond interest rate, because of the 2% sales discount.

- (b) With the allowance to reduce taxes by deducting the bond interest, Equation (10.4) shows a tax savings of $\$80(0.3) = \24 per year. The bond dividend amount for the PW relation is now $\$80 - \$24 = \$56$. Solving for i^* after taxes reduces the cost of debt capital by nearly one-half, to 4.25%.

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Example of Tax Deductibility Impact on Cost of Debt Capital

- Assume a loan has a 10% interest rate charged to the borrower
 - The effective tax rate is 30%
 - The after-tax cost of borrowing at 10% is $(0.10)(1 - 0.30) = (0.10)(0.70) = 0.07$ or 7%
- Observations
 - Due to tax deductibility the effective cost is 7% after tax
 - Higher tax rates result in lower after-tax borrowing rates

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Determination of the Cost of Equity Capital and the MARR

- Sources of equity capital
 - Sale of preferred stock (PS)
 - Sale of common stock (CS)
 - Use of retained earnings (RE)
 - RE = past profits retained within the firm
 - This money belongs to the owners of the firm

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Types of Stock

- Preferred Stock:** stock in a corporation which gives the shareholders priority in payment of dividends at a fixed rate (and distribution of assets in case of dissolution of the corporation) over owners of "common" stock. While the assurance of first chance at profits is a psychological and real benefit, preferred stock shareholders do not participate in higher dividends if the corporation makes large profits, and usually cannot vote for directors.
- Common Stock:** stock in a corporation in which dividends are calculated upon a percentage of net profits, with distribution determined by the Board of Directors. Usually holders of common stock have voting rights. The common shareholders gamble on higher profits, and collectively have voting control of the corporation.

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Cost of Equity Capital

- For preferred stock, $R_e = (\text{fixed percentage of original stock price i.e fixed dividend}) / (\text{original stock price} - \text{discount})$
- For common stock, a dividend growth model (valuation model) is used
- Basic model

$$R_e = \frac{\text{first-year dividend}}{\text{price of the stock}} + \text{expected growth rate}$$
$$R_e = \frac{DV_1}{p} + g$$

- "g" is the estimated annual increase in returns to the shareholders

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Capital Asset Pricing Model -- CAPM

- Cost of equity capital from common stock,
- $R_e = \text{risk-free return} + \text{risk-premium}$
- $R_e = R_f + \beta(R_m - R_f)$
 - β = volatility of firm's common stock relative to other stocks ($\beta = 1$ is the norm)
 - R_m = return on stocks in a defined market portfolio as measured by a prescribed index
 - R_f = quoted US Treasury Bill rate (considered a safe investment)
 - $(R_m - R_f)$ = premium paid above the safe or "risk-free" rate

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