

# Chapter 11

## The Cost of Capital

**An-Najah National University**

**Prepared by Instructor: E.Shatha Qamhieh**

**Managerial Finance Course**

# Sources of Long-Term Financing



Internal long-Term Sources

External Long-Term Sources

Stockholders' Equity

- *Using Retained Earnings*

Stockholders' Equity

- *Issuing Preferred Stock*
- *Issuing Common Stock*

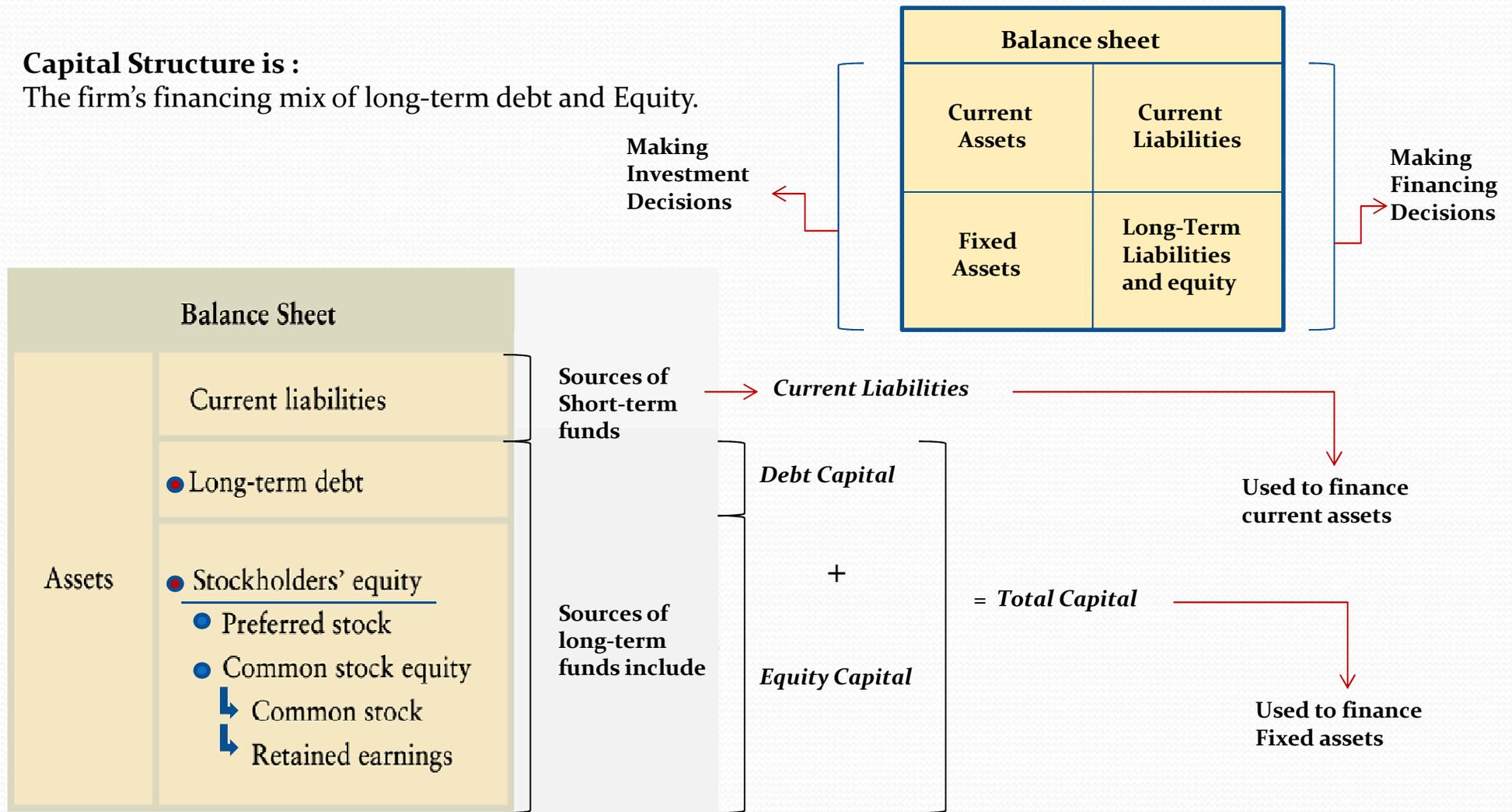
Long Term Debt

- *Issuing Bonds*
- *Acquiring Long-Term Bank Loans*

# The Firm's Balance Sheet and Capital Structure

## Capital Structure is :

The firm's financing mix of long-term debt and Equity.





## Basic sources of long-term funds for the firm are :

1. Long-term debt
2. Preferred stock
3. Common stock
4. Retained earnings

# What about the Cost of Capital?



## Definition 1 : The cost of capital :

It is the **rate of return** that a firm must earn on the projects in which it invests to maintain the market value of its stock and attract funds.

## Importance of Cost of capital:



- It is the “magic number” that is used to decide whether a proposed investment will increase or decrease the firm’s stock price.

# Key Assumptions for Cost of Capital

- **Business Risk:**

The risk to the firm of being unable to cover operating costs—is assumed to be unchanged.

This means that the acceptance of a given project does not affect the firm's ability to meet operating costs.

- **Financial Risk:**

The risk to the firm of being unable to cover required financial obligation is assumed to be unchanged.

This means that the projects are financed in such a way that the firm's ability to meet financing costs is unchanged.

- **After-tax costs:**

After-tax costs are considered relevant.

This means that the cost of capital is measured on an after-tax basis.

# After-tax costs and Cost of Capital:

XYZ Company

Income Statement and allocation of net income for the year ended Dec.31, 20xx

Sales	\$2,000
<u>Cost of Goods Sold</u>	<u>(400)</u>
Gross Profit	\$1,600
Operating expenses	(100)
<u>Other Expenses</u>	<u>(100)</u>
Earnings before interest and taxes(EBIT)	\$1,400
<u>Interest Expense</u>	<u>(200)</u>
Earnings after interest and before taxes	\$1,200
<u>Taxes (40%)</u>	<u>(480)</u>
Net Income	\$720
Dividends to Preferred stock	(170)
Net Income available to Common stock	\$550
Dividends declared to Common stock	(200)
Remaining Net Income allocated to Retained Earnings	\$350

## A firm is currently faced with two investment opportunities:

*project 1 available*

Cost = \$100,000  
Life = 20 years  
IRR = 7%

*Cost of least-cost financing source available*

Debt = 6%

**Decision:**

The firm undertakes the opportunity because it can earn 7% on the investment of funds costing only 6%.

*project 2 available*

Cost = \$100,000  
Life = 20 years  
IRR = 12%

*Cost of least-cost financing source available*

Equity = 14%

**Decision:**

The firm rejects the opportunity because the 14% financing cost is greater than the 12% expected return.

**Were the firm's actions in the best interests of its owners?**

**The answer is.....**

- **NO.** The company accepted a project yielding a 7% return and rejected one with a 12% return which is not in the best interest of the firm's shareholders.
- The firm must undertake investments that maximize the firm's owners wealth:

This can only be achieved if it takes projects that provide returns in excess of the firm's overall weighted average cost of financing (or WACC).
- Weighted Average Cost of Capital (WACC):

Represents the expected average future cost of funds over the long run.  
Tells managers about the return their investments in fixed assets (ex, plant and equipment) have to earn if the firm is to satisfy its investors.

***Essentially, the WACC represents the minimum acceptable rate of return that a firm should earn on any investment that it makes.***

## A firm is currently faced with two investment opportunities:

*project 1 available :*

Cost = \$100,000  
Life = 20 years  
IRR = 7%

*Cost of least-cost financing source available*

Debt = 6%  
Debt weight in capital structure = 50%

*project 2 available :*

Cost = \$100,000  
Life = 20 years  
IRR = 12%

*Cost of least-cost financing source available*

Equity = 14%  
Equity weight in capital structure = 50%

### ***Solution:***

***WACC = (weight of Debt × cost of Debt) + (weight of Equity × cost Equity)***

***WACC = (.5 × 6%) + (.5 × 14%)***

***WACC = (3 %) + (7 %)***

***WACC = 10%***

### ***Decision:***

***The firm rejects project 1 because it has IRR = 7% < WACC = 10%***

***The firm accepts project 2 because it has IRR = 12% > WACC = 10%***

***This action is in the best interests of the firm's owners***



## *Decision role*

*To select an investment opportunity or project :*

*If the investment **IRR < WACC** The firm **rejects***

*If the investment **IRR > WACC** The firm **accepts***

Weighted Average Cost of Capital (WACC) is found by the following equation:

$$WACC = r_a = w_i r_i + w_p r_p + w_s r_{r \text{ or } n}$$

$$WACC = (\text{weight of source 1} \times \text{cost of source 1}) + (\text{weight of source 2} \times \text{cost of source 2}) + \dots$$

		Weighted Average Cost of Capital =	$r_a$
Proportion of long-term debt (bonds) in capital structure =	$w_i$	Cost of debt ( bonds) =	$r_i$
Proportion of preferred stock in capital structure =	$w_p$	Cost of debt Preferred stock =	$r_p$
Proportion of common stock equity in capital structure =	$w_s$	Cost of retained earnings =	$r_r$
$w_i + w_p + w_s = 1.0$		Cost of new common stock equity =	$r_n$

***We need to learn how to calculate the cost for each source of Long-Term Financing***

## Cost of each long-term Source of Capital:

*cost of long-term debt:* *is the after tax cost today associated with new funds raised through long-term borrowing.*

1

To calculate the cost of long-term debt (Bonds)  $r_i$  we need to :

- (1) Calculate Net proceeds from selling the bond :  $N_d$
- (2) Calculate Before-tax (or pre-tax) cost of debt :  $r_d$
- (3) Calculate After-tax cost of debt :  $r_i$

# (1) How to calculate Net Proceeds?

**Net proceeds** : are funds actually received from the sale of security

Net proceeds from selling the security = \$ security selling price – \$ Flotation cost

Net proceeds from selling the security = \$ security selling price – (percentage of flotation cost × security par value)

## Flotation costs

1. They are the total costs of issuing and selling a security, they reduce the net proceeds from the sale.
2. These costs apply to all public offerings of securities – debt, preferred stock, and new common stock.

### Components of Flotation costs:

(1) Underwriting costs – compensation earned by investment bankers for selling the security

(2) Administrative costs – issuer expenses such as legal, accounting, printing, and other expenses

## Yield-to-Maturity (YTM):

- The yield to maturity is the compound annual rate of return earned on a debt security purchased on a given day and held to maturity.
- It is the prevailing market interest rate.

The bond is sold at

discount	If	Bond coupon rate	<	market interest rate
premium		Bond coupon rate	>	market interest rate

If the bond is sold at

discount	Then	Net Proceeds	<	Par Value
premium	Then	Net Proceeds	$\geq$	Par Value
premium	or	Net Proceeds	<	Par Value

(2) Before-tax cost of debt( $r_d$ ) for a bond can be obtained in 3 ways:

1. Using cost quotation
2. Calculating the cost
3. Approximating the cost

**Before-tax cost of debt( $r_d$ )**



**Using Cost Quotations**

When the net proceeds from selling a bond equal its par value, the before-tax cost equals the annual coupon interest rate for the bond

$$r_d = I\%$$

A second quotation that is sometimes used is the **yield-to-maturity (YTM)** on a similar risk bond.

$$r_d = \text{YTM}$$

**Calculating the Cost**

This approach finds the before-tax cost of debt by calculating the IRR on the bond cash flows. IRR is the discount rate that equates present value of both the cash inflows and outflows and represents the before tax cost of debt  $r_d$

**Calculated by:** 1-Financial calculator, 2- an excel sheet, 3- or trial-and-error technique.

$$\$N_d = \$I \times \left[ \frac{1 - (1+r)^{-n}}{r} \right] + \$\text{Par Value} (1+r)^{-n}$$

$r$  is the internal rate of return IRR to be calculated

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and  $r_d = \text{IRR}$

**Approximating the Cost**

Can be calculated using the formula

$$r_d = \frac{I + \frac{\text{Par value} - N_d}{n}}{\frac{\text{Par value} + N_d}{2}}$$

**Where:**

$I$  = annual interest

$N_d$  = net proceeds from the sale of debt (bond)

$n$  = no. of years to the bond's maturity

### (3) How to Calculate After-tax cost of debt : $r_i$

- Interest expense is a tax deductible expense since it is deducted before paying taxes in the income statement, and thus it reduces the firm taxable income.
- But all other sources of long-term debt are paid from net income after tax.
- As a result, we will need to adjust before tax cost of debt according to the company's tax bracket to have the relevant after-tax cost.

T is the tax rate %

$$\text{After tax cost of Debt (Bond)} = r_i = r_d \times (1 - T)$$

- The cost of long-term debt is less than the cost of any other form of long term financing because of the tax deductibility of interest.

# Steps to calculate cost of Bonds $r_i \%$

Step 1

Net Proceeds

$$N_d = \$ \text{ security selling price} - \$ \text{ Flotation cost}$$

Step 2

Pre-tax cost of debt

$$r_d$$

Step 3

After-tax cost of debt

$$r_i = r_d \times (1 - T)$$

- 1) If :  $N_d = \text{par value}$ , then :  $r_d = I \%$
- 2) on similar risk bond the (YTM)  $\% = r_d$

Using cost Quotation

Approximating the cost

$$r_d = \frac{\$I + \frac{\text{Par value} - N_d}{n}}{\frac{\text{Par value} + N_d}{2}}$$

Calculating the cost

$$\$N_d = \$I \times \left[ \frac{1 - (1+r)^{-n}}{r} \right] + \$\text{Par Value} (1+r)^{-n}$$

## Example (1)

### The Cost of Long-Term Debt (Bonds) using Quotation method

Net proceeds from selling the bond = \$ bond selling price – ( percentage of flotation cost × bond par value )

$$\begin{aligned} \text{Net proceeds from selling the bond} &= \$ 1,020 - (.02 \times \$1,000) \\ &= \$ 1,020 - \$ 20 = \$1,000 \end{aligned}$$

1) **using:** If : net proceeds  $N_d = \text{par value}$ , then :  $r_d = I\%$   
 $N_d = \$ 1,000 = \text{par value}$  , then :  $r_d = I\% = 9.4\%$

Coupon rate = 9.4% this is the before-tax cost of debt  $r_d$

$$\text{After tax cost of Debt (Bond)} = r_i = r_d \times (1 - T)$$

$$r_i = 9.4\% \times (1 - 0.40) = 5.64\% \text{ this is the after-tax cost of debt } r_i$$

2) **using:** on similar risk bond the (YTM) % =  $r_d$

YTM = 9.4% this is the before-tax cost of debt  $r_d$

$$\text{After tax cost of Debt (Bond)} = r_i = r_d \times (1 - T)$$

$$r_i = 9.4\% \times (1 - 0.40) = 5.64\% \text{ this is the after-tax cost of debt } r_i$$

Selling price	\$1,020
Flotation coast	2%
Par value	\$ 1,000
Coupon rate ( Annual Interest rate I%)	9.4 %
Years to maturity	20
YTM on similar risk bond	9.4%
Tax Rate	40%

## Example (2)

### The Cost of Long-Term Debt (Bonds) using calculating method

Net proceeds from selling the bond = \$ bond selling price – ( percentage of flotation cost × bond par value )

$$\begin{aligned} \text{Net proceeds from selling the bond} &= \$ 980 - (.02 \times \$1,000) \\ &= \$ 980 - \$ 20 = 960 \end{aligned}$$

*We apply the following equation using:*

1-Financial calculator, 2- or an excel sheet, 3- or trial-and-error

$$\begin{aligned} \$ N_d &= \$ I \times \left[ \frac{1 - (1 + r)^{-n}}{r} \right] + \$ \text{Par Value} (1 + r)^{-n} \\ \$ 960 &= \$ 90 \times \left[ \frac{1 - (1 + r)^{-20}}{r} \right] + \$1,000 (1 + r)^{-20} \end{aligned}$$

IRR = r = 9.452% this is the before-tax cost of debt  $r_d$

$$\text{After tax cost of Debt (Bond)} = r_i = r_d \times (1 - T)$$

$$r_i = 9.452\% \times (1 - 0.40) = 5.67\% \text{ this is the after-tax cost of debt } r_i$$

Selling price	\$ 980
Flotation cost	2%
Par value	\$ 1,000
Coupon rate	9%
Tax rate	40%

End of year(s)	Cash flow
0	\$ 960
1-20	- \$ 90
20	- \$ 1,000

## The Cost of Long-Term Debt (Bonds) using approximation method

Net proceeds from selling the bond = \$ bond selling price – \$ Flotation cost

Net proceeds from selling the bond = \$ bond selling price – ( percentage of flotation cost × bond par value )

$$\text{Before tax cost of Debt (Bond)} = r_d = \frac{\text{Annual Interest in Dollars} + \frac{\text{Bond Par Value} - \text{Net proceeds from selling the bond}}{\text{Number of years to bond maturity}}}{\frac{\text{Bond Par Value} + \text{Net proceeds from selling the bond}}{2}}$$

$$\text{Before tax cost of Debt (Bond)} = r_d = \frac{\$ I + \frac{\text{Par Value} - N_d}{n}}{\frac{\text{Par Value} + N_d}{2}}$$

$$\text{After tax cost of Debt (Bond)} = r_i = r_d \times (1 - T)$$

## Example (3)

### The Cost of Long-Term Debt (Bonds) using approximation method

$$\begin{aligned} \text{Net proceeds from selling the bond} &= \$ 980 - (.02 \times \$1,000) \\ &= \$ 980 - \$ 20 = 960 \end{aligned}$$

$$r_d = \frac{I + \frac{\$1,000 - N_d}{n}}{\frac{N_d + \$1,000}{2}}$$

$$\begin{aligned} r_d &= \frac{\$90 + \frac{\$1,000 - \$960}{20}}{\frac{\$960 + \$1,000}{2}} = \frac{\$90 + \$2}{\$980} \\ &= \frac{\$92}{\$980} = \underline{\underline{9.4\%}} \end{aligned}$$

Selling price	\$ 980
Flotation coast	2%
Par value	\$ 1,000
Coupon rate	9%
Years to maturity	20
Tax rate	40%

After tax cost of Debt (Bond)

$$= r_i = r_d \times (1 - T)$$

$$r_i = 9.452\% \times (1 - 0.40) = 5.67\% \text{ this is the after-tax cost of debt } r_i$$

# What about the cost of preferred stock?

- It is the ratio of the preferred stock dividend to the firm's net proceeds from the sale of preferred stock.
- Most preferred stock dividends are stated as a *dollar amount*: “*x dollars per year.*” Sometimes preferred stock dividends are stated as an *annual percentage rate*.
- Before the cost of preferred stock is calculated, *any dividends stated as percentages should be converted to annual dollar dividends.*
- Because preferred stock dividends are paid out of the firm's after tax cash flows, no tax adjustment is required.
- Cost of long-term financing with preferred stock is greater than cost of long-term financing with debt (bonds) because:
  1. Preferred stock are riskier than long term debt (bonds).
  2. Interest expense for long term debt is tax deductible expense but dividends to preferred stock are paid from net income after tax.

2

To calculate the cost of Preferred stock  $r_p$  we need to

∴

(1) Calculate Net proceeds from selling the preferred stock :

$N_p$

(2) Calculate dividends of preferred stock:  $D_p$

(3) Calculate cost of preferred stock :  $r_p$

*Cost of preferred stock =  $r_p$*

*Annual dividends amount for preferred stock =  $D_p$*

*Net proceeds from selling preferred stock =  $N_p$*

$$r_p = \frac{D_p}{N_p}$$

## Example (4) The Cost of Preferred Stock:

Net proceeds from selling the preferred stock = \$ stock selling price – ( percentage of flotation cost × stock par value )

$$\begin{aligned}\text{Net proceeds from selling the preferred stock} &= N_p = \$ 100 - (.05 \times \$100) \\ &= \$ 100 - \$ 5 = \$ 95\end{aligned}$$

Dividends of preferred stock =  $D_p$  = stock par value × Annual dividend rate

$$\begin{aligned}\text{Dividends of preferred stock} &= D_p = \$100 \times .1 \\ &= \$10\end{aligned}$$

$$\begin{aligned}\text{Cost of preferred stock} &= r_p = \frac{D_p}{N_p} \\ &= \frac{\$ 10}{\$ 95}\end{aligned}$$

$$r_p = 10.53 \%$$

<b>Selling price per share</b>	\$100
<b>Flotation coast from par value</b>	5%
<b>Par value per share</b>	\$100
<b>dividends as annual percentage rate from par value</b>	10 %

# What about the cost of Common Stock?

- **Cost of common stock equity  $r_s$ :** *is the rate at which investors discount the expected dividends of the firm to determine its share value.*
  
- There are two forms of common stock financing:
  1. Retained earnings
  2. New issues of common stock
  
- There are two different ways to estimate the cost of common equity:
  1. The constant growth valuation model (Gordon Model)
  2. The capital asset pricing model (CAPM).

3

Cost of common stock equity ( $r_s = r_r$  retained earnings):

There are two different ways

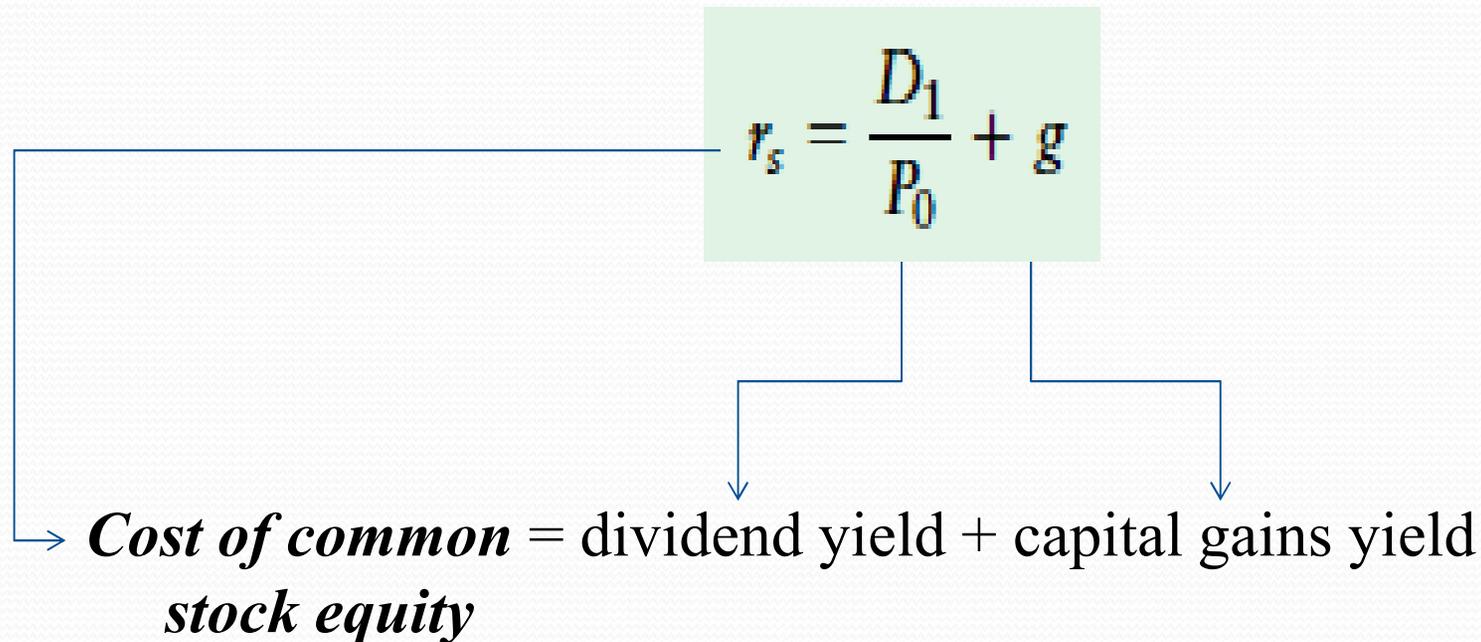
1. Using constant growth model:

$$r_s = \frac{D_1}{P_0} + g$$

2. Using CAPM:

$$r_s = R_F + [b \times (r_m - R_F)]$$

## 1) Cost of retained earnings ( $r_s = r_r$ ) using constant growth model



- $P_0$  = value of common stock (current market price per share)
- $D_1$  = per-share dividend expected at the end of year 1
- $r_s$  = required return on common stock
- $g$  = constant rate of growth in dividends



## *Constant-growth valuation (Gordon growth) model:*

- Assumes that the value of a share of stock equals the present value of all future dividends (assumed to grow at a constant rate) that it is expected to provide over an infinite time horizon.
- Indicates that the cost of common stock equity can be found by dividing the dividend expected at the end of year 1 by the current market price of the stock (the “dividend yield”) and adding the expected growth rate (the “capital gains yield”).

## Example (5)

### Cost of retained earnings using constant growth model :

- The market price,  $P_0$ , of a firm's common stock is \$50 per share.
- The firm expects to pay a dividend,  $D_1$ , of \$4 at the end of the coming year, 2013.
- The dividends paid on the outstanding stock over the past 6 years (2007 through 2012) were as follows:

Year	Dividend
2012	\$3.80
2011	3.62
2010	3.47
2009	3.33
2008	3.12
2007	2.97

- Calculate the cost of retained earnings using constant growth model

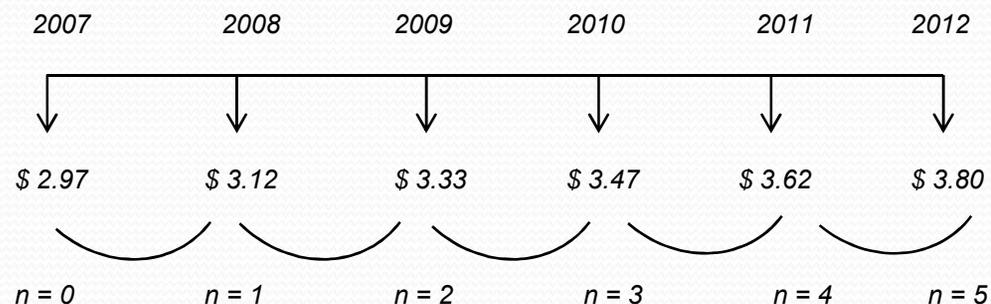
#### Solution:

$P_0 = \$50$  , and  $D_1 = \$4$  , But  $g$  needs to be calculated

$$r_s = \frac{D_1}{P_0} + g$$

## Calculating $g$ : constant growth rate

Year	Dividend
2012	\$3.80
2011	3.62
2010	3.47
2009	3.33
2008	3.12
2007	2.97



To find the historical annual growth rate of dividends, we must solve the following for  $g$ :

$$FV = PV \times (1 + r)^n$$

$$D_{2012} = D_{2007} \times (1 + g)^5$$

$$\frac{D_{2012}}{D_{2007}} = (1 + g)^5$$

$$\frac{\$ 3.80}{\$ 2.97} = (1 + g)^5$$

$$1.2795 = (1 + g)^5$$

$${}^5\sqrt{1.2795} = {}^5\sqrt{(1 + g)^5}$$

$$1.0505 = 1 + g$$

$$1.0505 - 1 = g$$

$$.0505 = g$$

$$\% 5.05 = g$$

Constant growth rate =  $g$

$$\% 5 \cong g$$

Now all variables are available:

$$P_0 = \$50, D_1 = \$4, g = 5\%$$

Apply the constant growth model formula

$$r_s = \frac{D_1}{P_0} + g$$

$$= \frac{\$4}{\$50} + .05$$

$$= .080 + .05$$

$$= .13$$

$$r_s = 13\% = r_r$$

## Example (6)

### Cost of retained earnings using constant growth model :

- Assume that a firm has just paid a dividend of \$2.50 per share.
- The firm expects dividends to grow at 10% indefinitely.
- The firm is currently selling its common stock share for \$50 per share.

Calculate the cost of retained earnings using constant growth model

Solution:

$P_0 = \$50$  , and  $D_0 = \$2.5$  per share is actual dividends paid,  $g = 10\%$  , but  $D_1$  is the expected dividend to be paid at the end of the coming year needs to be calculated:

$$D_1 = D_0 \times (1+g) = \$2.50 \times (1+.10) = \$2.75$$

$$r_s = \frac{D_1}{P_0} + g = \frac{\$2.75}{\$50} + .1 = .055 + .1 = .155$$

$$r_s = 15.5\% = r_r$$

## 2) Cost of retained earnings ( $r_s = r_r$ ) using CAPM:

cost of retained earnings  $r_r$

*The same as the cost of an equivalent fully subscribed issue of additional common stock, which is equal to the cost of common stock equity,  $r_s$*

$$r_s = R_F + [b \times (r_m - R_F)]$$

$$r_s = r_r$$

- $R_F$  = risk-free rate of return
- $r_m$  = market return; return on the market portfolio of assets
- $b$  = coefficient of non diversified risk



## *Capital Asset Pricing Model (CAPM):*

- Describes the relationship between the required return,  $r_s$ , and the non diversified risk of the firm as measured by the beta coefficient,  $b$ .
- Using CAPM indicates that the cost of common stock equity is the return required by investors as compensation for the firm's non diversified risk, measured by beta.

## Example (7) Cost of retained earnings using CAPM :

- If 3-month T-bill rate is currently 5.0%
- The market risk premium is 9%
- The firm's beta is 1.20
- Calculate the cost of retained earnings using CAPM

### Solution:

$r_F = 5\%$  ,  $b = 1.2$  , and  $r_M = 9\%$

$$r_S = r_F + b (r_M - r_F)$$

$$r_S = 5.0\% + 1.2 (9.0\%) = 15.8\%.$$

$$r_S = 15.8\% = r_r$$

4

Cost of common stock equity ( $r_n$  new issues of common stock):

***cost of a new issue of common stock,  $r_n$***

*The cost of common stock, net of underpricing and associated flotation costs.*

***underpriced***

*Stock sold at a price below its current market price,  $P_0$ .*

Using constant growth model:

$$r_n = \frac{D_1}{N_n} + g$$

- $N_n$  = net proceeds from selling new issues of common stock
- $D_1$  = per-share dividend expected at the end of year 1
- $r_n$  = cost of new issues of common stock
- $g$  = constant rate of growth in dividends

## Example (8)

### Cost of new issues of common stock using constant growth model :

- Assume that a firm has just paid a dividend of \$2.50 per share.
- The firm expects dividends to grow at 10% indefinitely.
- The selling price of new issue of common stock is \$50 per share after underpricing.
- flotation costs amount to \$4.00 per share.

Calculate the cost of new issues of common stock using constant growth model

Solution:

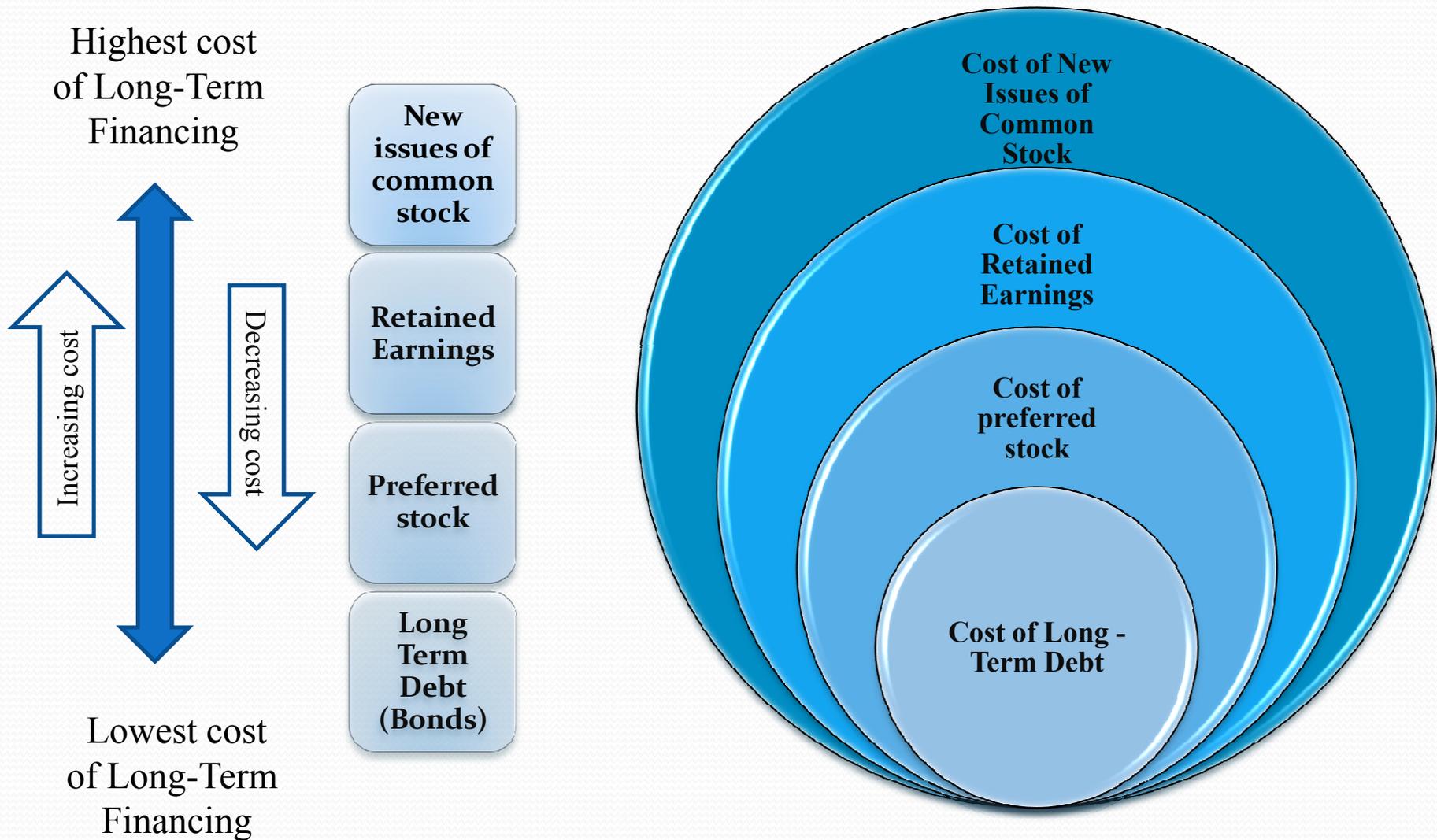
Selling price = \$50 , flotation cost = \$4 per share, and  $D_0 = \$2.5$  per share is actual dividends paid,  $g = 10\%$  , but  $D_1$  is the expected dividend to be paid at the end of the coming year needs to be calculated:

$$D_1 = D_0 \times (1 + g) = \$2.50 \times (1 + .10) = \$2.75$$

$$r_n = \frac{D_1}{N_n} + g = \frac{\$2.75}{\$50 - \$4} + .1 = .0597 + .1 = .1597 \cong .16$$

$r_n = 16\%$

## A comparison of the amount of cost for each source of Long-Term Financing



# Chapter 11

## Cost of Capital

### Concept Exercises

An-Najah National University

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Managerial Finance

### E-1

A firm raises capital by selling bonds at par value = \$1000, with net proceeds from selling the bond = \$1,000. If the debt matures in 10 years and has a coupon interest rate of 8%, what is the bond's YTM?

Since:

The bond par value = net proceeds from selling the bond  
 $\$1,000 = \$1,000$

Then:

$YTM = r_d =$  coupon interest rate of 8%,

## E-2

Your firm, People's Consulting Group, has been asked to consult on a potential preferred stock offering by Brave New World. This 15% preferred stock issue would be sold at its par value of \$35 per share. Flotation costs would total \$3 per share. Calculate the cost of this preferred stock.

$$\begin{aligned}\text{Cost of preferred stock} &= r_p = \frac{D_p}{N_p} \\ &= \frac{(.15 \times \$35)}{(\$35 - \$3)} \\ r_p &= 16.41\%\end{aligned}$$

### E-3

Duke Energy has been paying dividends steadily for 20 years. During that time, dividends have grown at a compound annual rate of 7%. If Duke Energy's current stock price is \$78 and the firm plans to pay a dividend of \$6.50 next year, what is Duke's *cost of common stock equity*?

$$r_s = \frac{D_1}{P_0} + g = \frac{\$6.5}{\$78} + .07 = .083 + .07 = .153$$

$$r_s = 15.3\% = r_r$$

#### E-4

Weekend Warriors, Inc., has 35% debt and 65% equity in its capital structure. The firm's estimated after-tax cost of debt is 8% and its estimated cost of equity is 13%. Determine the firm's *weighted average cost of capital (WACC)*.

#### ***Solution:***

$$WACC = (\text{weight of Debt} \times \text{cost of Debt}) + (\text{weight of Equity} \times \text{cost Equity})$$

$$WACC = (.35 \times 8\%) + (.65 \times 13\%)$$

$$WACC = (2.8\%) + (8.45\%)$$

$$WACC = 11.25\%$$

### E-5

Oxy Corporation uses debt, preferred stock, and common stock to raise capital. The firm's capital structure targets the following proportions: debt, 55%; preferred stock, 10%; and common stock, 35%. If the cost of debt is 6.7%, preferred stock costs 9.2%, and common stock costs 10.6%, what is Oxy's *weighted average cost of capital (WACC)*?

$$WACC = r_a = w_i r_i + w_p r_p + w_s r_{r \text{ or } n}$$

### ***Solution:***

$$WACC = (.55 \times 6.7\%) + (.10 \times 9.2\%) + (.35 \times 10.6\%)$$

$$WACC = (3.685\%) + (.92\%) + (3.71\%)$$

$$WACC = 8.315\%$$

## P-1

Currently, Warren Industries can sell 15-year, \$1,000-par-value bonds paying annual interest at a 12% coupon rate. As a result of current interest rates, the bonds can be sold for \$1,010 each; flotation costs of \$30 per bond will be incurred in this process. The firm is in the 40% tax bracket.

- a. Find the *net proceeds* from sale of the bond,  $N_d$ .
- d. Use the *approximation formula to estimate the before-tax cost of debt*.
- c. Find the *after-tax costs of debt*.

**a. Net Proceeds:**

$$N_d = \$1,010 - \$30$$
$$N_d = \$980$$

- d. Approximate before-tax cost of debt:**

$$k_d = \frac{\$120 + \frac{(\$1,000 - \$980)}{15}}{\frac{(\$980 + \$1,000)}{2}} = 12.26\% \quad k_d$$

**c. Approximate after-tax cost of debt** =  $12.26\% \times (1 - .4) = 7.36\%$

## P-2

A bond has been issued by a firm with the following information on the security:

bond					
Par value	\$1,000	Coupon interest rate	6%	Tax bracket	20%
Net Selling price	\$930	Years to maturity	10		

Answer the following questions.

- Calculate the *before-tax cost of the Sony bond*.
- Calculate the *after-tax cost of the Sony bond given David's tax bracket*.

$$\begin{aligned} \text{Annual interest amount on the bond} &= .06 \times \$1,000 \\ &= \$60 \end{aligned}$$

$$\begin{aligned} \text{Before tax cost of Debt (Bond)} = r_d &= \frac{\$I + \frac{\text{Par Value} - N_d}{n}}{\frac{\text{Par Value} + N_d}{2}} = \frac{\$60 + \left[ \frac{\$1,000 - \$930}{10} \right]}{\frac{\$1,000 + \$930}{2}} \\ r_d &= 6.9\% \end{aligned}$$

$$\begin{aligned} \text{After tax cost of Debt (Bond)} &= r_i = 6.9\% \times (1 - .2) \\ r_i &= 5.52\% \end{aligned}$$

### P-3

For each of the following \$1,000 par value bonds, assuming *annual interest payment* and a 40% tax rate, calculate the *after-tax cost to maturity* using the *approximation formula*.

Bond	Life (years)	Underwriting fee	Discount or premium	Coupon interest rate
A	20	\$25	-\$20	9%
B	16	40	+10	10
C	15	30	-15	12
D	25	15	par	9
E	22	20	-60	11

$$k_d = \frac{I + \frac{\$1,000 - N_d}{n}}{\frac{N_d + \$1,000}{2}}$$

$$k_i = k_d \times (1 - T)$$

### Bond A

$$k_d = \frac{\$90 + \frac{\$1,000 - \$955}{20}}{\frac{\$955 + \$1,000}{2}} = \frac{\$92.25}{\$977.50} = 9.44\%$$

$$k_i = 9.44\% \times (1 - .40) = 5.66\%$$

### Bond B

$$k_d = \frac{\$100 + \frac{\$1,000 - \$970}{16}}{\frac{\$970 + \$1,000}{2}} = \frac{\$101.88}{\$985} = 10.34\%$$

$$k_i = 10.34\% \times (1 - .40) = 6.20\%$$

### Bond C

$$k_d = \frac{\$120 + \frac{\$1,000 - \$955}{15}}{\frac{\$955 + \$1,000}{2}} = \frac{\$123}{\$977.50} = 12.58\%$$

$$k_i = 12.58\% \times (1 - .40) = 7.55\%$$

### Bond D

$$k_d = \frac{\$90 + \frac{\$1,000 - \$985}{25}}{\frac{\$985 + \$1,000}{2}} = \frac{\$90.60}{\$992.50} = 9.13\%$$

$$k_i = 9.13\% \times (1 - .40) = 5.48\%$$

## Bond E

$$k_d = \frac{\$110 + \frac{\$1,000 - \$920}{22}}{\frac{\$920 + \$1,000}{2}} = \frac{\$113.64}{\$960} = 11.84\%$$

$$k_i = 11.84\% \times (1 - .40) = 7.10\%$$

## P-4

Gronseth Drywall Systems, Inc., is in discussions with its investment bankers regarding the issuance of new bonds. The investment banker has informed the firm that different maturities will carry different coupon rates and sell at different prices.

The firm must choose among several alternatives. In each case, the bonds will have a \$1,000 par value and flotation costs will be \$30 per bond. The company is taxed at a rate of 40%. Calculate the *after-tax cost of financing with each of the following alternatives*.

Alternative	Coupon Rate	Time to maturity	Premium or discount
A	9%	16	\$250
B	7	5	50
C	6	7	Par
D	5	10	-75

### Alternative A

$$k_d = \frac{\$90 + \frac{\$1,000 - \$1,220}{16}}{\frac{\$1,220 + \$1,000}{2}} = \frac{\$76.25}{\$1,110} = 6.87\%$$

$$k_i = 6.87\% \times (1 - .40) = 4.12\%$$

### Alternative B

$$k_d = \frac{\$70 + \frac{\$1,000 - \$1,020}{5}}{\frac{\$1,020 + \$1,000}{2}} = \frac{\$66.00}{\$1,010} = 6.54\%$$

$$k_i = 6.54\% \times (1 - .40) = 3.92\%$$

### Alternative C

$$k_d = \frac{\$60 + \frac{\$1,000 - \$970}{7}}{\frac{\$970 + \$1,000}{2}} = \frac{\$64.29}{\$985} = 6.53\%$$

$$k_i = 6.53\% \times (1 - .40) = 3.92\%$$

## Alternative D

$$k_d = \frac{\$50 + \frac{\$1,000 - \$895}{10}}{\frac{\$895 + \$1,000}{2}} = \frac{\$60.50}{\$947.50} = 6.39\%$$

$$k_i = 6.39\% \times (1 - .40) = 3.83\%$$

## P-5

Taylor Systems has just issued preferred stock. The stock has a 12% annual dividend and a \$100 par value and was sold at \$97.50 per share. In addition, flotation costs of \$2.50 per share must be paid.

a. Calculate the *cost of the preferred stock*.

b. If the firm sells the preferred stock with a 10% annual dividend and nets \$90.00 after flotation costs, what is its cost?

$$\begin{aligned} \text{a. Cost of preferred stock} &= r_p = \frac{D_p}{N_p} \\ &= \frac{(.12 \times \$100)}{(\$97.5 - \$2.5)} \end{aligned}$$

$$r_p = 12.63 \%$$

$$\begin{aligned} \text{b. Cost of preferred stock} &= r_p = \frac{D_p}{N_p} \\ &= \frac{(.10 \times \$100)}{(\$90)} \end{aligned}$$

$$r_p = 11.11 \%$$

## P-6

Determine the cost for each of the following preferred stocks.

Preferred stock	Par value	Sales price	Flotation cost	Annual dividends
A	\$100	\$101	\$9	11%
B	40	38	\$3.5	8%
C	35	37	\$4	\$5
D	30	26	5% of par	\$3
E	20	20	\$2.5	9%

Cost of Preferred Stock:  $k_p = D_p \div N_p$

Preferred Stock

Calculation

<b>A</b>	$k_p = \$11.00 \div \$92.00 = 11.96\%$
<b>B</b>	$k_p = 3.20 \div 34.50 = 9.28\%$
<b>C</b>	$k_p = 5.00 \div 33.00 = 15.15\%$
<b>D</b>	$k_p = 3.00 \div 24.50 = 12.24\%$
<b>E</b>	$k_p = 1.80 \div 17.50 = 10.29\%$

## P-7

J&M Corporation common stock has a beta,  $b$ , of 1.2. The risk-free rate is 6%, and the market return is 11%.

- Determine the risk premium on J&M common stock (not the market risk premium).
- Determine the required return that J&M common stock should provide.
- Determine J&M's *cost of common stock equity using the CAPM*.

$$k_s = R_F + [\text{risk premium on the common stock}]$$

$$k_s = R_F + [b \times (\text{market risk premium})]$$

$$k_s = R_F + [b \times (k_m - R_F)]$$

$$k_s = 6\% + 1.2 \times (11\% - 6\%)$$

$$k_s = 6\% + 6\%$$

$$k_s = 12\%$$

- Risk premium on J&M common stock = 6%
- Rate of return that the company should provide (investor point of view) = 12%
- After-tax cost of common equity (company point of view) using the CAPM = 12%

**P-8**

Ross Textiles wishes to measure its cost of common stock equity. The firm's stock is currently selling for \$57.50. The firm expects to pay a \$3.40 dividend at the end of the year (2013). The dividends for the past 5 years are shown in the following table.

Year	Dividends
2012	\$3.1
2011	2.92
2010	2.6
2009	2.3
2008	2.12

After underpricing and flotation costs, the firm expects to net \$52 per share on a new issue.

- Determine the growth rate of dividends from 2008 to 2012.
- Determine the net proceeds,  $N_n$ , that the firm will actually receive.
- Using the constant-growth valuation model, determine the cost of retained earnings,  $r_r$ .
- Using the constant-growth valuation model, determine the cost of new common stock  $r_n$ .

$$a. \quad FV = PV \times FVIF_{i\%,4} \quad g = \frac{D_{2012}}{D_{2008}} = FVIF_{i\%,4} = \frac{\$3.10}{\$2.12} = 1.462$$

From FVIF table, the factor closest to 1.462 occurs at 10% (i.e., 1.464 for 4 years).

$$b. \quad N_n = \$52 \text{ (given in the problem)}$$

**c.** 
$$k_r = \frac{D_{2013}}{P_0} + g$$

$$k_r = \frac{\$3.40}{\$57.50} + .10 = 15.91\%$$

**d.** 
$$k_r = \frac{D_{2013}}{N_n} + g$$

$$k_r = \frac{\$3.40}{\$52} + .10 = 16.54\%$$

**P-9**

Retained earnings versus new common stock Using the data for each firm shown in the following table, calculate the *cost of retained earnings* and the *cost of new common stock* using the *constant-growth valuation model*.

Firm	Current market price	Dividend growth rate	Projected dividend per share next year	Underpricing per share	Flotation cost per share
A	\$50	%8	\$2.25	\$2	\$1
B	20	4	1	.5	1.5
C	42	6	2	1	2
D	19	2	2.1	1.3	1.7

<u>Firm</u>	<u>Calculation</u>
<b>A</b>	$k_r = (\$2.25 \div \$50.00) + .08 = 12.50\%$ $k_n = (\$2.25 \div \$47.00) + .08 = 12.79\%$
<b>B</b>	$k_r = (\$1.00 \div \$20.00) + .04 = 9.00\%$ $k_n = (\$1.00 \div \$18.00) + .04 = 9.56\%$
<b>C</b>	$k_r = (\$2.00 \div \$42.50) + .06 = 10.71\%$ $k_n = (\$2.00 \div \$39.50) + .06 = 11.06\%$
<b>D</b>	$k_r = (\$2.10 \div \$19.00) + .02 = 13.05\%$ $k_n = (\$2.10 \div \$16.00) + .02 = 15.13\%$

## P-10

Lighting Corp. wishes to explore the effect on its cost of capital of the rate at which the company pays taxes. The firm wishes to maintain a capital structure of 30% debt, 10% preferred stock, and 60% common stock. The cost of financing with retained earnings is 14%, the cost of preferred stock financing is 9%, and the before-tax cost of debt financing is 11%. Calculate the weighted average cost of capital (WACC) given the tax rate assumptions in parts a to c.

a. Tax rate 40%

b. Tax rate 35%

c. Tax rate 25%

d. Describe the relationship between changes in the rate of taxation and the weighted average cost of capital.

**a.**  $WACC = (.30)(11\%)(1 - .40) + (.10)(9\%) + (.60)(14\%)$   
 $WACC = 1.98\% + .9\% + 8.4\%$   
 $WACC = 11.28\%$

**b.**  $WACC = (.30)(11\%)(1 - .35) + (.10)(9\%) + (.60)(14\%)$   
 $WACC = 2.15\% + .9\% + 8.4\%$   
 $WACC = 11.45\%$

**c.**  $WACC = (.30)(11\%)(1 - .25) + (.10)(9\%) + (.60)(14\%)$   
 $WACC = 2.48\% + .9\% + 8.4\%$   
 $WACC = 11.78\%$

**d.** As the tax rate decreases, the WACC increases due to the reduced tax shield from the tax-deductible interest on debt.

**P-11**

Ridge Tool has on its books the amounts and specific (after-tax) costs shown in the following table for each source of capital.

Source of capital	Book value	Individual cost
Long term debt	\$700,000	5.3%
Preferred stock	50,000	12
Common stock equity	650,000	16

a. Calculate the firm's *weighted average cost of capital using book value weights*.

Type of Capital	Book Value	Weight	Cost	Weighted Cost
L-T Debt	\$ 700,000	.500	5.3%	2.650%
Preferred stock	50,000	.036	12.0%	.432%
Common stock	650,000	.464	16.0%	7.424%
	\$1,400,000	1.000		10.506%

The WACC is the rate of return that the firm must receive on long-term projects to maintain the value of the firm. The cost of capital can be compared to the return for a project to determine whether the project is acceptable.

**P-12**

Webster Company has compiled the information shown in the following table.

Source of capital	Book value	Market value	After-tax cost
Long term debt	\$4,000,000	\$3,840,000	6%
Preferred stock	40,000	60,000	13
Common stock equity	1,060,000	3,000,000	17
Totals	\$5,100,000	\$6,900,000	

- Calculate the weighted average cost of capital using *book value weights*.
- Calculate the weighted average cost of capital using *market value weights*.
- Compare the answers obtained in parts a and b.

**a. Book value weights:**

Type of Capital	Book Value	Weight	Cost	Weighted Cost
L-T Debt	\$4,000,000	0.784	6.00%	4.704%
Preferred stock	40,000	0.008	13.00%	.104%
Common stock	<u>1,060,000</u>	0.208	17.00%	<u>3.536%</u>
	\$5,100,000			8.344%

**b. Market value weights:**

Type of Capital	Market Value	Weight	Cost	Weighted Cost
L-T Debt	\$3,840,000	0.557	6.00%	3.342%
Preferred stock	60,000	0.009	13.00	.117%
Common stock	<u>3,000,000</u>	0.435	17.00	<u>7.395%</u>
	\$6,900,000			10.854%