



Chapter 9 Cost of Capital

Overview of the Cost of Capital



- The **cost of capital** represents the firm's cost of financing, and is the minimum rate of return that a project must earn to increase firm value.
 - Financial managers are ethically bound to only invest in projects that they expect to exceed the cost of capital.
 - The cost of capital reflects the entirety of the firm's financing activities.
- Most firms attempt to maintain an optimal mix of debt and equity financing.
 - To capture all of the relevant financing costs, assuming some desired mix of financing, we need to look at the overall cost of capital rather than just the cost of any single source of financing.

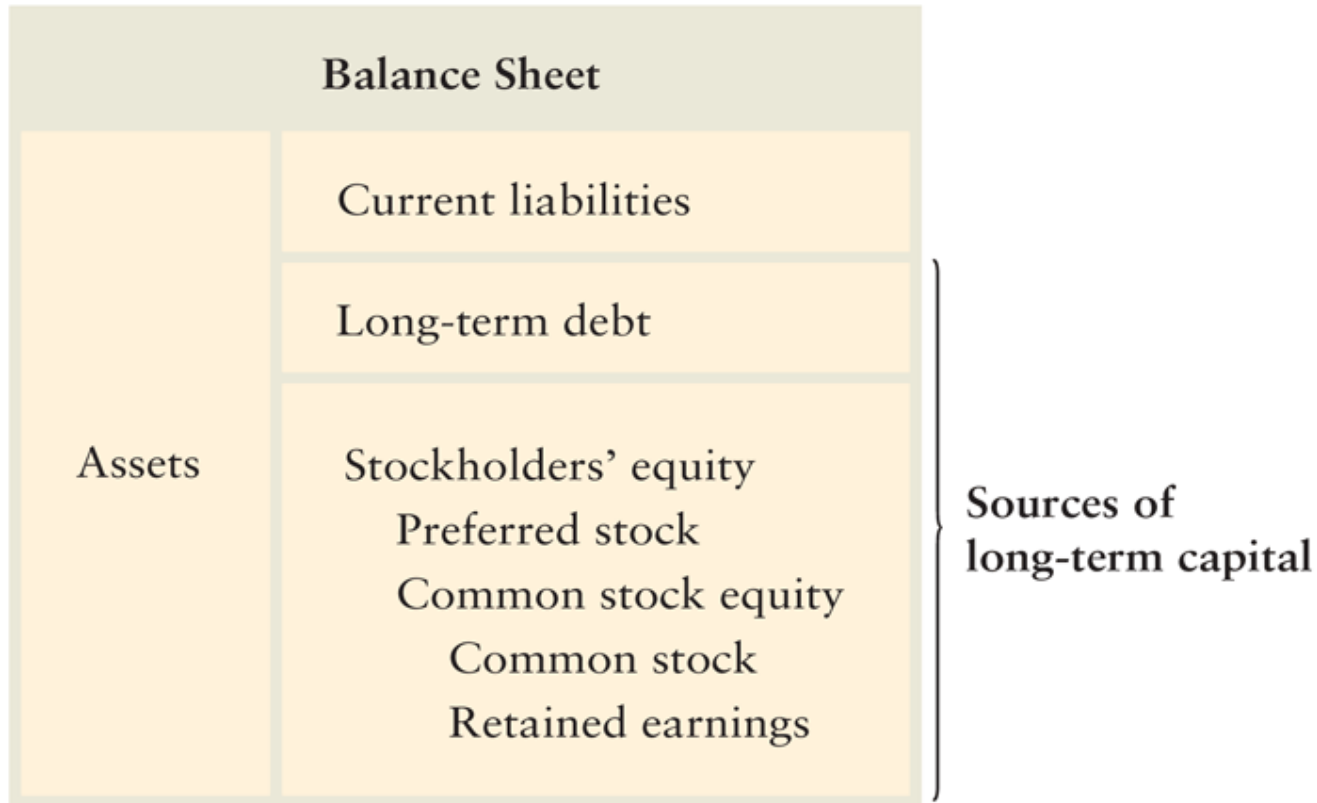
Focus on Ethics



- The Ethics of Profit

- Introduced in 1999, Vioxx was an immediate success, quickly reaching \$2.5 billion in annual sales.
- However, a Merck study launched in 1999 eventually found that patients who took Vioxx suffered from an increased risk of heart attacks and strokes.
- Despite the risks, Merck continued to market and sell Vioxx.
- The 2004 Vioxx withdrawal hit Merck's reputation, profits, and stock price hard.
- The Vioxx recall increased Merck's cost of capital. What effect would an increased cost of capital have on a firm's future investments?

Overview of the Cost of Capital: Sources of Long-Term Capital



Some Key Assumptions



- **Business Risk**—the risk to the firm of being unable to cover operating costs
 - assumed to be unchanged.
 - acceptance of a given project does not affect the firm’s business risk
- **Financial Risk**—the risk to the firm of being unable to cover required financial obligations
 - assumed to be unchanged.
 - means that the projects are financed in such a way that the firm’s ability to meet financing costs is unchanged.
- After-tax costs are always considered

The Basic Concept



- Why do we need to determine a company's overall **“weighted average cost of capital?”**
- Using this piecemeal approach to evaluate investment opportunities is not in the best interest of the firm's shareholders.
 - Over the long haul, the firm must undertake investments that maximize firm value.
- This can only be achieved if it undertakes projects that provide returns in excess of the firm's overall weighted average cost of financing (or WACC).

Cost of Long-Term Debt



- The pretax **cost of debt** is the financing cost associated with new funds through long-term borrowing.
 - Yield to maturity is used as the base
- **Net proceeds** are the funds actually received by the firm from the sale of a security. $\text{net proceeds} = \text{market price} - \text{flotation costs}$
- **Flotation costs** are the total costs of issuing and selling a security. They include two components:
 1. Underwriting costs—compensation earned by investment bankers for selling the security.
 2. Administrative costs—issuer expenses such as legal, accounting, and printing.

Cost of Long-Term Debt: After-Tax Cost of Debt



- The interest payments paid to bondholders are tax deductible for the firm, so the interest expense on debt reduces the firm's taxable income and, therefore, the firm's tax liability.
- The after-tax cost of debt, r_i , can be found by multiplying the before-tax cost, r_d , by 1 minus the tax rate, T , as stated in the following equation:

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

Specific Sources of Capital: The Cost of Long-Term Debt (cont.)



Net Proceeds

A company is contemplating selling \$10 million worth of 20-year, 9% coupon bonds with a par value of \$1,000. Suppose further that the firm must sell the bonds at \$980. Flotation costs are 2% or \$20.

Net proceeds to the firm for each bond is therefore \$960

$(\$980 - \$20)$.

Cost of Preferred Stock



- Preferred stock gives preferred stockholders the right to receive their stated dividends before the firm can distribute any earnings to common stockholders.
 - Most preferred stock dividends are stated as a dollar amount.
 - Sometimes preferred stock dividends are stated as an annual percentage rate, which represents the percentage of the stock's par, or face, value that equals the annual dividend.
- The **cost of preferred stock**, r_p , is the ratio of the preferred stock dividend to the firm's net proceeds from the sale of preferred stock.

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

Cost of Capital



Bond		Preferred Stock		Cost of Debt (if given)	
Coupon	9.00%	Dividend		Cost of Debt (before tax)	9.45%
N	20	Price		Cost of Preferred	0.00%
Price	\$980.00	Flotation Costs (\$)		Cost of RE (DIV)	#DIV/0!
Flotation Costs (\$)	\$20.00			Cost of RE (SML)	0.00%
Tax Rate	40.00%			Cost of New CS	#DIV/0!
Par Value	\$1,000				
		Market Value	Weights	After-Tax Cost	
		Debt	#DIV/0!	5.67%	
		Preferred Stock	#DIV/0!	0.00%	
		Common Equity (RE)	#DIV/0!	#DIV/0!	
		Common Equity (NEW)		#DIV/0!	
		Total Market Value	\$0.00		

Cost of Capital

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Cost of Capital



Bond		Preferred Stock		Cost of Debt (if given)	
Coupon	9.00%	Dividend	\$8.70	Cost of Debt (before tax)	9.45%
N	20	Price	\$87.00	Cost of Preferred	10.61%
Price	\$980.00	Flotation Costs (\$)	\$5.00	Cost of RE (DIV)	#DIV/0!
Flotation Costs (\$)	\$20.00			Cost of RE (SML)	0.00%
Tax Rate	40.00%			Cost of New CS	#DIV/0!
Par Value	\$1,000				

Cost of capital

Cost of Common Stock



- The cost of common stock is the return required on the stock by investors in the marketplace.
- There are two forms of common stock financing:
 1. retained earnings
 2. new issues of common stock
- The **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.

Specific Sources of Capital: The Cost of Common Stock (RE)



Using the constant growth model, we

$$r_r = \frac{D_1}{P_{\text{mkt}}} + g$$

- We can also estimate the cost of common equity using the CAPM:

$$r_r = RF + \beta * (r_m - RF)$$

Specific Sources of Capital: The Cost of Common Stock (cont.)



For example, assume a firm has just paid a dividend of \$2.50 per share, expects dividends to grow at 10% indefinitely, and is currently selling for \$50.00 per share.

For example, if the 3-month T-bill rate is currently 5.0%, the stock market average return is 14%, and the firm's beta is 1.20, the firm's cost of retained earnings will be:

Cost of Capital



Common Stock	
Div (D_0)	\$2.50
Growth	10%
Price	\$50.00
Flotation Costs (\$)	
Risk Free Rate	5%
Beta	1.20
Km	14%
Div (D_1) (if given)	

Bond		Preferred Stock		Cost of Debt (if given)	
Coupon	9.00%	Dividend	\$8.70	Cost of Debt (before tax)	9.45%
N	20	Price	\$87.00	Cost of Preferred	10.61%
Price	\$980.00	Flotation Costs (\$)	\$5.00	Cost of RE (DIV)	15.50%
Flotation Costs (\$)	\$20.00			Cost of RE (SML)	15.80%
Tax Rate	40.00%			Cost of New CS	15.50%
Par Value	\$1,000				

	Market Value	Weights	After-Tax Cost
Debt		#DIV/0!	5.67%
Preferred Stock		#DIV/0!	10.61%
Common Equity (RE)		#DIV/0!	15.65%
Common Equity (NEW)			15.50%
Total Market Value	\$0.00		

Cost of Capital

Specific Sources of Capital: The Cost of Common Stock (cont.)



- Cost of New Equity (r_n)

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

Continuing with the previous example, it will cost the firm flotation costs of \$3.00 per share. However the firm must also underprice the share \$1?

What do you do with the underprice amount?

Cost of Capital



Common Stock	
Div (D_0)	\$2.50
Growth	10%
Price	\$50.00
Flotation Costs (\$)	\$ 4.00
Risk Free Rate	5%
Beta	1.20
Km	14%
Div (D_1) (if given)	

Bond		Preferred Stock		Cost of Debt (if given)	
Coupon	9.00%	Dividend	\$8.70	Cost of Debt (before tax)	9.45%
N	20	Price	\$87.00	Cost of Preferred	10.61%
Price	\$980.00	Flotation Costs (\$)	\$5.00	Cost of RE (DIV)	15.50%
Flotation Costs (\$)	\$20.00			Cost of RE (SML)	15.80%
Tax Rate	40.00%			Cost of New CS	15.98%
Par Value	\$1,000				
		Market Value	Weights	After-Tax Cost	
		Debt	#DIV/0!	5.67%	
		Preferred Stock	#DIV/0!	10.61%	
		Common Equity (RE)	#DIV/0!	15.65%	
		Common Equity (NEW)		15.98%	
		Total Market Value	\$0.00		

Cost of Capital

Weighted Average Cost of Capital



•The **weighted average cost of capital (WACC)**, r_a , reflects the expected average future cost of capital over the long run; found by weighting the cost of each specific type of capital by its proportion in the firm's capital structure.

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

•where

w_i = proportion of long-term debt in capital structure

w_p = proportion of preferred stock in capital structure

w_s = proportion of common stock equity in capital structure

$$w_i + w_p + w_s = 1.0$$

Weighted Average Cost of Capital (cont.)



- Three important points should be noted in the equation for r_a :
 1. For computational convenience, it is best to convert the weights into decimal form and leave the individual costs in percentage terms.
 2. The weights must be non-negative and sum to 1.0. Simply stated, WACC must account for all financing costs within the firm's capital structure.
 3. The firm's common stock equity weight, w_s , is multiplied by either the cost of retained earnings, r_r , or the cost of new common stock, r_n . Which cost is used depends on whether the firm's common stock equity will be financed using retained earnings, r_r , or new common stock, r_n .

The Weighted Average Cost of Capital

Capital Structure Weights



The firm has issued 3,265 bonds a \$980; 14,545 shares of pfd at \$55; and 80,000 sh of CS at \$50

Book Value			Market Value		
	\$	w_i		\$	w_i
Debt	3,265,000	.69	Debt (3265*980)	3,199,700	.40
Pfd	400,000	.09	Pfd (14,545*55)	799,975	.10
CE	<u>1,000,000</u>	.22	CE (80000*50)	<u>4,000,000</u>	.50
	4,000,000			8,000,000	

The Weighted Average Cost of Capital

Assumes the firm has sufficient retained earnings to fund any anticipated investment projects.

Use r_r as the cost of equity (retained earnings)

$$\begin{aligned} WACC = r_a &= w_i * r_i + w_p * r_p + w_s * r_r \\ &= (.4)(5.67) + (.1)(10.61) + (.5)(15.65) = 11.15 \end{aligned}$$

If we exhaust retained earnings and need to issue new common stock:

Use r_n as the cost of equity

$$\begin{aligned} WACC = r_a &= w_i * r_i + w_p * r_p + w_s * r_n \\ &= (.4)(5.67) + (.1)(10.61) + (.5)(15.98) = 11.32 \end{aligned}$$



	Market Value	Weights	After-Tax Cost
Debt	\$3,199,700.00	40.00%	5.67%
Preferred Stock	\$799,975.00	10.00%	10.61%
Common Equity (RE)	\$4,000,000.00	50.00%	15.65%
Common Equity (NEW)			15.98%
Total Market Value	\$7,999,675.00		

Break Point	Amount Until Break	Break Point	New After Tax Cost
Debt		\$0	
Retained Earnings		\$0	
	First Tier	11.15%	
	Break Pt (no debt BP, no RE)	11.32%	
	Break Pt (debt BP <= EQ BP)		
	Break Pt (Debt BP > EQ BP)		
	Final Break Point		

- The first tier shows the cost of capital using retained earnings as common equity financing.
- Retained Earnings are limited. When they run out we will then use new common stock to finance; the cost will go up.

Focus on Practice



•Uncertain Times Make for an Uncertain Weighted Average Cost of Capital

- As U.S. financial markets experienced and recovered from the 2008 financial crisis and 2009 “great recession,” firms struggled to keep track of their weighted average cost of capital since the individual component costs were moving rapidly in response to the financial market turmoil.
- The financial crisis pushed credit costs to a point where long-term debt was largely inaccessible, and the great recession saw Treasury bond yields fall to historic lows making cost of equity projections appear unreasonably low.
- Why don’t firms generally use both a short and long-run weighted average cost of capital?

Weighted Average Cost of Capital: Weighting Schemes



- Book Value versus Market Value:
 - **Book value weights** are weights that use accounting values to measure the proportion of each type of capital in the firm's financial structure.
 - **Market value weights** are weights that use market values to measure the proportion of each type of capital in the firm's financial structure.
- Historical versus Target:
 - **Historical weights** are either book or market value weights based on *actual* capital structure proportions.
 - **Target weights** are either book or market value weights based on *desired* capital structure proportions.
- From a strictly theoretical point of view, the preferred weighting scheme is target market value proportions.

The Marginal Cost & Investment Decisions



- The Weighted Marginal Cost of Capital (WMCC)
 - The WACC typically increases as the volume of new capital raised within a given period increases.
 - This is true because companies need to raise the return to investors in order to entice them to invest to compensate them for the increased risk introduced by larger volumes of capital raised.
 - In addition, the cost will eventually increase when the firm runs out of cheaper retained equity and is forced to raise new, more expensive equity capital.

The Marginal Cost & Investment Decisions (cont.)



Finding the break points in the WMCC schedule will allow us to determine at what level of new financing the WACC will increase due to the factors listed above.

$$BP_i = \frac{AF_i}{w_i}$$

where:

BP_j = breaking point from financing source j

AF_j = amount of funds available at a given cost

w_j = target capital structure weight for source j

The Marginal Cost & Investment Decisions (cont.)



Assume that in the example we have been using that the firm has \$2 million of retained earnings available. When it is exhausted, the firm must issue new (more expensive) equity. Furthermore, the company believes it can raise \$1 million of cheap debt after which it will cost 7% (after-tax) to raise additional debt.

Given this information, the firm can determine its break points as follows:

The Marginal Cost & Investment Decisions (cont.)



Break Point	Amount Until Break	Break Point	New After Tax Cost
Debt	\$1,000,000.00	\$2,500,133	7.00%
Retained Earnings	\$2,000,000.00	\$3,999,838	
	First Tier	11.15%	
	Break Pt (no debt BP, no RE)		
	Break Pt (debt BP <= EQ BP)	11.69%	
	Break Pt (Debt BP > EQ BP)		
	Final Break Point	11.85%	

0 - 2,500,133 11.15

2,500,134 – 3,999,838 11.69

Over 3,999,838 11.85

Cost of Capital

WACC



- What is the WACC? The XYZ company has a capital structure with 35% debt and 65% Equity. The after-tax costs of financing are as follows:

Debt 9% New Equity 18% Retained Earnings 15%

	Market Value	Weights	After-Tax Cost
Debt	\$35	0.350	9.00%
Preferred Stock		0.000	
Common Equity (RE)	\$65	0.650	15.00%
Common Equity (New)			18.00%
Total Market Value	\$100		
WACC Using Retained Earnings			12.90%
WACC Using New Issues of Common Stock			14.85%



NPV Approach

Now we will rank by NPV. With the \$250,000 limit in investment we will only do projects C, B, and A while projects E & F clearly will add wealth to the shareholder.

Why?

Projects	Investment	NPV	Cumulative Investment
C	\$100,000	\$45,000	\$100,000
B	\$70,000	\$42,000	\$170,000
A	\$80,000	\$20,000	\$250,000
E	\$60,000	\$19,000	\$310,000
F	\$110,000	\$16,500	\$420,000
D	\$40,000	-\$4,000	\$460,000