Chapter 9 Cost of Capital

The objectives of this chapter are to enable you to:

- *Interpret the firm's component and overall costs of capital as resource costs*
- *Measure the firm's cost of capital*
- *Understand the relationship between risk and the firm's cost of capital*
- *Sense how sources of funding impact the firm's capital costs*

9.A: INTRODUCTION

By definition, a firm maximizes its profits when the difference between its revenues and costs are maximized. The typical firm realizes most of its revenues from sales of its products and services and incurs costs from the purchase of various resources necessary to provide these products and services. Among these necessary resources is capital, or money the firm must raise in order to operate. The firm will attempt to minimize its cost of capital just as it will attempt to minimize any of its other resource costs.

If the firm chooses investments on the basis of net present value, it will choose all positive NPV projects. However, the firm must determine appropriate means of financing these positive NPV projects. In some instances, the firm will make its investment and financing decisions separately; that is, it will first locate all positive NPV projects and then determine appropriate means of financing these projects. In this case, the firm will determine an appropriate mix of debt and equity so as to minimize the cost of all of the capital necessary to finance its portfolio of projects. Thus, the firm will attempt to minimize its overall (or average) cost of capital. This cost is measured as a percentage of the capital raised. In many instances, the firm's overall (or average) percentage cost of capital may be used as a discount rate for the firm's cash flows. By minimizing the overall cost of capital, the firm will maximize the present value of cash flows it is able to generate. If the firm does not separate its investment and financing decisions, it should still attempt to minimize its overall cost of capital just as it would attempt to minimize its other costs.

9.B: COST OF CAPITAL DEFINITIONS - NO TAXES

Cost of capital is the money the firm must pay to raise capital (funds to finance its investments) relative to the capital raised. Thus, cost of raising capital is measured as a percentage (or ratio) of the funds raised. Capital that the firm raises will be reflected on the right-hand side or capital side of the firm's balance sheet; payments necessary to sustain this capital will be reflected on the firm's income statement. A firm's cost of capital can be determined by dividing the payments required to sustain capital by the amount of capital raised.

Cost of Capital

A component cost of capital is the cost to the firm of raising money from a particular source. The sum of money obtained from a particular source such as debt or equity will be reflected on the firm's balance sheet; the payments such as interest or dividends required to sustain this capital component will be reflected in the firm's income statement. For example, the firm's cost of debt is simply the interest payments required to sustain the firm's debt divided by the total amount of capital it has raised by borrowing money:

(9.1) $$k_D = i = \frac{INT}{DEBT} = \frac{INT}{D}$$

However, interest payments required to sustain debt reduce the firm's taxable income, thus reducing the level of income taxes it must pay. Therefore, the firm's after-tax cost of debt may be of greater importance:

(9.2) $$k_D = k_D(1-\tau) = \frac{INT(1-\tau)}{D}$$

where (ϑ) is the corporate tax rate.

Some firms will raise capital through the sale of preferred stock. The cost of preferred stock is simply the dividends paid to preferred stock holders divided by the total amount of capital raised from the sale of preferred stock:

(9.3) $$k_{ps} = \frac{pfd.Div}{pfd.Equity}$$

Because preferred stock dividends are not tax-deductible and usually have no growth potential, the cost of preferred stock is often quite high. Since preferred stock is an expensive source of capital, it is not one of the most popular methods for raising funds. Preferred stock was frequently issued by companies before corporate taxes became an important issue. Much of the recently issued preferred stock has been issued by utility companies that, because of governmental intervention, are able to pass on the costs to consumers. Other newly issued preferred shares have been issued by new, growing companies and banks fulfilling regulatory capital standards. These shares are often convertible into common stock.

The firm's cost of common stock (hereafter referred to as cost of equity) is determined by dividing the total income on which shareholders have a claim by the net worth of the company:

(9.4)
$$k_e = \frac{NIAT}{EQUITY} = \frac{NIAT}{E}$$

The firm's net income after taxes (NIAT) can be split into two categories: dividends and retained earnings. The firm retains earnings with the expectation that future earnings will increase and that dividend payments will be able to grow. Retained earnings presumably will be re-invested

by the firm and will result in a higher capital base and higher future earnings from which the firm may pay increased dividends. Therefore, the growth rate associated with a firm's dividend payments may be the firm's level of retained earnings divided by its equity:

(9.5) $$g = RE \div E$$

Thus, Equation (9.4) can be re-written as follows:

(9.6) $$k_e = \frac{DIV + RE}{E} = \frac{DIV}{E} + g$$

Equations (9.5) and (9.6) assume that NIAT in future periods will continue to be the same proportion of the firm's equity level. However, since the firm is retaining some of its earnings, its equity level will grow. Thus, NIAT will grow at a constant growth rate (g). Also, notice that the second part of Equation (9.6) can be derived algebraically from the growing perpetuity equation (3.12).

The firm's overall (or average) cost of capital is simply a weighted average of its component costs of capital:

(9.7) $$k_a = w_d k_d + w_{ps} k_{ps} + w_e k_e$$

where k_d, k_{ps}, and k_e are the firm's costs of debt, preferred stock and equity. The terms (w_d), (w_{ps}) and (w_e) are the proportions of the firm's total capital derived from debt, preferred stock and equity:

$$w_d = \frac{D}{D + Pfd.Equity + E}; w_{ps} = \frac{Pfd.Equity}{D + Pfd.Equity + E}; w_e = \frac{E}{D + Pfd.Equity + E}$$

Because preferred stock is prohibitively expensive for many corporations, and since it complicates much of our analysis, it will not be included in the capital structures of most of the examples presented in this chapter. Therefore, the above weights can be re-written:

(9.8) $$w_d = \frac{D}{D + E}; w_E = \frac{E}{D + E}$$

In this case, the firm's average cost of capital is rewritten:

(9.9) $$K_a = w_d k_d + w_e k_e = \frac{D}{D + E} k_d = \frac{E}{D + E} k_e$$

This average cost of capital can also be determined by summing the income available to both creditors (bondholders) and shareholders and dividing by the total amounts they have invested in the firm:

Cost of Capital

(9.10) $$k_a = \frac{NIAT + INT}{D + E} = \frac{NOI}{ASSETS}$$

The firm's financing objective will be to choose a debt- equity mix (that is, to choose appropriate w_d and w_e levels) such that its average cost of capital as measured by either Equation (9.9) or Equation (9.10) is minimized. The firm's debt-equity mix is referred to as its capital structure because it pertains to the structure of the capital side of the balance sheet. Thus, the firm's optimum debt-equity mix is its optimum capital structure.

Another way of writing the firm's cost of equity (Equation [9.4]) can be found by solving Equation (9.9) for (k_e). First, subtract (d/d+e)k_d from both sides:

(9.11) $$k_a - \frac{D}{D + E} k_d = \frac{E}{D + E} k_e$$

Then divide both sides by E/(D + E):

(9.12) $$k_a \cdot \frac{D}{D + E} k_d - \frac{D(D + E)}{E(D + E)} \cdot K_d = k_e$$

Now, simplify and reverse the sides of the equation:

(9.13) $$k_e = k_a \cdot \frac{D}{E} + k_a - \frac{D}{E} \cdot k_d$$

Simplify further:

(9.14) $$k_e = k_a + \frac{D}{E}(k_a - k_d)$$

This form of the cost of equity equation will be useful in much of the forthcoming analysis.

Marginal cost of capital is the cost to the firm of raising the next unit of money. For example, the firm's marginal cost of capital is increasing if the interest rate on its debt increases as it borrows additional funds, assuming that the firm does not sell equity. The opportunity cost of capital to the firm is the return the firm forgoes by not investing in the next best alternative project. For example, if the firm forgoes investing in marketable securities for a return of ten percent in favor of investing in a particular machine at some other return level, then the opportunity cost of capital to the firm is the foregone ten percent. Thus, the opportunity cost of capital is not necessarily how much the firm must pay for capital; it is the return the firm forgoes by not employing capital in the next best available project.

Consider the Pierce Company whose accounting statements are presented in Table 9.1. From Equations (9.1) and (9.2), we find that the firm's before and after tax costs of debt are 10% and 7.5 percent, respectively. Pierce's cost of equity is 15%, determined from either Equations (9.4) or (9.6). The growth rate associated with its dividends is simply 10% from Equation (9.5). The

company's average cost of capital is 13.33%, determined from either Equation (9.9) or (9.10).

Pierce Company Income Statement, 2004

Sales	$2,000,000
Cost of Goods Sold	500,000
Gross Margin	1,500,000
Fixed Overhead Costs	500,000
Earnings Before Interest and Taxes (EBIT)	1,000,000
Interest Payments	200,000
Earnings Before Taxes (EBT)	800,000
Taxes @ τ =.25	200,000
Net Income After Taxes (NIAT)	600,000
Dividends	200,000
Retained Earnings	400,000

Pierce Company Balance Sheet: December 31, 2014

ASSETS		CAPITAL	
Current Assets	$1,000,000	Debt	$2,000,000
Fixed Assets	5,000,000	Equity	4,000,000
Total Assets	6,000,000	Total Capital	6,000,000

Table 9.1: Pierce Company Accounting Statements

QUESTIONS AND PROBLEMS

9.1. The following are accounting statements for the Hudson Company:

Income Statement,2014		Balance Sheet, Dec.31,2014	
Sales...$500,000	ASSETS		CAPITAL
Costs....300,000			Debt.....$800,000
EBIT.....200,000			Equity.....400,000
INT.....100,000	Total		Total
EBT.....100,000	Assets..$1,200,000		Capital...1,200,000
Taxes.... 20,000			
NIAT..... 80,000			

Compute the following for the Hudson Company:
a. before-tax cost of debt
b. after-tax cost of debt
c. cost of equity
d. overall cost of capital

APPENDIX.a

A.9.a. EXTERNAL FINANCING REQUIREMENTS

Economic forces affecting firms will vary over time; consequently, firms will vary their operations. As the level of the firm's operations increase, it is likely that its level of assets will increase. For example, if a firm's sales level were to double, we might expect that the firm would need higher levels of inventories, plant, equipment and other assets to sustain this increased level of operation. An increase in the firm's level of assets will necessitate an identical change in the firm's level of capital. Thus, an increase in the firm's asset level must result in an increase in the sum of the firm's debt plus equity. If management has determined that its level of operations (sales) will increase in an upcoming year, it must first determine an appropriate investment policy. That is, management must determine how it will change each of the asset accounts listed on the firm's balance sheet. Then management must determine the total sum of capital required to support the change in the total asset level. Some of this necessary capital can be derived from internal sources such as retained earnings or current liabilities. These sources are likely to change simultaneously with the firm's level of operation and provide capital directly from the increase in the firm's level of operation. For example, an increase in the firm's sales level may result directly in an increase in the firm's level of retained earnings since revenues, variable costs and profits can be expected to increase. Furthermore, as the firm's sales level increases, it may be reasonable to anticipate an increase in the firm's number of employees, further resulting in an increase in the firm's accrued wages level. Other current liability levels are likely to increase in a similar manner. The remaining funds must be obtained through some external source such as the sale of long-term bonds or equity. In summary, the amount of money the firm must raise from external sources is determined by Equation (A.9.1):

$$\text{(A.9.1)}\quad EFN = \Delta Assets - \Delta CL - RE \quad ,$$

where:

EFN is the firm's external funding need,

Δ Assets is the anticipated change in the firm's asset level from the prior year to the year of the increased operating level,

Δ CL is the anticipated change in the firm's current liability debt level, assuming that current liabilities change spontaneously with the firm's sales level, and

RE is the firm's anticipated retained earnings level for the year of the increased level of operation.

For example, consider the Milton Company whose sales level is projected to increase by 20% in 2015 over its 2014 level of $100,000. This sales increase is projected to necessitate a 18% asset level increase in 2015 over the firm's $50,000 2014 asset level. Spontaneously changing current liabilities will increase by $3,000. Furthermore, this 2015 sales level will generate

$10,000 in Net Income After Taxes, half of which will be retained. Thus, the Milton Company must raise a total of $9,000 to support its 2015 asset level increase. Of the $9,000 total funding requirement, $8,000 will be raised through internal sources - $3,000 from the increase in current liabilities and $5,000 from the 2015 retained earnings level. Thus, from Equation (A.9.1), the firm's external funding needs are:

$$EFN = \$9,000 - \$3,000 - \$5,000 = \$1,000$$

After determining how much money to raise, management of the Milton Company must determine the most appropriate means of raising the $1,000 external funding requirement. This issue was dealt with in Chapter 9.

For a second, more complex example, consider the Washington Company whose financial statements are given in Figure A.9.1. Management is forecasting an increase in the company's sales level by 40% to $700,000. Managers predict that this 40% sales increase will increase the firm's Cost of Goods Sold level by 50% to $300,000. Fixed costs will remain constant at $100,000. The firm will continue to make the $50,000 interest payments necessary to sustain its $600,000 in bonds outstanding. Management expects the firm to remain in the 40% corporate income tax bracket and pay out one third of its earnings in dividends. In order to sustain this 40% increase in sales, management has determined that each asset account must also increase by 40%; that is, the total must increase by $400,000. Current Liabilities will also increase by 40%. The firm pays no interest on its current liabilities. Managers have already decided to sell bonds at an interest rate of ten percent to provide any external capital necessary to finance the asset level increase. Management's problem is to determine how much additional capital to raise through this ten percent bond issue. Based on this information and the company's financial statements given in Figure A.9.1, determine the Washington Company's 2015 external funding needs (EFN).

Our first problem is to complete a pro-forma income statement for 2015. However, we don't know what the company's interest expenditure in 2015 will be until we know how much money it will borrow (EFN). At the same time, we cannot determine how much money the firm needs to borrow until we know its interest expenditure (so we can solve for retained earnings). Therefore, we must solve simultaneously for EFN and interest expenditure. We can do so by setting up an appropriate format for the 2015 pro-forma income statement (see Figure A.9.2).

We know from Equation (A.9.1) that EFN can be found given the results of Figure A.9.2 as follows:

(A.9.1) $EFN = \Delta Assets - \Delta CL - RE$

$$EFN = \$400,000 - \$60,000 - RE$$

$$EFN = \$400,000 - \$60,000 - (\$100,000 - (.04 * EFN))$$

$$EFN = \$240,000 + .04\ EFN$$

$$.96\ EFN = \$240,000$$

Cost of Capital

EFN = $250,000

Our EFN problem is complete. We now know that the firm must borrow $250,000. Thus, the firm's total interest payments for 2015 must be $50,000 plus ten percent of $250,000, or $75,000.

FIGURE A.9.1: WASHINGTON COMPANY FINANCIAL STATEMENTS

Income Statement, 2014		**Pro-forma Income Statement, 2015**	
Sales (TR)	$500,000	Sales (TR)	$700,000
Cost of Goods Sold	200,000	Cost of Goods Sold	300,000
Gross Margin	300,000	Gross Margin	400,000
Fixed Costs	100,000	Fixed Costs	100,000
EBIT	200,000	EBIT	300,000
Interest Payments	50,000	Interest Payments	_____
Earnings Before Taxes	150,000	Earnings Before Taxes	
Taxes (@ 40%)	60,000	Taxes (@ 40%)	_____
Net Income After Tax	90,000	Net Income After Taxes	
Dividends (@ 33%)	30,000	Dividends (@ 33%)	_____
Retained Earnings	60,000	Retained Earnings	

Balance Sheet, December 31, 2014

ASSETS		**LIABILITIES AND EQUITY**	
Cash	$100,000	Accounts Payable	$100,000
Accounts Receivable	100,000	Accrued Wages	50,000
Inventory	100,000	Current Liabilities	150,000
Current Assets	300,000	Bonds Payable	600,000
Plant and Equipment	700,000	Equity	250,000
Total Assets	1,000,000	Total Capital	1,000,000

Pro-Forma Balance Sheet, December 31, 2015

ASSETS		**LIABILITIES AND EQUITY**	
Cash	$140,000	Accounts Payable	$140,000
Accounts Receivable	140,000	Accrued Wages	70,000
Inventory	140,000	Current Liabilities	210,000
Current Assets	420,000	Bonds Payable	
Plant and Equipment	980,000	Equity	_____
Total Assets	1,400,000	Total Capital	1,400,000

FIGURE A.9.2: WASHINGTON COMPANY PRO-FORMA INCOME STATEMENT

Pro-forma Income Statement, 2005

Sales (TR)	$500,000
Cost of Goods Sold	300,000
Gross Margin	400,000
Fixed Costs	100,000
EBIT	300,000
Interest Payments	50,000 + (.10 * EFN)
Earnings Before Taxes	250,000 - (.10 * EFN)
Taxes (@ 40%)	100,000 - (.04 * EFN)
Net Income After Taxes	150,000 - (.06 * EFN)
Dividends (@ 33%)	50,000 - (.02 * EFN)
Retained Earnings	100,000 - (.04 * EFN)