

WEIGHTED AVERAGE COST OF CAPITAL

- Once we have computed the costs of the individual components of the firm's financing, we would assign weight to each financing source according to some standard and then calculate a weight average cost of capital (WACC)
- Financial analysts frequently focus on a firm's total capitalization, which is the sum of its long-term debt of equity (capital structure) or mix of long-term sources of funds used by the firm.
- It is also referred to as firm's capitalization. It includes: bonds, common stock and preference shares.
- To estimate the weighted average cost of capital, we need to know the cost of each of the sources of capital used and the capital structure mix.
- To calculate weighted average cost of capital (WACC) that uses debt and common stock.
- Cost of Capital= $K_i(w_i) + K_p(w_p) + K_e(w_e)$

$$\text{WACC} = \left[\begin{array}{l} \text{after tax cost of} \\ \text{Debt} \end{array} \times \begin{array}{l} \text{Proportion of} \\ \text{debt financing} \end{array} + \begin{array}{l} \text{Cost of} \\ \text{equity} \end{array} \times \begin{array}{l} \text{proportion of} \\ \text{equity financing} \end{array} \right]$$

Example

Assume a firm borrows money at 6 percent after-taxes, pays 10 percent for equity, and raises its capital in equal proportions from debt and equity.

Calculate its WACC.

$$\text{WACC} = (0.06 \times 0.5) + (0.10 \times 0.5) = 0.08 = 8\%$$

CAPITAL STRUCTURE WEIGHT

- The cost of capital should reflect the riskiness of the project being evaluated.
- Thus a firm should calculate multiple costs of capital when it makes investments in multiple division or business units having different risk characteristics.
- In this regard, for the calculated cost of capital to be meaningful, it must correspond directly to the riskiness of the particular project being analyzed.
- In theory, the cost of capital should reflect the particular being in which the funds are raised and the systematic risk characteristics of the project.
- In practice however, the mixture of financing sources used by a firm will vary from year to year.
- Hence many firms find it expedient to use target capital structure proportions when calculating the firms weighted average cost of capital.
- For example, a firm may use its target mix of 40 percent debt and 60 percent equity to calculate its weighted average cost of capital even though, in that particular year, it raised the majority of its financing requirement by borrowing.
- Similarly, it might use the target proportion in the subsequent year when majority of its financing needs is obtained by its re-investment earnings or issuing new stock.
- The critical assumption in any weighting system is that the firm will in fact raise capital in the proportions specified
- Firms raise capital marginally (incremental) to make marginal investments in new projects.
- Thus, marginal cost of the capital (incremental) is used for the whole firm rather than using all the capital of the firm in general

CALCULATING THE WACC

<i>Source of capital</i>	<i>Weight</i>	<i>Cost of capital</i>	<i>= Products</i>
Bonds	W_d	$K_d (1-K_c)$	$W_d \times K_d(1-t_c)$
Preferred stock	W_{ps}	K_{ps}	$W_{ps} \times K_{ps}$
Common stock	W_{cs}	K_{cs}	$W_{cs} \times K_{cs}$
	Sum = 100%		Sum = K_{Wacc}

Example

In the fall of 2009, Grey manufacturing was considering a major expansion of its manufacturing operations. The firm has sufficient land to accommodate the doubling of its operations, which will cost \$ 200 million. To raise the needed funds, Grey's management has decided to simply mimic the firm's present capital structure as follows:

Source of capital	Amount of fund raised	% of total	After tax-cost of capital
Debt	\$ 80,000,000	40%	5.20%
Common stock	<u>\$ 120,000,000</u>	<u>60%</u>	14.5%
Total	\$ 200,000,000	100%	

Required

Calculate your estimates of Gray's weighted average cost of capital.

Solution

Source of capital	% of total capital	after-tax cost of capital	product
Debt	40%	5.2%	2.0800%
Common stock	<u>60%</u>	14.5%	<u>8.7000%</u>
	100%		WACC = 10.780%

Total WACC is 10.78%

Example 2

Suppose that the firm had the following financing at the latest balance sheet statement date, where the amount shown in the table below represents market values.

	AMOUNT OF FINANCING	PROPORTION OF TOTAL FINANCING
Debt	\$30million	30%
Preferred stock	10 million	10
Common stock equity	<u>60 million</u>	<u>60</u>
	100 million	100%

Suppose that the firm computed the following after-tax costs for the component sources of financing.

	<u>COST</u>
Debt	6.6%
Preferred stock	10.2%
<u>Common stock</u>	<u>14.0 %</u>

Required

Compute the firm WACC.

SOLVING

	<u>1</u>	<u>2</u>	<u>1X2</u>
	<u>COST</u>	<u>PROPORTION OF TOTAL FINANCING</u>	<u>WEIGHTED COST</u>
Debt	6.6%	30%	1.98%
Preferred stock	10.2	10	1.02
Common stock	<u>14.0</u>	<u>60</u>	<u>8.4</u>
		<u>100%</u>	<u>11.4%</u>

Hence, WACC is equal to 11.4 %

Example 3

The capital structure for the Carion Corporation is provided here. The company plans to maintain its debt structure in the future. If the firm has a 5.5 percent after-tax cost of debt, a 13.5 percent cost of preferred stock, and an 18 percent cost of common stock, what is the firm's weighted average cost of capital?

CAPITAL STRUCTURE (\$000)

Bonds	\$12,980
Preferred stock	2680
Common stock	<u>46,810</u>
	\$62,470

Table 9.7 A Summary of Cost of Capital Formulas

1. The After-Tax Cost of Debt, $K_d(1-T_c)$

a) Calculate the before-tax cost of debt, K_d , as follows:

$$\text{Net proceeds (NPd)} = \frac{\text{interest (year 1)}}{(1 + \text{cost of debt capital } (K_d))^1} + \frac{\text{interest (year 2)}}{(1 + K_d)^2} + \frac{\text{principal}}{(1 + K_d)^2}$$

b) Calculate the after-tax cost of debt as follows:

$$\text{After-tax cost of debt} = K_d(1-T_c)$$

Where T_c is the corporate tax rate.

1. The Cost of Preferred Stock, K_{ps}

$$K_{ps} = \frac{\text{preferred stock dividend}}{\text{net proceeds per share of preferred stock (NP ps)}}$$

Where NP_{ps} is the net proceeds per share of new preferred stock sold after flotation costs.

2. The Cost of Common Equity

a) Method 1: dividend growth model

Calculate the cost of internal common equity (retained earnings), K_{cs} , as follows:

$$K_{cs} = \frac{D_1}{P_{cs}} + g$$

Where D_1 is the expected dividend for the next year, P_{cs} is the current price of the firm's common stock, and g is the rate of growth in dividends per year.

Calculate the cost of external common equity (new stock offering), K_{ncs} , as follows:

$$K_{ncs} = \frac{D_1}{NPcs} + g$$

Where $NPcs$ is the net proceeds to the firms after flotation costs per share of stock sold.

b) Method 2: capital asset pricing model, K_c

$$K_c = r_f + \beta(r_m - r_f)$$

Where the risk-free rate is K_{rf} ; the systematic risk of the common stock's returns relative to the market as a whole, or the stock's beta coefficient, is β ; and the market-risk premium, which is equal to the difference in the expected rate of return for the market as a whole (i.e., the expected rate of return for the "average security") minus the risk-free rate, is $K_m - K_{rf}$.

3. The Weighted Average Cost of Capital

$$\text{Weighted Average cost of capital} = \left(\begin{array}{cc} \text{after-tax} & \text{proportion} \\ \text{cost of} & \text{of debt} \\ \text{debt} & \text{financing} \end{array} \right) \times + \left(\begin{array}{cc} & \text{proportion} \\ \text{cost of} & \text{of equity} \\ \text{equity} & \text{financing} \end{array} \right)$$

Note that we are simply calculating a weighted average of the costs of each of the firm's sources of capital where the weights reflect the firm's relative use of each source.

Rationale for a Weighted Average Cost

The rationale behind the use of a weighted average cost of capital is that, by financing in the proportions specified and accepting projects yielding more than the weighted average required return, the firm is able to increase the market price of its stock.

This increase occurs because investment projects are expected to return more on their equity-financed portions than the required return on equity capital, K_e .

Once this is apparent to the marketplace, the market price of the firm's stock should rise, all other things held constant.

OPTIMAL CAPITAL STRUCTURE (Under the Trade-off View)

GLOSSARY

Equity: For corporations, this is just another name for common stock. Equity is the amount of money that the stockholders or owners have invested in the company.

Capital structure: A company's ratio of long-term debt to equity.

Optimal Capital Structure: A "best" debt/equity ratio for a company. This is the debt/equity ratio that will minimize the cost of capital, i.e. the cost of financing the company's operations.

Trade-off Theory: The managers of a company should find a debt/equity ratio that balances the risk of bankruptcy (i.e. a high ratio) with the risk of using too little of the cheapest form of financing (i.e. a low ratio. The after-tax cost of debt will always be lower than the cost of financing with equity.)

Following **Modigliani and Miller's pioneering work** on capital structure; we are left with the question, "Is there such a thing as an optimal capital structure for a company? In other words, is there a **best** way to finance the company: an optimal debt/equity ratio?"

According to the **trade-off theory**, the answer is yes – in fact, you might even say that there is an optimal range. There is a specific debt/equity ratio that will minimize a company's cost of capital. (This is also the point at which the value of the company will be maximized.)

However, because the cost of capital curve is fairly shallow (like the bottom of a bowl), you can deviate from this optimal debt/equity ratio without appreciably increasing the cost of capital.

This creates a range in the bottom portion of the curve where the cost of capital is essentially the same throughout the range.

There is a danger of getting outside of this range however. The cost of capital will increase rapidly once you get outside the range, as shown by the **blue Average Cost of Capital** line in the graph below.

The Trade-off View of the Cost of Capital

EXPLAIN GRAPH

A company's overall cost of capital is a weighted average of the cost of debt and the cost of equity. For example, if a company's debt/equity ratio is 30/70 and the after-tax cost of debt is 4% and the cost of equity is 10.5%, the company's overall cost of capital is $0.30 * 4\%$ plus $0.70 * 10.5\%$, or 8.55%.

Let's take a company from its inception:

1. When a company is new, it will likely be financed entirely with equity, so its average cost of capital is the same as its cost of equity (10% in the graph above for a 0/100 debt/equity ratio).

2. As the company grows, it establishes a track record and attracts the confidence of lenders. As the company increases its use of debt, the company's debt/equity ratio increases and the average cost of capital decreases. In essence, the company is substituting the cheaper debt for the more expensive equity, thereby decreasing its overall cost. (It might be useful to think of the company borrowing money, then using that borrowed money to buy back some of its common stock. The debt goes up, the equity goes down, and the company's average cost of capital decreases because the company has substituted the cheaper debt for the more expensive equity).
3. Eventually, as the company's debt/equity ratio increases, the cost of debt and the cost of equity will increase. Lenders will become more concerned about the risk of the loan and will increase the interest rate on its loans. Common shareholders will become more concerned about default on the loans (and, in bankruptcy, losing all of their investment) and will insist on receiving a higher rate of return to compensate them for the higher risk. Since both the cost of debt and equity increases, the average cost of capital will also increase.
4. This results in a minimum point on the cost of capital curve. However, the curve (for most industries) is relatively shallow. This means that the financial manager has considerable flexibility in choosing a debt/equity ratio. He or she wants to move to the shallow portion of the curve and, once there, remain there. However, there is a range of debt/equity ratios that will allow the company to stay in this shallow portion of the curve.

Just remember that there is a danger in getting outside of this range.

- If you move too far to the left-hand side of the curve, you are paying too much to raise money – you would be better off borrowing money (at a relatively low after – tax

interest rate) and buying back some of the more expensive equity. (The cost of financing with debt is always considering lower than financing with equity.)

- If you move too far the right-hand side of the curve, you are paying too much to raise money – lenders and stockholders perceive your company as being too risky. You should either pay down the debt or issue new equity in the next round of financing in order to reduce the risk and to move back into the shallow portion of the curve.

Pecking Order Theory

There is a competing theory to the trade-off view. It is based more on observations of how managers take short-cuts rather than a repudiation of the trade-off view. The pecking order theory says that companies tend to finance investments with internal funds when possible and also issue debt whenever possible. Since internal funds (profits that are retained in the company) are a form of equity and have a very high cost, managers are obviously not always following the recommendations of the trade-off view.

The pecking order theory says that companies finance investments by raising funds in this order:

- (1) Internal funds (retained earnings)
- (2) Debt
- (3) Sale of new common stock (the most expensive form of financing).

Much of this may have to do with convenience – the pecking order corresponds to the easiest and most convenient ways to raise money.

Although a bit dated, an excellent description of capital structure (and capital budgeting), as practiced by corporate managers, may be found in this [Duke University article](#) (in pdf format).

