



The Cost of Capital

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Learning Goals

Understand the key assumptions, the basic concept, and the specific sources of capital associated with the cost of capital

Determine the cost of long-term debt and the cost of preferred stock

Calculate the cost of common stock equity and convert it into the cost of retained earnings and the cost of new common stock





Learning Goals

Calculate the weighted average cost of capital (WACC) and discuss weighing alternative schemes.

Describe the procedures used to determine break points and the weighted marginal cost of capital (WMCC)

Explain the WMCC and its use with the investment opportunities schedule (IOS) to make financing investment decisions.





Overview

Cost of Capital

Cost of capital

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





Key Assumptions

Business Risk

The risk to the firm of being unable to cover operating costs-is assumed unchanged

Financial Risk

The risk to the firm of being unable to cover required financial obligations – is assumed to be unchanged

After-tax costs are considered relevant

The cost of capital is measured on an after-tax basis.





Sample Problem

A firm is currently faced with an investment opportunity.

Best project available today

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%.

Best project 1 week later

Cost = \$100,000

Life = 20 years

IRR = 12%

Cost of least-cost financing source available

Debt = 14%

Decision:

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





Sample Problem

Question?

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

The answer is.....

NO. It accepted a project yielding a 7% return and rejected one with a 12% return.





Sample Problem

Clearly, there should be a better way, and there is:

The firm can use a combined cost, which over the long run will yield better decisions.

By weighting the cost of each source of financing by its *target proportion* in the firm's capital structure, the firm can obtain a *weighted average cost* that reflects the interrelationship of financing decisions.





Sample Problem

Assuming that a 50-50 mix of debt and equity is targeted,

the weighted average cost here would be
10% $((0.5 \times 6\% \text{ debt}) + (0.50 \times 14\% \text{ equity}))$

With this cost,

**the first opportunity would have been rejected
(7% IRR < 10% weighted average cost)**

**The second would have been accepted
(12% IRR > 10% weighted average cost)**

Such as an outcome would clearly be more desirable.






Specific Sources of Capital

Basic sources of long-term funds for the business firm:

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





Cost of Long-Term Debt

Cost of long-term debt (r_i)

The after-tax cost today of raising long-term funds through borrowing.

- Net Proceeds
- Before-Tax Cost of Debt
- After-Tax Cost of Debt





Net Proceeds

Net proceeds

funds actually received from the sale of security

Floataction costs

the total costs of issuing and selling a security-reduce the net proceeds from the sale.

These costs apply to all public offerings of securities – debt, preferred stock, and common stock.

(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





Net Proceeds..example

Duchess Corp., a major hardware manufacturer, is contemplating selling \$10 million worth of 20-year, 9% coupon (stated annual interest rate) bonds, each with a par value of \$1,000. Because similar risk bonds earn returns greater than 9%, the firm must sell the bonds for \$980 to compensate for the lower coupon interest rate. The floatation costs are 2% of the par value of the bond ($0.02 \times \$1,000$), or \$20.

Then the ***net proceeds*** to the firm from the sale of each bond are therefore \$960 (\$980-\$20).



Before-Tax Cost of Debt

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

Using Cost Quotations

When the net proceeds from sale of a bond equal its par value, the before-tax cost just equals the coupon interest rate .

A bond with a 10% coupon interest rate that nets proceeds equal to the bond's \$1,000 par value would have a before-tax cost, r_d , of 10%.

Calculating the Cost

This approach finds the before-tax cost of debt by calculating the IRR on the bond cash flows. This value is the cost to maturity of the cash flows associated with the debt.

Calculated by: Financial calculator, an electronic calculator, or trial-and-error technique. It represents the annual before-tax percentages cost of the debt.

Approximating the Cost

Can be calculated using the formula

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

Where:

I = annual interest

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

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

Before-Tax Cost of Debt..example

Calculating the Cost

In the preceding example, the net proceeds of a \$1,000, 9% coupon interest rate, 20-year bond were found to be \$960. The calculation of the annual cost is quite simple. The cash flow pattern is exactly the opposite of a conventional pattern; it consists of an initial inflow (the net proceeds) followed by a series of annual outlays (the interest payments). In the final year, when the debt is retired, an outlay representing the repayment of the principal also occurs. The cash flows associated with Duchess Corp.'s bond issue are as follows;

End of year (s)	Cash Flow	
0	\$960	(\$980-\$20)
1-20	- \$90	9% coupon int. rate X \$1,000 par value
20	-\$1000	(repayment of the principal)

Spreadsheet Analysis





Before-Tax Cost of Debt..example

Approximating the Cost

The before-tax cost of debt, r_d , for a bond with a \$1,000 par value can be approximated by using the following equation:

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

Where:

I = annual interest

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

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

By substituting the values, this approximate before-tax cost of debt is 9.4% which is close to 9.452 value calculated precisely in the preceding example

After-Tax Cost of Debt

Cost of Capital

The specific cost of financing must be stated on an after-tax basis. Because interest on debt is tax deductible, it reduces the firm's taxable income.

The after-tax cost of debt, r_i , can be found by:

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






After-Tax Cost of Debt..example



Duchess Corp. has a 40% tax rate . Using the 9.4 before-tax debt cost calculated, and using the equation $r_i = r_d \times (1 - T)$, we find an after-tax cost of debt of 5.6% (9.4% X (1-0.40)).

Typically, the cost of long-term debt is less than a given firm's cost of any of the alternative forms of long-term financing, primarily because of the tax deductibility of interest.



Cost of Preferred Stock

Preferred stock represents a special type of ownership interest in the firm. It gives preferred stockholders the right to receive their stated dividends before the firm can distribute any earnings to common stockholders.

Because the preferred stock is a form of ownership, the proceeds from its sale are expected to be held for an infinite period of time.





Cost of Preferred Stock

Calculating the Cost of Preferred Stock

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 the preferred stock. The net proceeds represent the amount of money to be received minus any floatation costs

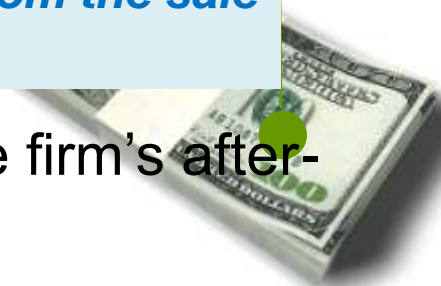
$$r_p = D_p / N_p$$

Where:

D_p = Annual dollar dividend

N_p = Net proceeds from the sale of the stock

Because preferred stock dividends are paid out of the firm's after-tax cash flows, a tax adjustment is not required.



Cost of Preferred Stock..example

Duchess Corp. is contemplating issuance of a 10% preferred stock that is expected to sell for its \$87-per-share par value. The cost of issuing and selling the stock is expected to be \$5 per share. Find the cost of the stock.

Solution:

- 1) Calculate the dollar amount of the annual preferred dividend $D_p = \$8.70 = (0.10 \times \$87)$
- 2) The net proceeds per share from the proposed sale of stock equals the sale price minus the floatation costs
 $N_p = \$82 = \$87 - \$5$
- 3) Substituting the values in the formula,
 $r_p = 10.6\% = \$8.70/\82





Cost of Common Stock

The **cost of preferred stock** is the return required on the stock by investors in the marketplace.

2 Forms of common stock financing

Retained Earnings

New issues of
common stock





Cost of Common Stock

Finding the Cost of Common Stock Equity

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.

Two techniques are used for its measurement:

- (1) Constant-growth valuation model
- (2) Capital Asset Pricing Model (CAPM)





Cost of Common Stock

Using the Constant-Growth Valuation (Gordon) Model

Constant-growth valuation or gordon 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 is expected to provide over an infinite time horizon.

$$P_0 = D_1 / (r_s - g)$$



$$r_s = (D_1 / P_0) + g$$

Where:

P_0 = value of common stock

D_1 = per-share dividend expected at the end of year 1

r_s = required return on common stock (cost of common stock equity)

g = constant rate of growth in dividends





Cost of Common Stock

Using the Capital Asset Pricing Model (CAPM)

CAPM— describes the relationship between the required return, r_s , and the non-diversifiable risk of the firm as measure by the beta coefficient, b .

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

Where:

R_F = risk-free rate of return

r_m = market rate return; return on the market portfolio of assets

Using CAPM indicates that the cost of common stock equity is the return required by investors as compensation for the firm's non-diversifiable risk, measured by beta.





Cost of Common Stock

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 .

Cost of New Issues of Common Stock (r_n)

The cost of common stock, net of under-pricing and associated floatation costs.

Underpriced – stock sold at a price below its current market price, P_0

$$r_n = (D_1/N_n) + g$$

Where:

N_n = net proceeds from sale of new common stock

D_1 = per-share dividend expected at the end of year 1

g = constant rate of growth in dividends





Weighted Average Cost of Capital



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





Weighted Average Cost of Capital

Calculating Weighted Average Cost of Capital (WACC)

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

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

$w_i + w_p + w_s = 1.0$

r_i = cost of debt

r_p = cost of preferred stock

r_r = cost or retained earnings

r_n = cost of new common stock



Weighted Average Cost of Capital..example

The company uses the ff. weights in calculating its weighted average cost of capital:



Source of capital	Weight
Long-term debt	40%
Preferred stock	10
Common stock equity	50
Total	100%

Costs of the various types of capital for Duchess Corp.:

Cost of debt, $r_i = 5.6\%$

Cost of preferred stock, $r_p = 10.6\%$

Cost of retained earnings, $r_r = 13.0\%$

Cost of new common stock, $r_n = 14.0\%$

Source of capital	Weight	Cost	Weighted Cost
Long-term debt	0.40	5.6%	2.2%
Preferred stock	0.10	10.6	1.1
Common stock equity	<u>0.50</u>	13.0	<u>6.5</u>
Totals	1.0		9.8%

Weighted average cost of capital = 9.8%

Assuming an unchanged risk level, the firm should accept all projects that will earn a return greater than 9.8%.



Weighted Average Cost of Capital

Weighting Schemes

Book Value Vs. Market Value

- **Book value weights** use accounting values to measure the proportion of each type of capital in the firm's financial structure while **market value weights** measure the proportion of each type of capital at its market value.
- **Market value weights** are appealing, because the market values of securities closely approximate the actual dollars to be received from their sale.
- **Market value weights** are clearly preferred over **book value weights**





Weighted Average Cost of Capital

Weighting Schemes

Historical Vs. Target

- **Historical weights** can be either book or market value weights based on *actual* capital structure proportions while **target weights**, which can also be based on either book or market values, reflect the firm's desired capital structure proportions.
- The preferred weighing scheme is **target market value** proportions.





Weighted Average Cost of Capital..example

Chuck Solis currently has 3 loans outstanding, all of which mature in exactly 6 yrs and can be repaid w/o penalty any time prior to maturity. The outstanding balances and annual interest rates on these loans are noted below.

Loan	Outstanding balance	Annual interest rate
1	\$26,000	9.6%
2	9,000	10.6
3	45,000	7.4

After a thorough search, Chuck found a lender who would lend him \$80,000 for 6 yrs at annual interest rate 9.2% on the condition that the loan proceeds be used to fully pay the 3 outstanding loans, which combined have an outstanding balance of \$80,000.





Weighted Average Cost of Capital..example

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Chuck wishes to choose the less costly alternative: (1) do nothing or (2) borrow the \$80,000 and pay off all three loans.





Weighted Average Cost of Capital..example

ANALYSIS:

Calculates the weighted average cost of Chuck's current debt by weighing each debt's annual interest cost by the proportion of the \$80,000 total it represents and summing the 3 weighted values.

Using the formula, the weighted average cost of current debt is,


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

$$(\$26,000/\$80,000/9.6\%) + (\$9,000/\$80,000 \times 10.6\%) + (\$45,000/\$80,000, 7.4\%)$$

$$r_a = (0.3250/9.6\%) + (0.1125/\$80,000 \times 10.6\%) + (0.5625/\$80,000, 7.4\%)$$

$$r_a = 3.12\% + 1.19\% + 4.16\% = \underline{\underline{8.5\%}}$$

Given that the weighted ave. cost of the \$80,000 of current debt of 8.5% is below the 9.2% cost of the new \$80,000 loan, Chuck should do nothing, and just continue to pay off the 3 loans as originally scheduled .





Marginal Cost and Investment Decisions

Weighted Marginal Cost of Capital (WMCC)

WMCC– the firm's weighted average cost of capital (WACC) associated with its next dollar of total new financing.

How to calculate WMCC?

1. Calculate **break points**, which reflect the level of total new financing at which the cost of one of the financing component arises.

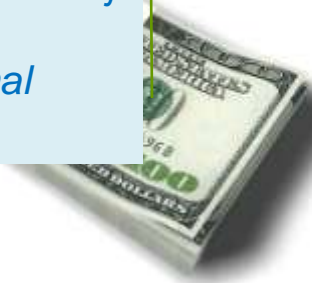
$$BP_j = AF_j / W_j$$

Where:

BP_j = break-point for financing source j

AF_j = amt of funds available from financing source j at a given cost

W_j = capital structure weight (stated in decimal form) for financing sources





Marginal Cost and Investment Decisions

How to calculate WMCC.....?

2. Calculate **WACC**, for a level of total new financing bet. break points.

- First, we find the WACC for a level of total new financing bet. Zero and the first break point.
- Second, we find the WACC for a level of total new financing bet. the first and second break points, and so on.

3. Together, the data computed above can be used to prepare a weighted marginal cost of capital (WACC) schedule. This graph relates the firm's weighted average cost of capital to the level of total new financing.





Marginal Cost and Investment Decisions..example

Problem: When Duchess Corp. exhausts its \$300,000 of available retained earnings (at $r_r=13\%$), it must use the more expensive new common stock financing (at $r_n=14\%$) to meet its common stock equity needs. In addition, the firm expects that it can borrow only \$400,000 of debt at the 5.6% costs; additional debt will have an after-tax cost (r_i) of 8.4%.

Analysis: 2 break points therefore exists: (1) when the \$300,000 of retained earnings costing 13% is exhausted, (2) when the \$400,000 of a long-term debt costing 5.6% is exhausted.

Using the formula, $BP_j = AF_j / W_j$

$$\begin{aligned} BP_{\text{common equity}} &= \$300,000 / 0.5 \\ &= \$600,000 \end{aligned}$$

$$\begin{aligned} BP_{\text{long-term debt}} &= \$400,000 / 0.4 \\ &= \$1,000,000 \end{aligned}$$



Marginal Cost and Investment Decisions..example

Analysis...cont

Computing for the WACC:

Range of total new financing	Source of capital	Weight	Cost	Weighted Cost
\$ 0 to \$600,000	Debt	0.4	5.6%	2.2%
	Preferred	0.1	10.6	1.1
	Common	0.5	13.0	<u>6.5</u>
			WACC	9.8%
\$600,000 to \$1,000,000	Debt	0.4	5.6%	2.2%
	Preferred	0.1	10.6	1.1
	Common	0.5	14.0	<u>7.0</u>
			WACC	10.3%
\$ 1,000,000 and above	Debt	0.4	8.4%	3.4%
	Preferred	0.1	10.6%	1.1
	Common	0.5	14.0	<u>7.0</u>
			WACC	11.5%



Marginal Cost and Investment Decisions

Investment Opportunities Schedule (IOS)

IOS— is a ranking of investment possibilities from best (higher return) to worst (lower return).

The first project will have the highest return, the next project the second highest, and so on.





Marginal Cost and Investment Decisions

Using the WMCC and IOS to Make Financing/Investment Decisions

- As long as a project's $IRR > \text{weighted marginal cost of new financing}$, the firm should accept the project
- The return will decrease with the acceptance of more projects, and the WMCC will increase because greater amounts of financing will be required.

[See spreadsheets](#)

Decision Rule: Accept projects up to the point at which the marginal return on an investment equals its weighted marginal cost of capital. Beyond this point, its investment return will be less than its capital cost.





Questions???

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