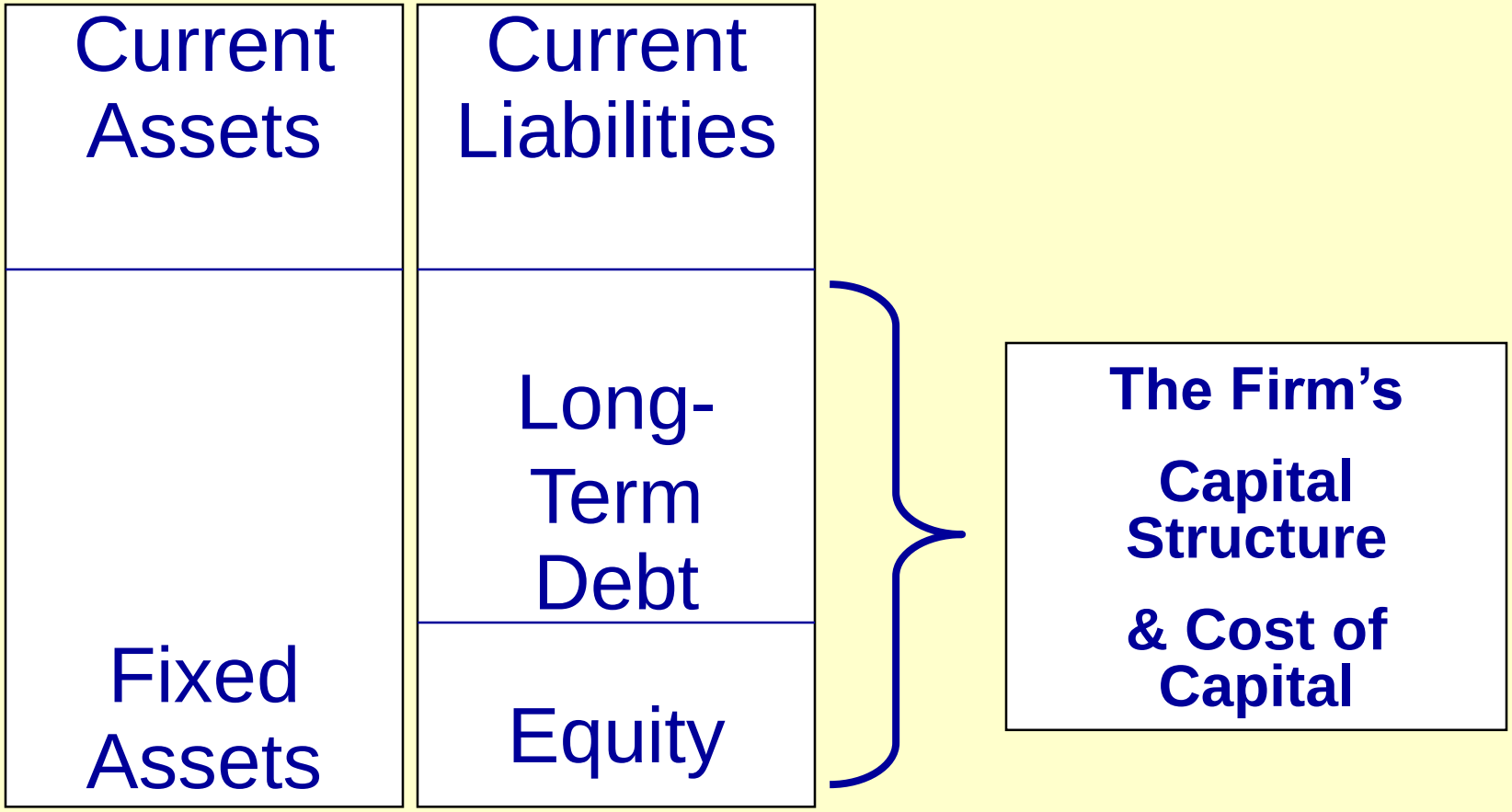
The Cost of Capital

The Firm's Capital Structure



The Basic Concept

- Why do we need to determine a company's overall "weighted average cost of capital?"

Assume the ABC company has the following investment opportunity:

- Initial Investment = $100,000

- Useful Life = 20 years

- IRR = 7%

- Least cost source of financing, Debt = 6%

Given the above information, a firm's financial manger would be inclined to accept and undertake the investment.

The Basic Concept

- Why do we need to determine a company's overall "weighted average cost of capital?"

Imagine now that only one week later, the firm has another available investment opportunity

- Initial Investment = $100,000

- Useful Life = 20 years

- IRR = 12%

- Least cost source of financing, Equity = 14%

Given the above information, the firm would reject this second, yet clearly more desirable investment opportunity.

The Basic Concept

- Why do we need to determine a company's overall "weighted average cost of capital?"
- As the above simple example clearly illustrates, using this piecemeal approach to evaluate investment opportunities is clearly 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).

The Cost of Specific Sources of Capital

The After-Tax Cost of Debt (k_d)

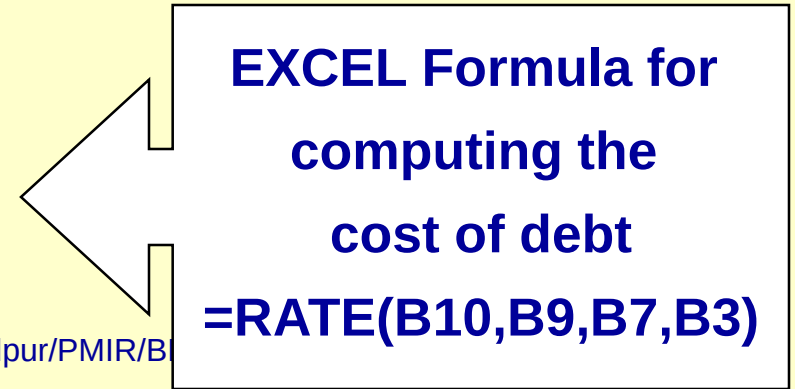
- The pretax cost of debt is equal to the the yield-to-maturity on the firm's debt adjusted for flotation costs.
- Recall that a bond's yield-to-maturity depends upon a number of factors including the bond's coupon rate, maturity date, par value, current market conditions, and selling price.
- After obtaining the bond's yield, a simple adjustment must be made to account for the fact that interest is a tax-deductible expense.
- This will have the effect of reducing the cost of debt.

The Cost of Specific Sources of Capital

The After-Tax Cost of Debt (k_d)

Suppose a company could issue 9% coupon, 20 year debt with a face value of $1,000 for $980. Suppose further that flotation costs will amount to 2% of par value. Find the before-tax cost of debt.

Finding the Cost of Debt	
Par Value	$ (1,000.00)
Flotation Costs (% of Par)	2.00%
Flotation Costs ($)	$ (20.00)
Issue Price	$ 980.00
Net Proceeds Price	$ 960.00
Coupon Interest (%)	9.00%
Coupon Interest ($)	$ (90.00)
Time to maturity	20
Before-tax cost of debt	9.45%



The Cost of Specific Sources of Capital

The After-Tax Cost of Debt (k_d)

$$K_d = YTM (1-t)$$

Find the after-tax cost of debt assuming the company in the previous example is in the 40% tax bracket:

$$k_d = 9.45\% (1-.40) = 5.67\%$$

This suggests that the after-tax cost of raising debt capital is 5.67%.

The Cost of Specific Sources of Capital

The Cost of Preferred Stock (k_p)

$$K_P = D_P/(P_P - F)$$

In the above equation, "F" represents flotation costs (in $). As was the case for debt, the cost of raising new preferred stock will be more than the yield on the firm's existing preferred stock since the firm must pay investment bankers to sell (or float) the issue.

The Cost of Specific Sources of Capital

The Cost of Preferred Stock (k_p)

$$K_P = D_P/(P_P - F)$$

For example, if a company could issue preferred stock that pays a $5 annual dividend, sell it for $55 per share, and have to pay $3 per share to sell it, the cost of preferred stock would be:

$$k_P = \$5/(\$55 - \$3) = 9.62\%$$

The Cost of Specific Sources of Capital

The Cost of Common Equity

- There are two forms of common stock financing: retained earnings and new issues of common stock.
- In addition, there are two different ways to estimate the cost of common equity: any form of the dividend valuation model, and the capital asset pricing model (CAPM).
- The dividend valuation models are based on the premise that the value of a share of stock is based on the present value of all future dividends.

The Cost of Specific Sources of Capital

The Cost of Common Equity

- Using the constant growth model, we have:

$$k_R = (D_1/P_0) + g.$$

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

$$k_S = r_F + b(k_M - r_F).$$

- The CAPM differs from dividend valuation models in that it explicitly considers the firm's risk as reflected in beta.

The Cost of Specific Sources of Capital

The Cost of Common Equity

- On the other hand, dividend valuation models do not explicitly consider risk.
- These models use the market price (P0) as a reflection of the expected risk-return preference of investors in the marketplace.
- Usually, the CAPM model is preferred to compute the cost of equity (over the dividend valuation approach)

The Cost of Specific Sources of Capital

The Cost of Common Equity

- The two methods also differ in that the dividend valuation models (unlike the CAPM) can easily be adjusted for flotation costs when estimating the cost of new equity.
- This will be demonstrated in the examples that follow.

The Cost of Specific Sources of Capital

The Cost of Common Equity

Cost of Retained Earnings (k_S)

Security Market Line Approach

$$k_S = r_F + b(k_M - r_F).$$

For example, if the 3-month T-bill rate is currently 5.0%, the market risk premium is 9%, and the firm's beta is 1.20, the firm's cost of retained earnings will be:

$$k_S = 5.0 + 1.2(9) = 15.8\%.$$

The Cost of Specific Sources of Capital

The Cost of Common Equity

Cost of Retained Earnings (k_R)

Constant Dividend Growth Model

$$k_R = (D_1/P_0) + g.$$

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 per share.

First, $D_1 = 2.50(1+.10) = 2.75$, and

$k_R = (2.75/50) + .10 = 15.5\%$.

The Cost of Specific Sources of Capital

The Cost of Common Equity

Cost of Retained Earnings (K_R)

The previous example indicates that our estimate of the cost of retained earnings is somewhere between 15.5% and 15.8%. Using some managerial judgement and preferring to err on the high side, we will use 15.8% as our final estimate of the cost of retained earnings.

The Cost of Specific Sources of Capital

The Cost of Common Equity

Cost of New Equity (K_n)

Constant Dividend Growth Model

$$K_n = [D_1/(P_0 - F)] + g.$$

Continuing with the previous example, how much would it cost the firm to raise new equity if flotation costs amount to $4.00 per share?

$$K_n = [2.75/(50 - 4)] + .10 = 15.97\% \text{ or } 16\%.$$

The Weighted Average Cost of Capital

$$WACC = w_i k_i + w_p k_p + w_s k_s$$

Capital Structure Weights

The weights in the above equation are intended to represent a specific financing mix (where w_i = % of debt, w_p = % of preferred, and w_s = % of common).

Specifically, these weights are the target percentages of debt and equity that will minimize the firm's overall cost of raising funds.

The Weighted Average Cost of Capital

$$WACC = w_i k_i + w_p k_p + w_s k_s$$

Capital Structure Weights

One method uses book values from the firm's balance sheet. For example, to estimate the weight for debt, simply divide the book value of the firm's long-term debt by the book value of its total assets.

To estimate the weight for equity, simply divide the total book value of equity by the book value of total assets.

The Weighted Average Cost of Capital

$$WACC = w_i k_i + w_p k_p + w_s k_s$$

Capital Structure Weights

A second method uses the market values of the firm's debt and equity. To find the market value proportion of debt, simply multiply the price of the firm's bonds by the number outstanding. This is equal to the total market value of the firm's debt.

Next, perform the same computation for the firm's equity by multiplying the price per share by the total number of shares outstanding.

The Weighted Average Cost of Capital

$$WACC = w_i k_i + w_p k_p + w_s k_s$$

Capital Structure Weights

Finally, add together the total market value of the firm's equity to the total market value of the firm's debt. This yields the total market value of the firm's assets.

To estimate the market value weights, simply divide the market value of either debt or equity by the market value of the firm's assets .

The Weighted Average Cost of Capital

$$WACC = w_i k_i + w_p k_p + w_s k_s$$

Capital Structure Weights

For example, assume the market value of the firm's debt is $40 million, the market value of the firm's preferred stock is $10 million, and the market value of the firm's equity is $50 million.

Dividing each component by the total of $100 million gives us market value weights of 40% debt, 10% preferred, and 50% common.

The Weighted Average Cost of Capital

$$WACC = w_i k_i + w_p k_p + w_s k_s$$

Capital Structure Weights

Using the costs previously calculated along with the market value weights, we may calculate the weighted average cost of capital as follows:

$$WACC = .4(5.67\%) + .1(9.62\%) + .5(15.8\%)$$

$$= 11.13\%$$

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

Some Basic Assumptions

- 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 obligations -- 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 are considered relevant -- the cost of capital is measured on an after-tax basis.

The WMCC & 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 WMCC & Investment Decisions

The Weighted Marginal Cost of Capital (WMCC)

Finding Break Points

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.

$$BP_j = Af_j / w_j$$

Where:

BP_j = breaking point form financing source j

Af_j = amount of funds available at a given cost

w_j = target capital structure weight for source j

The WMCC & Investment Decisions

The Weighted Marginal Cost of Capital (WMCC)

Finding Break Points

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 WMCC & Investment Decisions

The Weighted Marginal Cost of Capital (WMCC)

Finding Break Points

BPequity = $2,000,000/.5 = $4,000,000

BPdebt = $1,000,000/.4 = $2,500,000

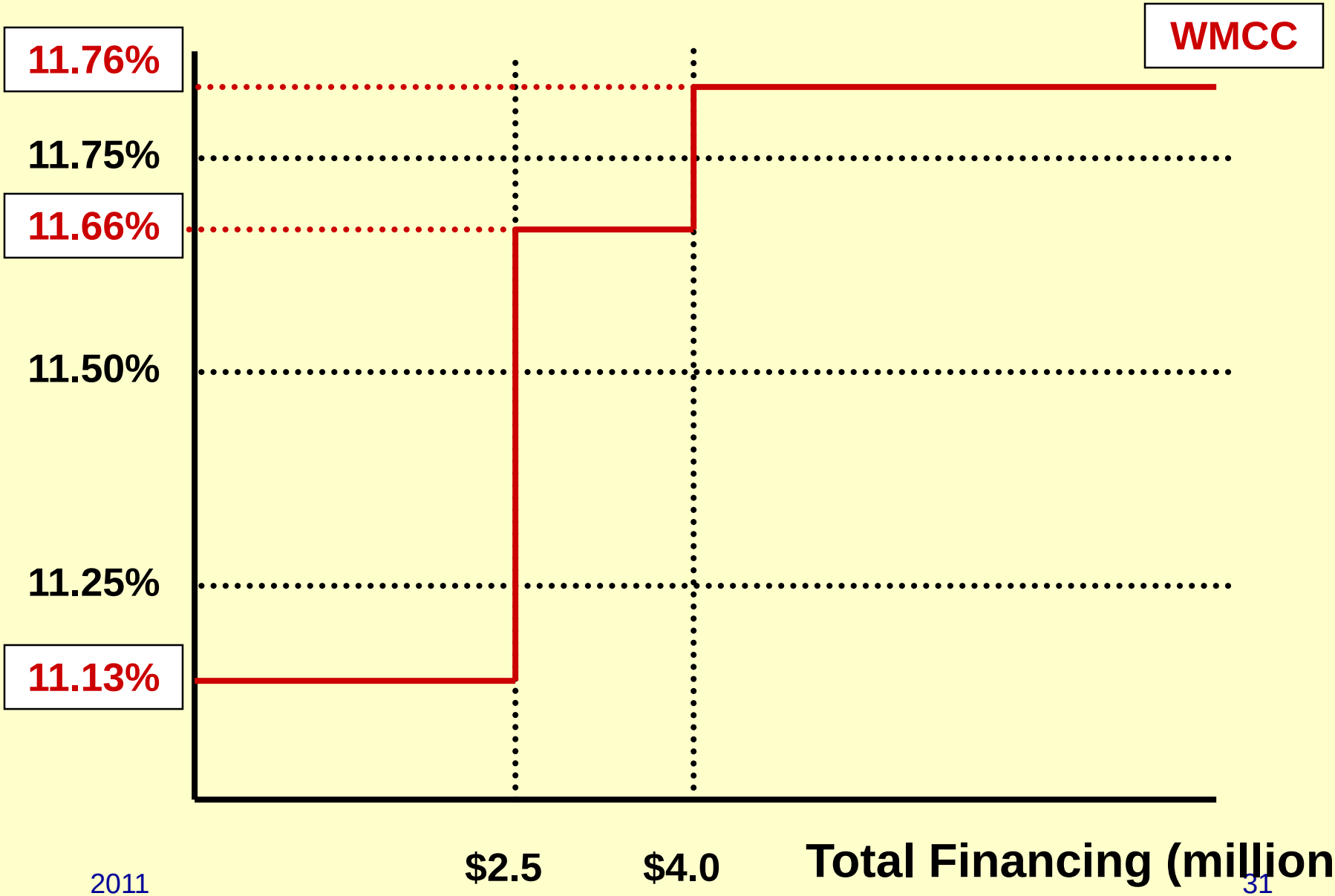
This implies that the firm can fund up to $4 million of new investment before it is forced to issue new equity and $2.5 million of new investment before it is forced to raise more expensive debt.

Given this information, we may calculate the WMCC as follows:

The WMCC & Investment Decisions

WACC for Ranges of Total New Financing				
Range of total New Financing	Source of Capital	Weight	Cost	Weighted Cost
$0 to $2.5 million	Debt	40%	5.67%	2.268%
	Preferred	10%	9.62%	0.962%
	Common	50%	15.80%	7.900%
			WACC	11.130%
$2.5 to $4.0 million	Debt	40%	7.00%	2.800%
	Preferred	10%	9.62%	0.962%
	Common	50%	15.80%	7.900%
			WACC	11.662%
over $4.0 million	Debt	40%	7.00%	2.800%
	Preferred	10%	9.62%	0.962%
	Common	50%	16.00%	8.000%
			WACC	11.762%

The WMCC & Investment Decisions



The WMCC & Investment Decisions

Investment Opportunities Schedule (IOS)

Now assume the firm has the following investment opportunities available:

Project	IRR	Initial Ivestment	Cumulative Investment
A	13.0%	$ 1,000,000	$ 1,000,000
B	12.0%	$ 1,000,000	$ 2,000,000
C	11.5%	$ 1,000,000	$ 3,000,000
D	11.0%	$ 1,000,000	$ 4,000,000
E	10.0%	$ 1,000,000	$ 5,000,000

Combining the WMCC with the IOS yields the following:

The WMCC & Investment Decisions