Masters in FINANCE

CAPITAL STRUCTURE – Part I

Modigliani and Miller's Perfect Word

Modigliani and Miller with Corporate Taxes

Corporate Investment Appraisal

Fall 2012

ISEG 100 1911-2011 ANOS

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OUTLINE

- The Perfect World of Modigliani-Miller (1958)
- The Effect of Corporate Income Taxes
- more factors appear in the coming sessions…

The Perfect World of Modigliani-Miller (1958)

THE PERFECT WORLD OF MODIGLIANI-MILLER

- Modigliani-Miller (1958) – set of assumptions;
- MM Proposition I: The Irrelevance Result;
  - Example
- MM Proposition II: Leverage increases risk and expected return for equity-holders.
- Homemade leverage: Example

Later we will adapt these results to accommodate our real-world imperfections, such as taxes, costs of bankruptcy,...

The Perfect World of Modigliani-Miller (1958)

OVERVIEW

The Capital Structure of a firm (or project) is the mix of Equity and Debt that the firm uses.

In a Perfect World, as presented first by Modigliani and Miller in 1958, we will see that the capital structure choice is irrelevant.

Why? The total value of the firm depends on the value of its assets, independently of them being financed with equity or debt. (MM Proposition I)

Even if the cost of debt is lower than the cost of equity, on average the cost of capital of the firm is always the same (r_{WACC} does not change with the capital structure). This happens because when a firm increases its cheaper source of financing – debt – it also increases the risk for equity-holders, and hence the cost of equity goes up.

The Perfect World of Modigliani-Miller (1958)

ASSUMPTIONS

Modigliani and Miller (MM) showed in 1958 their capital structure results under a set of conditions referred to as perfect capital markets:

- Investors and firms can trade the same set of securities at competitive market prices equal to the present value of their future cash flows.
- There are no taxes, transaction costs, or issuance costs associated with security trading.
- A firm's financing decisions do not change the cash flows generated by its investments, nor do they reveal new information about them.

MM Proposition I

In a perfect capital market, the total value of a firm is equal to the market value of the total cash flows generated by its assets and is not affected by its choice of capital structure.

Value of the Levered Firm

$$V^L = V^U$$

Value of the Unlevered Firm

This is also known as the Irrelevance result: the choice of capital structure does not affect the value of the firm.

The Perfect World of Modigliani-Miller (1958)

EXAMPLE: COMPARE DIFFERENT STRUCTURES

Consider the following investment opportunity, with equal probability for the date 1 scenarios.

Date 0	Date 1	
	Strong Economy	Weak Economy
–$800	$1400	$900

Capital Structure #1: 100% Equity Financing (Unlevered Equity)

Consider a R_f interest rate of 5%, and that you require a 10% risk premium.

The project's NPV is:

$$NPV = -800 + \frac{0.5 \times 1400 + 0.5 \times 900}{1 + 0.15} = \$200$$

You can actually raise $1000 in equity, and gain $200 on top of your required return.

	Date 0	Date 1: Cash Flows		Date 1: Returns	
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy
Unlevered equity	$1000	$1400	$900	40%	–10%

Expected Return=0.5(40%)+0.5(-10%)=15%

The Perfect World of Modigliani-Miller (1958)

Capital Structure #2: 50% Debt / 50% Equity (Levered equity)

Borrow $500. At rate Rf=5%, because debt will be riskless (look at cash flows)

Get the remainder as equity. What's the value of equity?

Look at the Cash Flows:

	Date 0	Date 1: Cash Flows	
	Initial Value	Strong Economy	Weak Economy
Debt	$500	$525	$525
Levered equity	*E* = ?	$875	$375
Firm	$1000	$1400	$900

In equilibrium the value of equity must be E=$500.

How can we check this?

Levered Equity has higher risk! The variability of returns is higher. So, the expected return of levered equity is higher than the expected return of unlevered equity.

Check it:

	Date 0	Date 1: Cash Flows		Date 1: Returns		
	Initial Value	Strong Economy	Weak Economy	Strong Economy	Weak Economy	Expected Return
Debt	$500	$525	$525	5%	5%	**5%**
Levered equity	$500	$875	$375	75%	–25%	**25%**
Unlevered equity	$1000	$1400	$900	40%	–10%	**15%**

The Perfect World of Modigliani-Miller (1958)

EXAMPLE: HOMEMADE LEVERAGE

Turning to our previous example we can understand MM's result by considering *homemade* leverage made by the investors themselves in case the firm is unlevered.

Suppose the firm is unlevered, and the investor creates his own leverage by borrowing $500 (or getting a margin loan) at R_f=5%.

	Date 0	Date 1: Cash Flows	
	Initial Cost	**Strong Economy**	**Weak Economy**
Unlevered equity	$1000	$1400	$900
Margin loan	–$500	–$525	–$525
Levered equity	$500	$875	$375

Likewise, if the firm is levered (with 50% Debt and 50% equity) an investor who wants to invest in the firm as if it were unlevered, can buy both the equity and the debt of the firm.

	Date 0	Date 1: Cash Flows	
	Initial Cost	**Strong Economy**	**Weak Economy**
Debt	$500	$525	$525
Levered equity	$500	$875	$375
Unlevered equity	$1000	$1400	$900

MM Proposition II

The cost of capital of levered equity is equal to the cost of capital of unlevered equity plus a premium that is proportional to the market value debt-equity ratio.

$$r_E = r_U + \frac{D}{E}(r_U - r_D)$$

Market Value of Debt

Cost of Levered Equity

Cost of Unlevered Equity

Market Value of Equity

Cost of Debt

The Perfect World of Modigliani-Miller (1958)

THE MARKET VALUE BALANCE SHEET

If we want we can visualize MM's reasoning by looking at a Market Value Balance-Sheet:

U	D E

Therefore when we compute the average cost of capital of the firm, we find that it's always the same in a perfect world. It equals the unlevered cost of capital (R_U):

$$R_U = \frac{E}{E+D} R_E + \frac{D}{E+D} R_D$$

The Perfect World of Modigliani-Miller (1958)

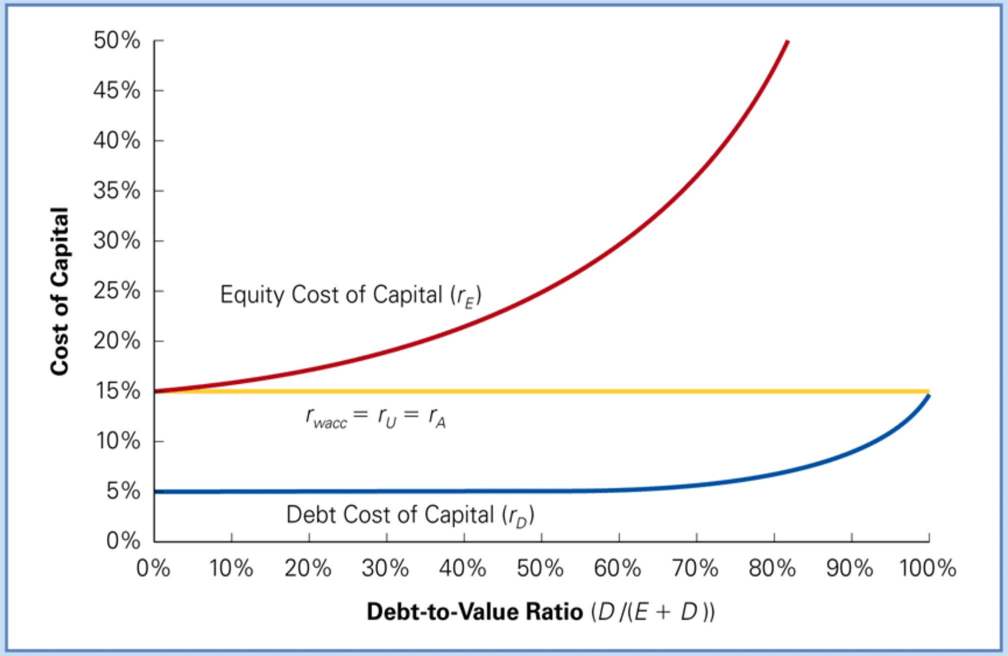
COST OF CAPITAL IN A PERFECT WORLD

We define the Unlevered Cost of Capital (or pre-tax WACC) as:

$$r_U = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D$$

And we know that in the MM world, the WACC equals the Unlevered Cost of Equity, which is the Cost of Capital of the firm's Assets:

$$r_{wacc} = r_U = r_A$$



(a)

E	D	r_E	r_D	$\frac{E}{E+D} r_E + \frac{D}{E+D} r_D$	$= r_{wacc}$
1000	0	15.0%	5.0%	1.0 × 15.0% + 0.0 × 5.0%	= 15%
800	200	17.5%	5.0%	0.8 × 17.5% + 0.2 × 5.0%	= 15%
500	500	25.0%	5.0%	0.5 × 25.0% + 0.5 × 5.0%	= 15%
100	900	75.0%	8.3%[4]	0.1 × 75.0% + 0.9 × 8.3%	= 15%

(b)

The Perfect World of Modigliani-Miller (1958)

More comments

Levered betas (β_E) and Unlevered Betas (β_U):

The Beta of a stock will vary according to the debt-equity ratio of the firm. We can apply the same logic of MM II to betas:

$$\beta_U = \frac{E}{E+D}\beta_E + \frac{D}{E+D}\beta_D$$

$$\beta_E = \beta_U + \frac{D}{E}\left(\beta_U - \beta_D\right)$$

Holding Cash: Holding cash has the opposite effect of having debt.

When calculating D, we use Net Debt.

Example: E=$200.8 billion; Debt=$35.3 billion; and Cash and Short term investments = $ 23.3 billion.

D = 35.3 – 23.3 = - $ 12 billion

The Effect of Corporate Taxes

We depart from Modigliani-Miller's perfect world, adjusting their original analysis in order to include real-life imperfections.

We start by examining the effect of Corporate Taxes.

Corporations pay taxes on their profits after interest payments are deducted. Thus, interest expense reduces the amount of corporate taxes. This creates an incentive to use debt.

Later we will see that there are also disadvantages in using debt. Otherwise, firms would choose 100% Debt as their capital structures.

The Effect of Corporate Taxes

INTEREST TAX SHIELD

The Interest Tax Shield is the reduction in taxes paid due to the tax deductibility of interest.

Computing the Interest Tax Shield

Problem

Shown below is the income statement for D.F. Builders (DFB). Given its marginal corporate tax rate of 35%, what is the amount of the interest tax shield for DFB in years 2006 through 2009?

DFB Income Statement ($ millions)	2006	2007	2008	2009
Total sales	$3369	$3706	$4077	$4432
Cost of sales	–2359	–2584	–2867	–3116
Selling, general, and administrative expense	–226	–248	–276	–299
Depreciation	–22	–25	–27	–29
Operating income	762	849	907	988
Other income	7	8	10	12
EBIT	769	857	917	1000
Interest expense	–50	–80	–100	–100
Income before tax	719	777	817	900
Taxes (35%)	–252	–272	–286	–315
Net income	$467	$505	$531	$585

The Effect of Corporate Taxes

Solution

From Eq. 15.1, the interest tax shield is the tax rate of 35% multiplied by the interest payments in each year:

($ millions)	2006	2007	2008	2009
Interest expense	–50	–80	–100	–100
Interest tax shield (35% × interest expense)	**17.5**	**28**	**35**	**35**

Thus, the interest tax shield enabled DFB to pay an additional $115.5 million to its investors over this period.

When a firm uses debt, the interest tax shield provides a corporate tax benefit each year.

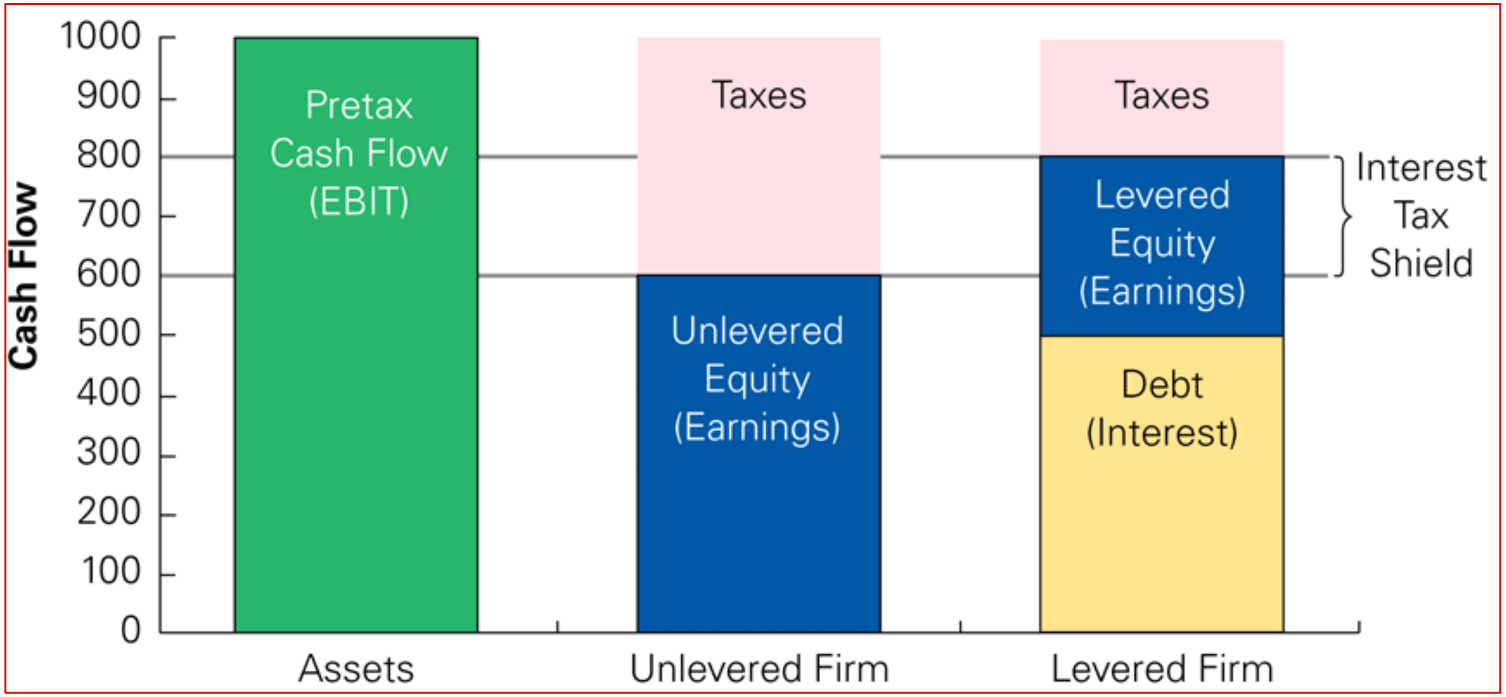
This benefit is the computed as the present value of the stream of future interest tax shields the firm will receive.

We will see that when securities are fairly priced, the original shareholders of a firm capture the full benefit of the interest tax shield from an increase in leverage.

The Effect of Corporate Taxes

The cash flows that a levered firm (i.e., a firm with debt financing) pays to investors will be higher than they would be without leverage (i.e., without debt) by the amount of the interest tax shield.

$$\begin{pmatrix}\text{Cash Flows to Investors}\\ \text{with Leverage}\end{pmatrix} = \begin{pmatrix}\text{Cash Flows to Investors}\\ \text{without Leverage}\end{pmatrix} + (\text{Interest Tax Shield})$$



The Effect of Corporate Taxes

MM Proposition I with Corporate Taxes

The total value of the levered firm exceeds the value of the firm without leverage due to the present value of the tax savings from debt.

$$V^L = V^U + PV(\text{Interest Tax Shield})$$

Value of the **L**evered firm

Value of the **U**nlevered firm

•Example: Suppose **a firm borrows debt *D* and keeps the level of debt permanently**. If the firm's marginal tax rate is τ_c , and if the debt involves an annual cost r_D , then the interest tax shield each year is $\tau_c \times r_D \times D$, and the tax shield can be valued as a perpetuity. $PV(\text{Interest Tax Shield}) = \dfrac{T_C(R_D D)}{R_D} = T_C D$

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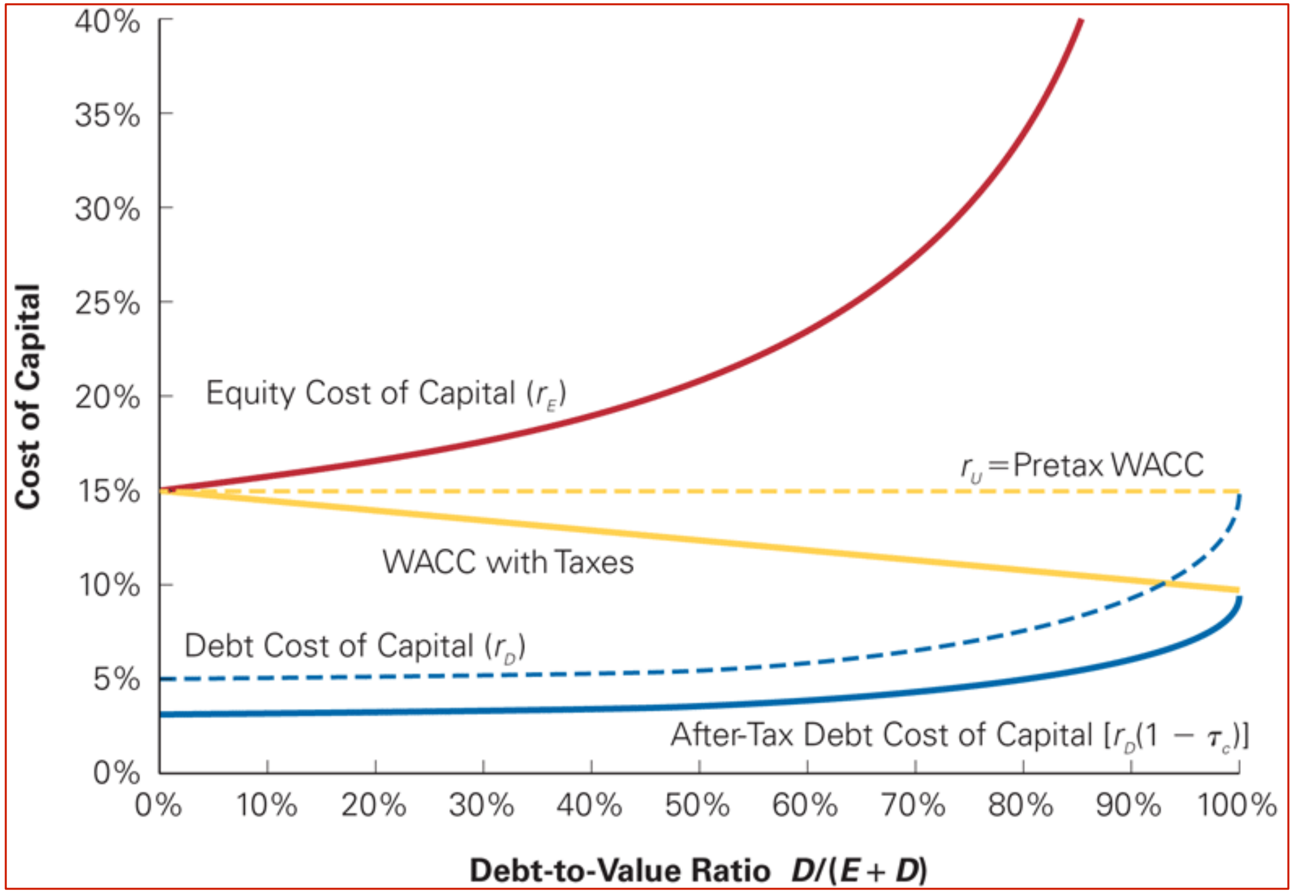
The Weighted Average Cost of Capital

With tax-deductible interest, the effective after-tax borrowing rate is $r_D(1 - \tau_c)$ and the weighted average cost of capital becomes

$$r_{wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - \tau_c)$$

$$r_{wacc} = \underbrace{\frac{E}{E+D} r_E + \frac{D}{E+D} r_D}_{\text{Pretax WACC}} - \underbrace{\frac{D}{E+D} r_D \tau_c}_{\substack{\text{Reduction Due} \\ \text{to Interest Tax Shield}}}$$

The Effect of Corporate Taxes



The Interest Tax Shield with a Target D/E ratio

- When a firm adjusts its leverage to maintain a **target debt-equity ratio**, we can compute its value with leverage, V^L, by discounting its free cash flow using the weighted average cost of capital.

- The Unlevered value of the firm, V^U, can be computed by discounting the FCFs at the firm's unlevered cost of capital, the pretax WACC.

- The value of the interest tax shield can be found by comparing the difference between V^L and V^U.

The Interest Tax Shield with a Target D/E ratio

Example: XYZ Company expects to have

- FCF in the coming year of $4.25 million;
- The FCF is expected to grow at a rate of 4% per year thereafter;
- Equity Cost of Capital (r_E) is 10%;
- Debt Cost of Capital (r_D) is 6%;
- Pays a corporare tax rate (T_C) of 35%;

If XYZ maintains a debt-equity ratio (D/E) of 0.50, what is the value of its interest tax shield?

The Effect of Corporate Taxes

If the firm were Unlevered we could compute its value by discounting the FCFs at the Pre-tax WACC:

$$\text{Pre-Tax wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D = \frac{1}{1+0.5} 10\% + \frac{0.5}{1+0.5} 6\% = 8.67\%$$

$$V^U = \frac{\$4.25}{0.0867 - 0.04} = \$91 \text{ million}$$

Given that the firm has a target ratio D/E=0.50, we can value it by discounting its FCFs at the WACC:

$$r_{wacc} = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D (1 - \tau_C) = \frac{1}{1+0.5} 10\% + \frac{0.5}{1+0.5} 6\% (1 - 0.35) = 7.97\%$$

$$V^L = \frac{\$4.25}{0.0797 - 0.04} = \$107 \text{ million}$$

The present value of the interest tax shield is the difference between the two valuations:

PV(Interest Tax Shield)= \$107 - \$91 = \$ 16 million.

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Recapitalizing to capture the Interest tax Shield

Firms may be tempted to repurchase shares with new issued debt in order to capture a higher interest tax shield. It is the original shareholders who benefit from the tax shield of increased leverage!

Example: Midco Industries wants to boost its stock price. The company currently has:

- Shares Outstanding: 20 million;
- With a Stock Price: $15 per share;
- No Debt;
- Stable earnings;
- Pays a 35% corporate tax rate.

The Effect of Corporate Taxes

The company plans to borrow \$100 million on a permanent basis, and use the funds to repurchase outstanding shares.

Without leverage

V^U = (20 million shares) × (\$15/share) = \$300 million

If Midco borrows \$100 million using permanent debt, the present value of the firm's future tax savings is

PV(interest tax shield) = $\tau_c D$ = 35% × \$100 million = \$35 million

Thus the total value of the levered firm will be

$V^L = V^U + \tau_c D$ = \$300 million + \$35 million = \$335 million

The Effect of Corporate Taxes

Because the value of the debt is $100 million, the new value of the equity must be:

$E = V^L - D = \$335 \text{ million} - \$100 \text{ million} = \$235 \text{ million}$

Total value of outstanding equity drops, BUT shareholders will also receive the $100 million that Midco will pay out through the share repurchase.

In total, equity-holders will receive the full $335 million, a gain of $35 million over the value of their shares without leverage.

Given the higher total value that accrues to equity-holders, we should actually expect a stock price increase to:

Stock Price = $335 million/20 million = $16.75

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The Effect of Corporate Taxes

With a repurchase price of $16.75, the shareholders who tender their shares and the shareholders who hold their shares both gain $1.75 per share as a result of the transaction.

$16.75 – $15 = $1.75

The company repurchases how many shares?

$100 million/$16.75 = 5 970 149 .3 (needs rounding for integer number of shares)

Spending the $100 million raised

The number of shares that remains outstanding is:

20 000 000 – 5 970 149 = 14 029 851

With a total market capitalization of 14 029 851*$16.75= $235 million