Session 5 – Part 1
Capital Structure II

Modigliani-Miller with Corporate Taxes (Tc)

Financial Markets and Management

MiM

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OUTLINE

- 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.

Interest Tax Deduction

- Example: Consider Safeway, Inc. which had earnings before interest and taxes of approximately $1.85 billion (EBIT) in 2008, and interest expenses of about $350 million. Safeway's marginal corporate tax rate was 35%.
  - Safeway's net income in 2008 was lower with leverage than it would have been without leverage.

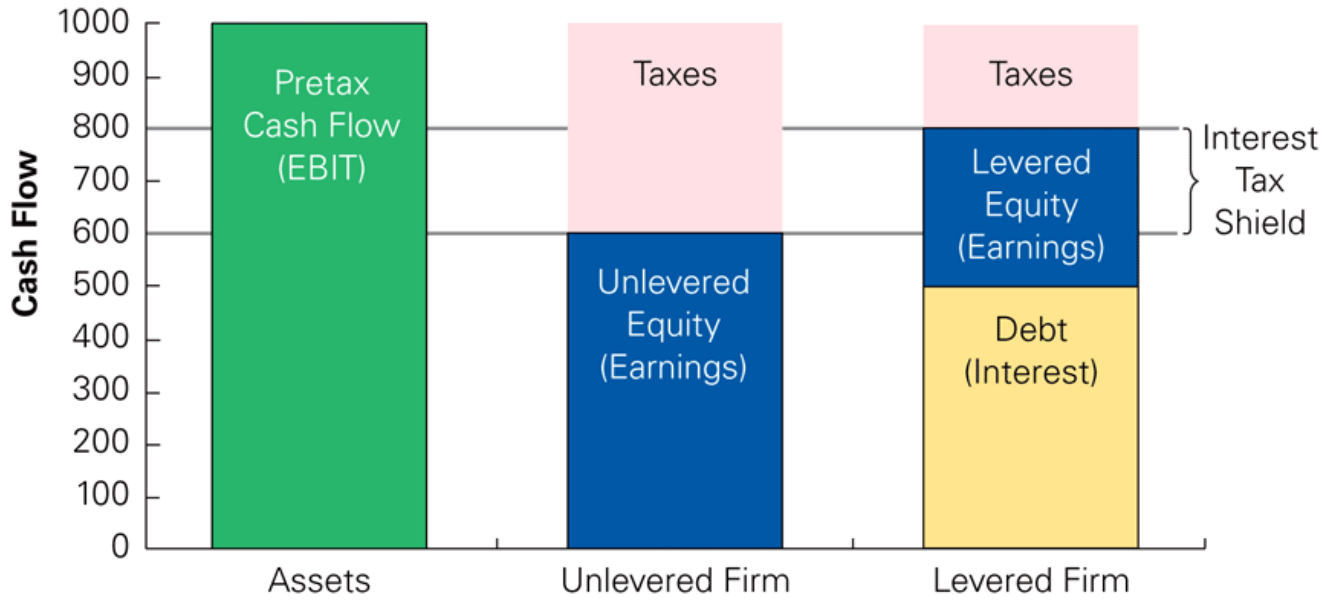
	With Leverage	Without Leverage
EBIT	$1850	$1850
Interest expense	–350	0
Income before tax	1500	1850
Taxes (35%)	–525	–648
Net income	$975	$1202

  - Safeway's debt obligations reduced the value of its equity. But the total amount available to all investors was higher with leverage (350+975).
  - Where does the additional $123 million come from?

Interest Tax Shield

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

- In Safeway's case, the gain is equal to the reduction in taxes with leverage:
  - Look: $648 million – $525 million = $123 million.
  - The interest payments provided a tax savings of 35% × $350 million = $123 million.



The Interest Tax Shield and Firm Value

- 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.

The Weighted Average Cost of Capital with Corporate Taxes

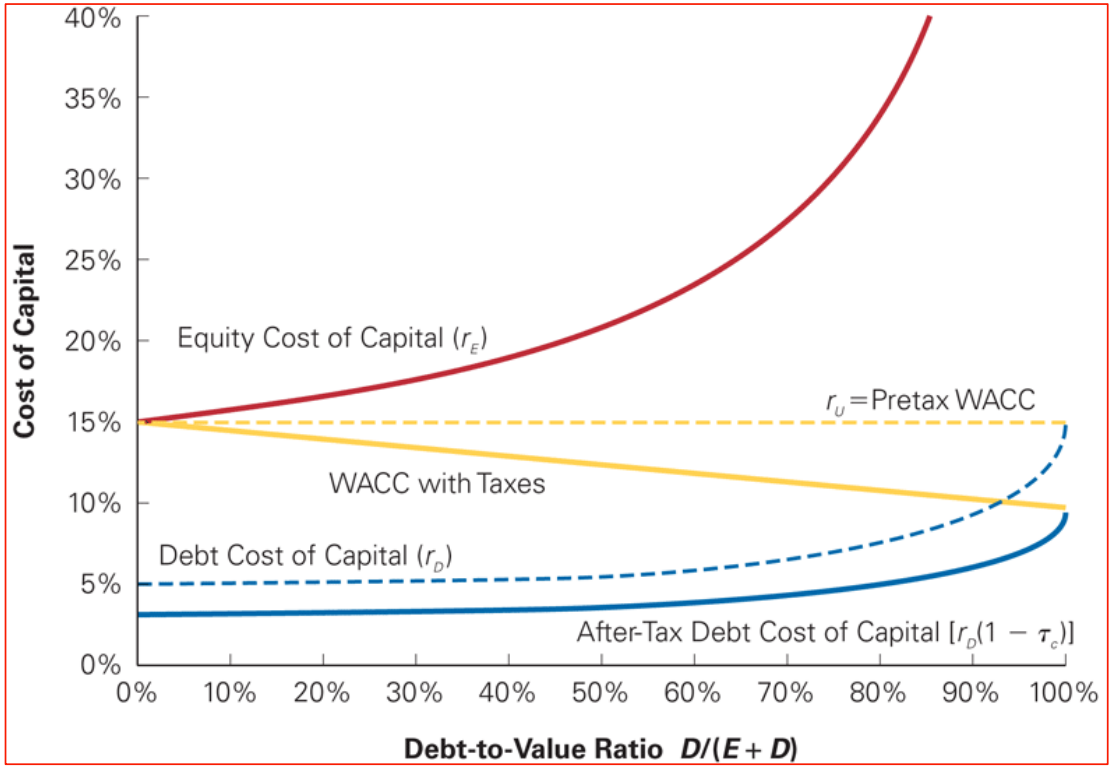
With tax-deductible interest, the effective after-tax borrowing rate is $r_D(1 - \tau_c)$ and the weighted average cost of capital becomes:

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

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

The Weighted Average Cost of Capital with Corporate Taxes

- For different target Debt-to-Value ratios, the WACC with taxes will change:



MM Proposition I (with Tc)

- We can adjust MM's Proposition I, to consider the effect of corporate taxation.
- 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 Levered firm

Value of the Unlevered firm

What's the Present Value of the Interest Tax Shield?

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

The **annual ITS** is Tc*(Interest Payment).

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

(PROMISE!) 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.

PV(ITS) - Special Case #1: Debt is a Perpetuity

- Suppose a firm borrows debt *D* and keeps the level of debt permanently.
- When Debt is a known value (that was pre-determined), the interest tax shield is discounted at the same rate as the interest payments: r_D
- 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.

$$PV(\text{Interest Tax Shield}) = \frac{T_C(R_D D)}{R_D} = T_C D$$

PV(ITS) - Special Case #2: The Interest Payments are known (Pre-determined Debt Levels)

Example: **Valuing the interest tax shield of a well-known Loan**

- Suppose ALCO expects to pay $60 million in interest each year for the next 8 years, and then repay the principal of $1 billion in year 8.
- ALCO's marginal tax rate will remain 39% throughout this period.
- If the cost of debt is 6%, by how much does the interest tax shield increase the value of ALCO?
- The annual interest tax shield is:

  $60 million × 39% = $23.4 million for 8 years.

$$PV(\text{Interest Tax Shield}) = \$23.4 \text{ million} \times \frac{1}{6\%}\left(1 - \frac{1}{1.06^{8}}\right)$$

$$= \$145.31 \text{ million}$$

PV(ITS) - Special Case #3: The Interest Tax Shield with a Target D/E ratio

In this case, what we know about the firm's Debt is not really the details of the loans, but rather the objective of the firm to keep a target ratio D/E (or $\frac{D}{D+E}$).

In such cases, it's not simple to estimate directly the interest payments and the annual ITS.

So we can estimate the PV(ITS) indirectly, according to MMI: $PV(ITS) = V_L - V_U$.

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

PV(ITS) - Special Case #3: The Interest Tax Shield with a Target D/E ratio

Example: Western Lumber 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 Western Lumber maintains a debt-equity ratio (D/E) of 0.50, what is the value of its interest tax shield?

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

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

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

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 V_L and V_U:

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

Appendix
Tips, Tricks & Tools

- To avoid wasting time, when under pressure, remember that:

$$\frac{D}{E} = \frac{\frac{D}{E+D}}{\frac{E}{E+D}}$$

- And also that:

$$\frac{D}{E+D} = \frac{\frac{D}{E}}{\frac{E}{E}+\frac{D}{E}} = \frac{\frac{D}{E}}{1+\frac{D}{E}}$$

$$\frac{E}{E+D} = \frac{\frac{E}{E}}{\frac{E}{E}+\frac{D}{E}} = \frac{1}{1+\frac{D}{E}}$$

- And:

$$R_{WACC} = \frac{E}{E+D}R_E + \frac{D}{E+D}R_D(1-T_C) = \frac{1}{1+\frac{D}{E}}R_E + \frac{\frac{D}{E}}{1+\frac{D}{E}}R_D(1-T_C)$$