Finance Lecture 5 Practical

JRE 300: Fundamentals of Accounting and Finance

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Quick Overview

The big ideas from Lecture 5:

1. MM Theorem: Capital structure doesn't matter (in a frictionless world)
2. How leverage affects equity beta and cost of equity
3. Taxes create a debt advantage (interest tax shield)
4. Bankruptcy costs create a debt disadvantage
5. Trade-off theory: Balancing tax benefits vs. distress costs
6. Central banks affect WACC and investment through policy rates

Today: Quick review + key formulas + practice problems

MM Theorem

Capital Structure Basics

Firm value: $V = E + D$

A firm's total value:

$$\boxed{V = E + D}$$

where:

- V = firm value
- E = **market value** of equity
- D = **market value** of debt

Key insight: Firm value comes from assets (NPV > 0 projects), not from how they're financed.

MM Theorem (frictionless world):

- Capital structure doesn't affect firm value
- WACC stays constant regardless of D/E ratio
- Changing leverage just reallocates risk among investors

How leverage affects equity beta

Beta conservation equation:

$$\boxed{\beta_E = \beta_{\text{Project}} + \frac{D}{E}(\beta_{\text{Project}} - \beta_D)}$$

With risk-free debt ($\beta_D = 0$):

$$\beta_E = \beta_{\text{Project}} \times \left(1 + \frac{D}{E}\right)$$

Example: $\beta_{\text{Project}} = 1.2$, $D/E = 1$

$$\beta_E = 1.2 \times (1 + 1) = 2.4$$

Intuition: More debt $\rightarrow$ equity becomes riskier $\rightarrow$ β_E increases

Cost of equity rises with leverage

Without taxes:

$$\boxed{r_E = r_0 + (r_0 - r_D) \times \frac{D}{E}}$$

where r_0 = unlevered cost of equity

Example: $r_0 = 11.4\%$, $r_D = 3\%$, $D/E = 1$

$$r_E = 11.4\% + (11.4\% - 3\%) \times 1 = 19.8\%$$

With taxes (τ_c = corporate tax rate):

$$\boxed{r_E = r_0 + (r_0 - r_D) \times \frac{D}{E} \times (1 - \tau_c)}$$

Tax shield reduces equity risk, so leverage premium is smaller.

WACC without taxes

Formula:

$$\text{WACC} = \frac{E}{E+D} \times r_E + \frac{D}{E+D} \times r_D$$

MM Result: In a frictionless world,

$$\boxed{\text{WACC} = r_0}$$

regardless of capital structure!

Why? Rising r_E exactly offsets the use of cheaper debt.

Taxes

The Interest Tax Shield

Interest tax shield example

Two identical firms, EBIT = \$100, $\tau_c = 25\%$

- **Firm A**: No debt
- **Firm B**: \$500 debt at 5% interest

	Firm A	**Firm B**
EBIT	\$100	\$100
Interest	\$0	\$25
Taxable income	\$100	\$75
Taxes (25%)	\$25	\$18.75
Cash to investors	**\$75**	**\$81.25**

Tax shield = Interest $\times \tau_c = \$25 \times 0.25 = \$6.25$

Debt saves taxes! This is why capital structure matters in the real world.

WACC with taxes

Formula with tax shield:

$$\boxed{\text{WACC} = \frac{E}{E+D} \times r_E + \frac{D}{E+D} \times r_D \times (1 - \tau_c)}$$

Key result: More debt $\rightarrow$ lower WACC

$$\text{WACC} = r_0 \times \left[1 - \frac{D}{E+D} \times \tau_c\right]$$

Why lower WACC matters:

- Lower discount rate $\rightarrow$ higher firm value
- More projects have positive NPV (lower hurdle rate)

Bankruptcy Costs

Why Not 100% Debt?

Types of bankruptcy costs

1. **Direct costs**:
   - Legal fees, court costs, administrative expenses
   - Typically 3-7% of firm value

2. **Indirect costs** (often much larger!):
   - **Lost customers**: Worry about warranties, service
   - **Lost suppliers**: Demand cash, refuse credit
   - **Lost employees**: Talented workers leave
   - **Underinvestment**: Can't raise capital for good projects
   - **Asset fire sales**: Forced to sell below fair value

Key point: More debt $\rightarrow$ higher bankruptcy risk $\rightarrow$ higher expected bankruptcy costs

Trade-off theory of capital structure

The optimization:

$$\max_{D/E} \quad \text{PV(Tax Shield)} - \text{PV(Bankruptcy Costs)}$$

Trade-off:

- More debt: Lower WACC, higher tax shield
- More debt: Higher bankruptcy risk, destroys value

Optimal capital structure: Balance tax benefits against distress costs

Depends on:

- Firm's systematic risk (β)
- Cash flow stability
- Asset tangibility
- Tax rates

Corporate taxes and equity market risk

Recall: $\beta_E = \beta_{\text{Project}} + \frac{D}{E}(\beta_{\text{Project}} - \beta_D) \times (1 - \tau_c)$

Macro implication: Higher corporate tax rates stabilize equity markets!

When τ_c falls (tax cuts):

- $(1 - \tau_c) \uparrow \rightarrow$ equity beta rises for levered firms
- Stock market becomes more volatile
- Equity returns more sensitive to macro shocks

Spillover effects:

- **Wealth inequality**: More volatile equity markets amplify wealth swings
- **Retirement stability**: More systematic risk in pensions
- **Financing**: Higher volatility raises cost of capital

Central Banks

Monetary Policy and WACC

The transmission mechanism

How central banks affect the real economy:

1. **Central bank** sets policy rate (overnight rate, fed funds rate)
2. **Banks** pass on higher costs to borrowers
3. r_f **and** r_D both rise (government and corporate bonds)
4. r_E rises (through CAPM: $r_E = r_f + \beta_E \times$ market premium)
5. **WACC** rises (weighted average of r_E and r_D)
6. **NPV** of projects falls (higher discount rate)
7. **Investment** decreases (fewer positive NPV projects)
8. **Hiring** decreases, unemployment rises
9. **Economic growth** slows, inflation cools

The chain:

$$\text{Policy rate} \uparrow \rightarrow \text{WACC} \uparrow \rightarrow \text{NPV} \downarrow \rightarrow \text{Investment} \downarrow$$

Policy rates affect firm valuations

Firm value:

$$V = \sum_{t=1}^{\infty} \frac{CF_t}{\text{WACC}^t}$$

When central bank raises rates:

- WACC ↑ (higher discount rate)
- Firm value ↓ (PV of cash flows falls)
- Stock prices fall immediately

When central bank cuts rates:

- WACC ↓ (lower discount rate)
- Firm value ↑ (PV of cash flows rises)
- Stock prices rise immediately

This is why: Markets react instantly to central bank announcements!

Key Formulas

Capital structure formulas

Firm value:

$$V = E + D$$

Equity beta with leverage:

$$\beta_E = \beta_{\text{Project}} + \frac{D}{E}(\beta_{\text{Project}} - \beta_D)$$

Cost of equity with leverage (with taxes):

$$r_E = r_0 + (r_0 - r_D) \times \frac{D}{E} \times (1 - \tau_c)$$

WACC with taxes:

$$\text{WACC} = \frac{E}{E + D} \times r_E + \frac{D}{E + D} \times r_D \times (1 - \tau_c)$$

Practice Problems