International Management Studies

Class 13

December 4, 2025

Contents

I. Applications of Time Value of Money

1. Concept of Time Value of Money (TVM)

"Money today is worth more than the same money in the future."

Reasons:

- **Opportunity cost** (can earn interest if invested)
- **Inflation**
- **Risk & uncertainty**
- **Consumption preference**

Core Formulas

Present Value (PV)

$$PV = \frac{FV}{(1+r)^t}$$

Future Value (FV)

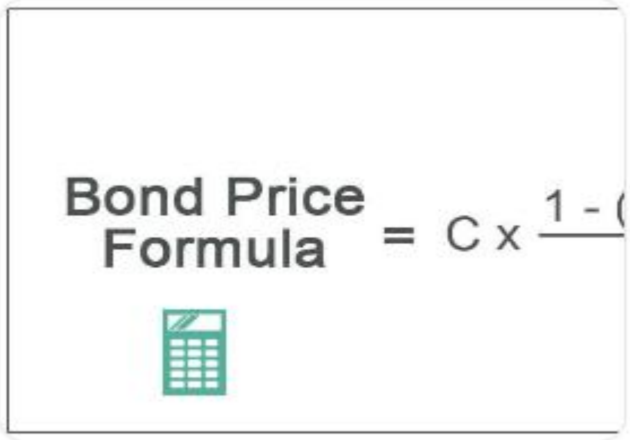
$$FV = PV(1+r)^t$$

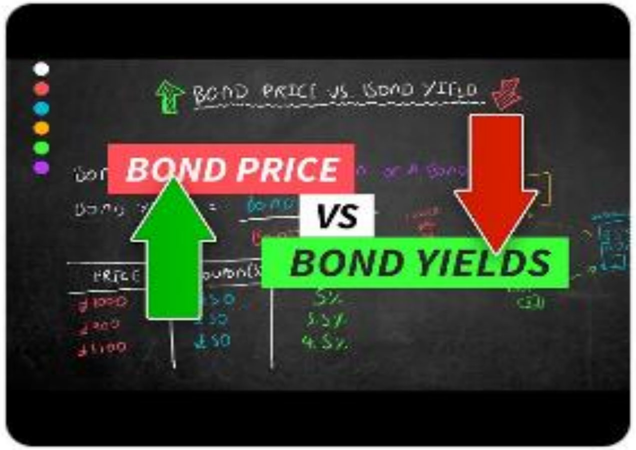
Present Value of an Annuity

$$PV_{ann} = C \times \frac{1-(1+r)^{-n}}{r}$$

1. Bond Valuation

2. Bond Valuation





Bond Price Basics

A bond's value = **Present value of coupon payments + Present value of face value**

$$P = \sum_{t=1}^{n} \frac{C}{(1+r)^t} + \frac{F}{(1+r)^n}$$

Case 1: Korean Treasury Bond (5-year)

- Face value: 100,000 KRW
- Coupon: 3% (annual)
- Yield: 4%

$$P = \frac{3,000}{1.04} + \cdots + \frac{3,000}{1.04^5} + \frac{100,000}{1.04^5}$$

📘 Time Value of Money Applications in Bond Valuation

Bond valuation is one of the most direct and important applications of the **time value of money (TVM)**.

A bond's price is simply the **present value of all future cash flows**, which includes:

1. **Periodic coupon payments** (an annuity)
2. **Final principal (face value)** payment at maturity (a lump sum)

$$P = \sum_{t=1}^{n} \frac{C}{(1+r)^t} + \frac{F}{(1+r)^n}$$

Where:

- C = coupon payment each period
- r = required yield (market interest rate)
- F = face value
- n = number of periods

✅ Application 1 — Pricing a Coupon Bond

Example

A 5-year bond has:

- Face value $F = \$1,000$
- Annual coupon rate = 6%
- Required yield = 5%

Step 1. Identify key cash flows

- Annual coupon $C = 0.06 \times 1,000 = \$60$
- Final payment = $1,000 at year 5

Step 2. Price = PV of coupons + PV of face value

$$P = 60\left(\frac{1-(1.05)^{-5}}{0.05}\right) + \frac{1,000}{(1.05)^5}$$

Step 3. Calculate components

Coupon PV:

$$\frac{1-(1.05)^{-5}}{0.05} = 4.32948$$

$$60 \times 4.32948 = 259.77$$

Face value PV:

$$\frac{1,000}{1.27628} = 783.53$$

Step 4. Add both parts

$$P = 259.77 + 783.53 = \boxed{1,043.30}$$

📌 **Interpretation:**

Since *coupon rate (6%) > market rate (5%)* → bond price is **above par** (premium bond).

✅ Application 2 — Pricing a Zero-Coupon Bond

Zero-coupon bonds have **no coupon payments**, so the price is simply the PV of the face value:

Example

- Face value = $1,000
- Yield = 6%
- Maturity = 10 years

$$P = \frac{1,000}{(1.06)^{10}}$$

$$P = \frac{1,000}{1.7908} = \boxed{558.39}$$

📌 **Interpretation:**

The investor buys the bond at $558 today and receives $1,000 in 10 years.

The difference is the interest earned.

✅ Application 3 — Pricing a Discount Bond (Market yield > coupon rate)

Example

A 4-year bond has:

- Face value = $1,000
- Coupon rate = 4%
- Required yield = 7%

Coupons = $40 annually.

Formula

$$P = 40\left(\frac{1 - (1.07)^{-4}}{0.07}\right) + \frac{1,000}{(1.07)^4}$$

Calculation

Coupon PV factor:

$$\frac{1 - (1.07)^{-4}}{0.07} = 3.3872$$

$$40 \times 3.3872 = 135.49$$

Face value PV:

$$\frac{1,000}{1.3108} = 763.92$$

Total price:

$$P = 135.49 + 763.92 = \boxed{899.41}$$

📌 **Interpretation:**

Since **coupon rate (4%) < market rate (7%)**, price falls below par → **discount bond**.

Result:

- Price ≈ **95,598 KRW**

Bond price ↓ when yield ↑ — key lesson for portfolio risk.

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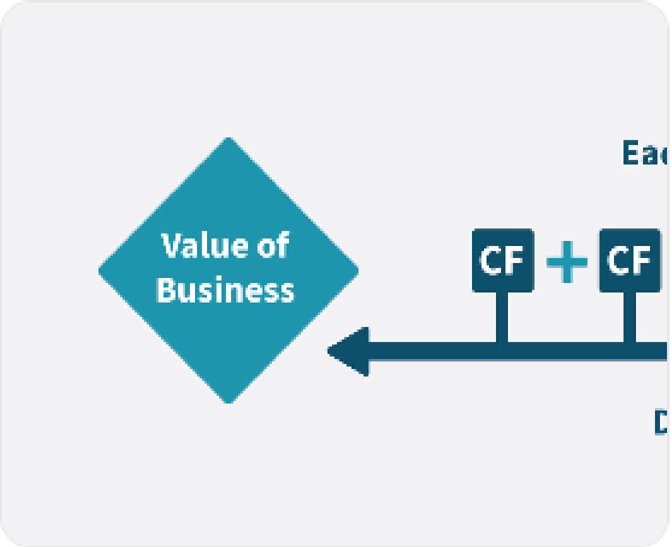
3. Stock Valuation



A. Dividend Discount Model (DDM)

$$P_0 = \frac{D_1}{r - g}$$

6. Alternative (recursive) derivation – very intuitive

Another elegant way starts from this identity:

$$P_0 = \frac{D_1}{1+k} + \frac{P_1}{1+k}$$

"Today's price" equals the PV of **next year's dividend** plus the PV of **next year's price**.

If dividends and price both grow at the same constant rate g, then:

$$P_1 = P_0(1+g)$$

Substitute this into the first equation:

$$P_0 = \frac{D_1}{1+k} + \frac{P_0(1+g)}{1+k}$$

Multiply both sides by $(1+k)$:

$$P_0(1+k) = D_1 + P_0(1+g)$$

Bring the P_0 terms together:

$$P_0(1+k) - P_0(1+g) = D_1$$

$$P_0\left[(1+k) - (1+g)\right] = D_1$$

$$P_0(k-g) = D_1$$

$$P_0 = \frac{D_1}{k-g}$$

Same result, but more "financial intuition" oriented.

Case: Samsung Electronics (dividend model)

Assume:

- Next dividend (D_1): 1,600 KRW
- Required return: 8%
- Dividend growth rate: 3%

$$P_0 = \frac{1,600}{0.08 - 0.03} = 32,000 \text{ KRW}$$

(Actual market price includes growth expectations beyond dividends.)

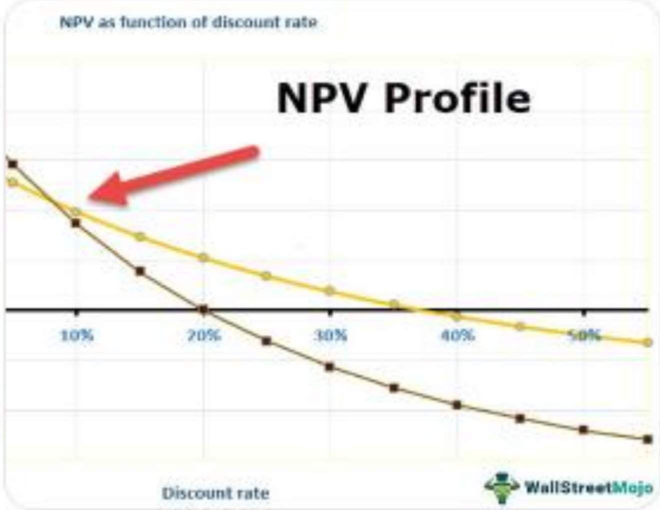
B. Free Cash Flow (FCF) Stock Valuation

$$P_0 = \sum_{t=1}^{n} \frac{FCF_t}{(1+r)^t} + \frac{TV}{(1+r)^n}$$

Real Case: Tesla (High-growth firm example)

- Traditional dividends = none
- FCF-based valuation used by investment banks
- Residual growth value (terminal value) often accounts for **70%+** of valuation

4. Project Valuation Methods (NPV & IRR)



A. NPV (Net Present Value)

$$NPV = \sum_{t=0}^{n} \frac{CF_t}{(1+r)^t}$$

Decision rule:

- **NPV > 0 → Accept**
- **NPV < 0 → Reject**

Case: Hyundai Motor EV Factory Expansion

Cash flows:

- Initial investment: –2 trillion KRW
- Annual cash inflow: 500 billion KRW for 6 years
- Discount rate: 8%

$$NPV = -2T + \sum_{t=1}^{6} \frac{0.5T}{(1.08)^t}$$

Result: **NPV ≈ +0.36 trillion KRW → Accept**

B. IRR (Internal Rate of Return)

Internal rate that makes NPV = 0.

Decision rule:

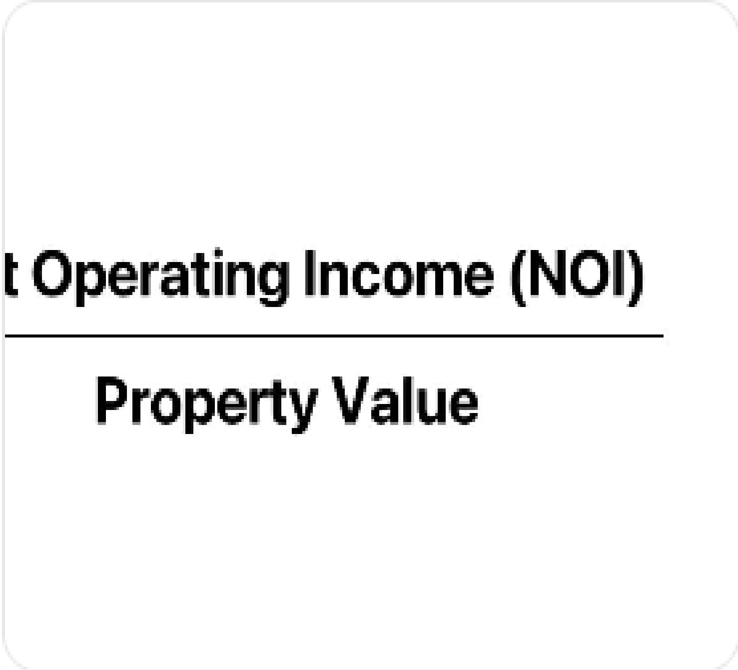
- **IRR > required return → Accept**

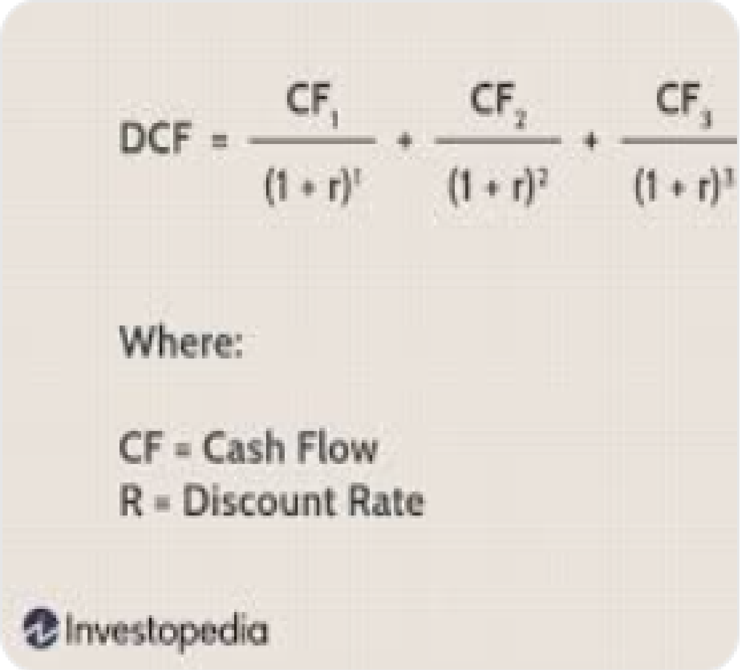
Case: LG Chem Battery Project

- IRR estimate = **11.7%**
- Required return = 9%

  → Project accepted by most analysts.

5. Real Estate Valuation Using TVM





A. Direct Capitalization Approach

$$\text{Value} = \frac{\text{NOI}}{\text{Cap Rate}}$$

Case: Seoul Commercial Building

- Net Operating Income (NOI): 300 million KRW
- Cap Rate: 4%

$$V = \frac{300M}{0.04} = 7.5B\ \text{KRW}$$

B. DCF (Discounted Cash Flow) Real Estate Valuation

Case: Busan 33m² Short-term Rental Unit

- Purchase price: 150 million KRW
- Annual net rental income: 10 million KRW
- Expected sale in 5 years: 160 million KRW
- Discount rate: 6%

$$PV(\text{rents}) = \sum_{t=1}^{5} \frac{10M}{1.06^t}$$

$$PV(\text{sale}) = \frac{160M}{1.06^5}$$

Result:

- PV of rents = **44.6M KRW**
- PV of sale = **119.5M KRW**
- Total = **164.1M KRW**

Because:

164.1M > 150M → **Positive investment**

6. Integrated Comparison of Valuation Methods

Asset Type	Key TVM Tool	Best For	Example
Bond	PV of coupons & principal	Fixed income pricing	KTB, US Treasury
Stock (Dividends)	Dividend discount model	Mature dividend firms	Samsung
Stock (Growth)	FCF model	Tech & growth firms	Tesla, NVIDIA
Projects	NPV / IRR	Corporate capital investment	Hyundai EV plant
Real Estate	Cap Rate & DCF	Property investment	Seoul office, Busan apartment

II. Q&A