Lecture 1

Cost of Capital

$$Risk - free\ interest\ rate + Risk\ Premium$$

- Risk-free interest rate: the cost of capital for a project with riskless cash flows
- Risk premium: the compensation for risk investors require to invest in projects with risky cash flows

Standard Definition

$$WACC = r_e \frac{E}{V} + r_d(1-\tau)\frac{D}{V}$$

- r_e (cost of equity): the return demanded by share holders
- r_d (cost of debt): the return demanded by lenders
- τ: marginal corporate tax rate
- $\frac{E}{V}$ & $\frac{D}{V}$: the relative proportions of equity and debt financing

Required Rate of Return on Equity

$$E(r_i) = r_f + \beta(E[r_m] - r_f)$$

- r_f: risk-free rate
- β_e (equity beta): the risk of investment in question differs from the average

Government Bonds

Example: two-year bond yield

Strategy 1: $payoff = (1+r_2)^2 - 1$

Strategy 2: $payoff = \left(1+{}_0^1r\right) \times \left(1+{}_1^2r\right) - 1$

- No uncertainty: government bonds would be risk free
  - Strategy 1 = Strategy 2
- Uncertainty
  - Strategy 1≠ Strategy 2
  - Inflation risk
  - Real interest rate risk

Beta

Expected returns:

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

Average market returns:

$$r_E = r_f + \beta_E(r_m - r_f)$$

Rate of Debt:

$$r_d = YTM - Prob(default) \times Expected\ Loss\ Rate$$

Unlevered (asset) beta:

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

- Systematic (market-related) risk:
  - Asset risk
  - Financial risk
- Usually estimated using regression analysis
- E = Price per share × # of shares
- D = Market value of outstanding debt

Promised vs. Expected Returns

Promised Return:

$$P_{Bond} = \frac{Interest + Principal}{(1+YTM)^n}$$

Expected Return: the return expected from holding the bond as compensation for risk in the bond's cash flows

Formula

$r_{WACC} = r_e \frac{E}{E+D} + r_d \frac{D}{E+D}(1-\tau)$
$r_E = r_f + \beta_E(r_m - r_f)$
$r_D = YTM - P{\times}L$
$r_D = r_f + \beta_D(r_m - r_f)$
$\beta_A = \frac{E}{D+E}\beta_E + \frac{D}{D+E}\beta_D$

Lecture 2

M-M's "Irrelevance" Theorem

- Financial decisions are irrelevant for firm value
- The choice of capital structure is irrelevant

Arbitrage

- Arbitrage opportunity:
  - Buy the one with the low price
  - Sell the one with the high price
  - Keep the difference in prices
  - Future cash flows will cancel out
- Proof by arbitrage:
  - Firm U: all-equity financed (unlevered);
    Firm: uses both debt and equity financing (levered)
  - Firm has cash flow of 10 or 4 with equal probability next year
- Proof by arbitrage: case I
  All equity firm vs. firm with risk free debt. The levered firm's debt has a face value of $4 due next year. It Is a zero coupon bond.
  Suppose you purchase a fraction (say 100%) of the equity of the unlevered firm (U) and 100%of the levered firm (L).

	All-equity Firm		Firm with Debt (Promised Payment $4)	
	Good State	Bad State	Good State	Bad State
100% Equity	10	4	6	0
100% Debt			4*	4*
Portfolio's Cash flow	10	4	10	4

*since debt is risk-free, the investor receives the same payment in each state

- Proof by arbitrage: case II
  All equity firm vs. firm with risky debt. In this case, the levered firm promises to pay $5.