Corporate Finance [Do not distribute beyond Cowell Fund]

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1 Modigliani-Miller

- MM Proposition I: in a frictionless economy (competitive markets, individuals/firms borrow at the same rate, no taxes/bankruptcy/transaction costs, financing decisions don't affect cash flows), the value of a firm does not depend on its capital structure; proof by no arbitrage
- MM Proposition II: Overall cost of capital (WACC) is constant even though cost of equity capital increases as D/E ratio increases; $r_e = WACC + (WACC - r_d)\frac{D}{E}$
- Finance: asset pricing or investments and corporate finance (choosing between corporate assets and liabilities)

2 Trade-Off Theory: Taxes and Bankruptcy Costs

Considering the Tax Shield

- Cash Flow = $(1 - t_c)X + t_c r_f D$ = equity payoff + tax shield
- PV(Tax Shield) = $\frac{t_c r_f D}{r_f} = t_c D$
- Value of a firm = $V(0) + t_C D$
- WACC = $V_E r_E + V_D r_D (1 - t_C)$

Trade-Off Theory

- The optimal debt-equity ratio trades-off tax advantage of debt versus costs of financial distress
- Convex equity cash flow and concave debt cash flow leads to debt-equity holder conflict

Costs of Financial Distress

- Direct bankruptcy costs (very low): administrative and legal, fire sales of assets, time spent by management
- Indirect bankruptcy costs: loss of customers/employees, predatory actions by rivals, inability to raise financing, debt overhang, asset substitution

Debt and Equity Financing

- Expected payoff: 100 good, 200 bad with 0.5 probability, 80 financing, and 30% tax rate
- Equity financing: $0.5(1 - 0.3)(100\alpha) + 0.5(1 - 0.3)(200\alpha) = 105\alpha$
- Equity financing: $105\alpha = 80 \rightarrow \alpha = 0.76$ and expected payoff = $0.5(1-0.76)(70)+0.5(1-0.76)(140) = 25$
- Debt financing: $(1 - 0.3) * (0.5(100 - 80) + 0.5(200 - 80)) = 49$
- Mix financing: must raise 0.5 * 80 from creditors $\rightarrow 0.5(0.7)(100 - 40)\alpha + 0.5(0.7)(200 - 40)\alpha$

3 Debt Overhang

Debt Overhang

- When too much existing debt leads to underinvestment
- Existing debt holders reap benefits from positive NPV investments they did not contribute to
- Solutions: limiting debt, renegotiating debt, or relying on project finance
- Can only materialize if debt is risky and cash flow cannot be contracted upon separately from assets in place (this is project finance: creating a separate entity with no debt holders)
- Outside equity financing does not help; renegotiation of debt can help

4 Effort

- Conditions for manager to exert effort: exerting effort is efficient (probability of high effort + low effort >= expected return of low effort + private benefit
- Condition for manager to exert effort: NPV with effort is positive (expected cash flows with high effort >= initial investment)
- Equity investors need to break even if manager exerts effort: F <= α(expected cash flow with high effort)
- Manager must prefer to exert effort: β(cash flow with high effort) >= β(expected payoff with low effort) + E; solve for β
- Payoff to existing shareholders: 1 - $\alpha - \beta$
- When considering the salary necessary for a manager to exert effort, subtract X from high and low cash flows and redo the calculations above; β remains the same
- When considering bonuses for high cash flows, subtract N from high cash flows only

5 Asymmetric Information I: Underinvestment, Overinvestment

Symmetric Information

- Everybody has the same information and external markets are competitive
- A company raises funds for new investment at fair prices
- Implications: capital structure allows for immediate refinancing and cash holdings are not necessary
- However, firms follow the Pecking order and prefer internal funds (cash that they save) before debt and then equity
- Potential explanation: informational frictions, such as managers having more information about value of existing assets, riskiness of investment projects, timing

Underinvestment (Credit Rationing)

- Underinvestment: when the average NPV of all firms at the high state is less than one
- Aklerof's lemon's problem: investors underpay, so good firms don't sell and only bad firms (lemons) are left in the market
- The market breaks down only if average NPV is negative

Overinvestment (Credit Boom)

- Average NPV is positive and the fraction of good firms is large
- Leads to pooling equilibrium where good and bad firms receive the same financing terms

6 Asymmetric Information II: Pecking Order

Overview

- Firms prefer internal financing, debt, then equity
- When outside claims are issued at a discount, firms prefer to use retained earnings to invest
- This leads to financial slack (holding excess cash)
- Why debt over equity: lower information costs, tax shield, maintaining control, signaling, dilution, flotation costs

7 NPV, IRR, and Venture Capital

How to Value and Asset

- Intuition, economics (NPV), and statistics (historical average, CAPM)

How to Value a Startup

- Investment time, investment amount, exit value, discount rate
- Pre- and post-money valuation

1.2. The General Case

We can calculate all important variables of a deal in a simple five step procedure:

Step 1: $POST = V/(1+r)^t$
POST is the post-money valuation.

Step 2: $PRE = POST - I$
PRE is the pre-money valuation.

Step 3: $F = I / POST$
F is the required ownership fraction for the investor.

Step 4: $y = x [F/(1-F)]$
y is the number of shares the investors require to achieve their desired ownership fraction.

Step 5: $p_1 = I / y$
p_1 is the price per share.

1.3 Sensitivity Analysis with the Basic Venture Capital Method

It is interesting to do some sensitivity analysis. How will the value of the company change if we change our assumptions? We will examine the effect of changing the following assumptions:

Variation 1: reduce the terminal value by 10 percent
Variation 2: increase IRR by an additional 10 percent (ex. from 50 to 60%)
Variation 3: increase investment by 10 percent
Variation 4: increase time to exit by 10 percent
Variation 5: increase the number of exiting shares: this has no effect on any real values!

Startup Valuation Using IRR

Step 1: $W = I(1+r)^t$
W is the amount of wealth investors expect to accumulate.

Step 2: $F = W / V$
F is the fraction of share ownership required by investors.

Step 3: $y = x\,[F/(1-F)]$
y is the number of shares the investors require to achieve their desired ownership fraction.

Step 4: $p_1 = I / y$
p_1 is the price per share.

Step 5: $POST = I / F$ or $POST = p_1 \times (x + y)$

8 Cash Flows, Financing Structure, Valuation

How to forecast cash flows

- Three essential elements: operations, taxes, investments
- FCFE = EBIT−Taxes−Depreciation+Depreciation/Amortization−Change in Net Working Capital−Capital Expenditures (CAPEX) + Net Borrowing
- NWC = Current assets - Current liabilities = Cash + Inventory + Acct receivable - Acct payable
- Consider terminal value: estimating future cash flows via perpetual growth

How to choose the optimal capital structure

- ΔEV = ΔTax shield - ΔDistress cost
- Expected loss or distress cost = Probability of default * Loss given default
- PD is determined by credit rating; LGD is often cited as 20%
- EL = PD * LGD

How value a company

- APV: V = Discounted cash flow with r_a (unlevered) + discounted tax shield with r_e (levered) = Discounted FCF with r_{WACC}
- Estimate DCF, WACC, capital structure, other valuation methods (multiples, historical), statistical ratios (operating margins, return on capital), and evaluate sensitivity

9 Summary

- Assets: unlevered assets, debt tax shield, distress cost
- Valuing an asset: IRR (without discount rate) and NPV → pre- and post-money valuation, percentage stakes given to existing versus new investors, share prices, number of shares
- Forecasting free cash flows: FCF = Revenue - costs - depreciation - tax + depreciation - change in net working capital - CAPEX + salvage value

- Note: FCF + DTS (valuation) = ECF + Debt CF (real world where interest is subtracted from EBIT before tax)
- Optimal capital structure (D/E ratio): trade-off theory between tax shields ($\frac{r_d * D}{r_{DTS}}$ and distress costs (Prob default * loss); underinvestment, re-shifting, interest coverage ratios, credit ratings, default rates
- Estimating discount rates: idiosyncratic, systematic, liquidity, tail risk; CAPM ($r_e = r_f + \beta_i(r_m - r_f)$) and WACC (unlever then relever
- Note: $\beta_A = \frac{E}{E+D(1-t)}\beta_e$ is more conservative than $\beta_A = \frac{E}{E+D}\beta_e + \frac{D}{E+D}\beta_D$ because it assumes $\beta_D = 0$
- Valuing a company: APV ($\frac{FCF}{1+r_A} + \frac{r_D * D * t}{1+r_A}$) and WACC ($\frac{FCF}{1+r_{WACC}}$)