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### **Capital Structure Theory**

1. What is the essence of the financing decision?
  - It consists of two elements (i) the choice of financing mix, and (ii) the choice of type of security to issue.
  - The financing mix affects both, (a) the cashflows of the firm, and (b) the hurdle rates of the firm. Hence capital structure is a precursor to the investment decision. Usually the decision becomes a joint one in more dynamic settings.
2. What are the benefits of debt financing to the firm, and its stakeholders?
  - There are two main benefits (a) tax benefits and (b) management discipline.
3. Since interest paid to debt is tax deductible, the government subsidizes some of the cost of debt. Hence, ceteris paribus, the higher the corporate tax rate  $T_c$ , the more debt we should see on firm balance sheets.
4. Real estate corporations are taxed at corporate tax rates. REITs are not taxed provided they distribute at least 95% of their income as dividends. Which do you think issues more debt? [the corporation]
5. Debt holders undertake the role of costly supervision of management. While equity holders in principle are also doing the same, the periodic verification on account of covenants, ratings, etc assures a higher level of managerial oversight with debt than equity.
6. In which of the following firms is debt likely to be a disciplinary device?
  - privately owned firm
  - publicly traded widely held firm

- public company with an active shareholder block.

7. What are the costs of debt financing?

- Bankruptcy costs
- Agency costs
- Loss of future financial flexibility.

8. Bankruptcy costs are usually classified into two types:

- Direct costs = legal costs, deadweight costs (explicit)
- Indirect costs = lost sales, loss of good personnel, reputation destruction (implicit)
- If BR costs increase, debt usually decreases.
- BR costs form the essential tradeoff against the gains from tax shields.

9. What are agency costs?

- These costs arise whenever the agent does not conform to the wishes and priorities of the principal.
- In the firm setting, this is when the management does not act in the best interests of the shareholders.
- For example, perk grabbing is a standard form of agency cost.
- Taking risk beyond that envisaged by the board of directors is yet another; this also affects bond holders, but managers are not usually deemed to be agents of the bond holders.
- As agency costs increase, debt usually decreases, as the costs of debt generally becomes too onerous for the firm.

10. What are the factors that financial strategists and managers usually worry about when determining capital structure? [in order, these are]

- Maintain financial flexibility
- Long term survival

- Maintain a predictable source of funds
- Maximize security prices
- Financial independence
- Maintain debt rating
- Maintain comparability with other firms in industry.

11. **THEOREM (Modigliani-Miller, 1958):**

- Assumptions:
  - (a) No taxes
  - (b) No transaction costs
  - (c) No market frictions
- Under these assumptions, if the capital structure choice does not affect total firm cashflows, then the value of the firm is invariant to capital structure.
- Implicit here is the fact that if cashflows are unaffected, then the risk of the cashflows is the same, and hence the cost of capital is also unchanged. Thus, the value of the firm cannot change.
- PROOF: MM proved their theorem using the principle of no-arbitrage. If two firms with identical cashflows but differing capital structures did not have the same value, then it is possible to make riskless profits by buying the cheaper firm and selling the expensive one, and at maturity, cashflows cancel out leaving riskless profits at inception.
- Let  $X$  be the cashflow of an unlevered firm. Then  $E_T = X, V_U$  is the value. Now take a levered firm with debt  $D$ . At maturity,  $D_T = r_D D$ . Equity  $E = X - r_D D$ .  $V_L = D + E = V_U$  to preclude arbitrage.
  - (a)  $X$  is independent of the D/E ratio (from the no taxes assumption)
  - (b) If transaction costs existed, then exact replication would be difficult to impose no-arbitrage conditions.
  - (c) If markets were not efficient, arbitrage would not wipe out differences in prices of identical cashflow firms, leading to inefficient holding of the theorem.

12. Does the MM theorem hold if bankruptcy is possible?

- If there are no BR costs, the MM theorem holds since the total firm cashflows would not change in the event of bankruptcy, thereby leading to no deviation in comparison to a firm with no debt.
- If there are BR costs, then the theorem breaks down, as an all-equity firm would have different cashflows in the BR states of the world.
- Corollary: This condition holds even in the presence of multiple classes of subordinate debt.

13. Does minimizing taxes always maximize the value of the firm? [yes]

14. **The effect of taxes:** (let the tax rate be  $T_c$ ). Assume no personal taxes. The after tax cashflow of the firm to all its constituents is:

$$\begin{aligned}
 C_T &= (X - r_D D)(1 - T_c) + r_D D \\
 &= \underbrace{X(1 - T_c)}_{\text{all-equity firm}} + \underbrace{r_D D T_c}_{\text{tax shields}} \quad [+ \text{other non-debt tax shields}]
 \end{aligned}$$

15. **Firm Valuation:** this is the PV of after tax cashflows in perpetuity

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$$V_U = PV \left\{ \sum_{t=1}^{\infty} X_t(1 - T_c) \right\}$$

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$$\begin{aligned}
 V_L &= PV \left\{ \sum_{t=1}^{\infty} X_t(1 - T_c) \right\} + PV \left\{ \sum_{t=1}^{\infty} r_D D T_c \right\} \\
 &= V_U + PV \left\{ \sum_{t=1}^{\infty} r_D D T_c \right\} \\
 &= V_U + T_c D
 \end{aligned}$$

The last step is easy to prove using an infinite series sum.

16. **Bankruptcy costs:**

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$$V_L = V_U + T_c D - BR(D)$$

$$\frac{\partial BR}{\partial D} > 0$$

- This results in a tradeoff between tax shields and BR costs, leading to a classic search for optimal capital structure.

**17. Personal Taxes:**

- Usually, because capital gains rates are lower,

$$T_E < T_D, \text{ both different from } T_c$$

- Investors would indifferent between debt and equity, if

$$r_E(1 - T_E) = r_D(1 - T_D)$$

- Make the assumption for now that all equity investors face the same  $T_E$  and debt holders  $T_D$ , are risk-neutral and debt and equity are riskfree.

- Total after all taxes cashflows to stakeholders is:

$$C = (X - r_D D)(1 - T_c)(1 - T_E) + r_D D(1 - T_D)$$

$$= \underbrace{X(1 - T_c)(1 - T_E)}_{\text{all equity firm}} + \underbrace{r_D D[(1 - T_D) - (1 - T_c)(1 - T_E)]}_{\text{tax shields from leverage}}$$

- Discount the tax shields at the after tax debt rate =  $r_D(1 - T_D)$ .

- PV of the leverage gain in perpetuity is

$$PV = \frac{r_D D[(1 - T_D) - (1 - T_c)(1 - T_E)]}{r_D(1 - T_D)}$$

$$= D \left( 1 - \frac{(1 - T_c)(1 - T_E)}{(1 - T_D)} \right)$$

$$= gD$$

- Therefore

$$V_L = V_U + gD$$

$$\text{if } \begin{cases} g > 0 & \text{issue debt} \\ g < 0 & \text{no debt} \end{cases}$$

- Note that  $g$  increases if either of  $T_c, T_E$  increase, and decreases if  $T_D$  increases.

### 18. Differential tax rates for equity and debt

- Recall assumptions: (i) riskfree debt, equity, (ii) risk-neutrality of investors.
- But investors of each type have differential tax rates.
- Miller's equilibrium states that even in this case, under the given assumptions, firms will be indifferent between debt and equity.
- Proof: If  $g = 0$ , then it must be that with personal taxes also, capital structure choice does not matter for firm value. Assume a perfectly elastic supply of debt. This occurs when firms are indifferent between issuing debt and equity, i.e.

$$r_D(1 - T_c) = r_E$$

On the demand side, investors are indifferent between debt and equity when

$$r_D(1 - T_D) = r_E(1 - T_E)$$

In equilibrium, the above two equations can be reduced to one condition (take  $r_D$  to the LHS of each equation, then equate the RHSs)

$$(1 - T_D) = (1 - T_c)(1 - T_E) \implies g = 0 \quad \blacksquare$$

### 19. Why do startups have almost no debt?

- Equity is used for incentives
- They have no earnings to shield.

20. When is preferred stock used as an issuance instrument compared to debt?
- Its like a bond because it has a fixed rate.
  - It has no tax shield, so its worse than debt
  - It cannot force BR, so has lower expected BR costs.
  - In the interbank case only 30% of the income attracts taxes at  $T_c$ .
21. How does the inflation level affect equilibrium debt levels?
- It usually increases it because it increases  $r_D$  which raises the tax shield.
22. Empirical evidence.
- Mackie-Mason (1990) - firms tend to issue equity when they cannot use their tax shields.
  - At the time of the tax reform of 1986, companies that lost their non-debt tax shields raised the most debt.
23. What instruments of issuance might manage risk-shifting problems the best?
- Risk shifting is a moral hazard problem where after debt is raised, management and equity holders raise the volatility of the assets to increase their option value and transfer value away from the debtholders.
  - Issue convertibles, this prevents risk-shifting.
24. What is the pecking order hypothesis?
- Firms will first use inside funds and then external.
  - Two factors matter:
    - (a) Financial flexibility, which is greater when internal funds are used.

- (b) Less control on management, which is not easily attained as equity holders and debt holders carry out independent monitoring.
- A survey showed that the following pecking order is predominant:
  - (a) Retained earnings
  - (b) Plain debt
  - (c) Convertible debt
  - (d) Common equity
  - (e) Preferred stock
  - (f) Convertible preferred (issued by less healthy firms, with lots of agency costs)

25. How is capital structure affected by asymmetric information?

- Leland & Pyle 1977 - not so much a capital structure theory, but they showed that the amount held by management did signal the quality of the project.
- Myers and Majluf 1984 (Investment and Financing policy with differential information).
  - (a) This model assumes that at  $t = 0$ , the managers get a private signal about the value of the project, and even though it is  $NPV > 0$ , they still do not act on it, because the old shareholders lose value. The market does not have the information the managers have.
  - (b) Assume 2 states, and the following are the values of assets-in-place (A) and investment opportunities (B).
 

	State1	State2	
(c) Payoffs A	$a = 150$	$a = 50$	$\bar{a} = 100$
B	$b = 20$	$b = 10$	$\bar{b} = 15$
  - (d) The amount to be invested is 100, so equity needs to be raised,  $E$ .
  - (e) Assume the firm goes ahead and issues stock anyway. Then the old shareholder value is

$$V^{old} = \bar{A} + \bar{B} = 100 + 15 = 115.$$



- (f) State1 - Firm value after issue:  $V^{old} = 150 + 20 + 100 = 270$  (true value). The mkt value will be  $115 + 100 = 215$ .

$$V^{old} = \frac{115}{215}270 = 144.42$$

$$V^{new} = \frac{100}{215}270 = 125.88$$

- (g) State 2 :

$$V^{old} = \frac{115}{215}160 = 85.58$$

$$V^{new} = \frac{100}{215}160 = 74.42$$

- (h) Check:

$$V^{old} = \frac{1}{2} (144.42 + 85.58) = 115$$

$$E = \frac{1}{2} (125.58 + 74.42) = 100$$

(i) Payoff matrix:

Payoff	Issue+invest	Do not invest
$V^{old}$ in S1	144.42	150
$V^{old}$ in S2	85.58	50

- (j) Notice from this that in State 1, even though it makes the sense to invest ( $NPV=20>0$ ), the firm will not as this will reduce their existing shareholder value. In State 2 it is unambiguously better to invest.

26. What is the debt “overhang” problem?