Lecture 10

Capital Structure

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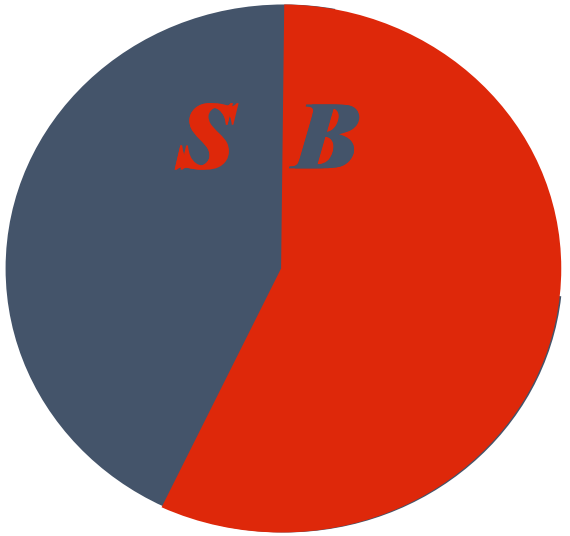
Capital Structure Definition

- Capital structure refers to the amount of debt and equity employed by a firm, expressed as debt to equity ratio.

- The value of a firm is defined to be the sum of the **market** value of the firm's debt and the firm's equity.

$$V = B + S$$



Value of the Firm

- The question is:
  - What capital structure (ratio of debt to equity) maximizes the shareholders' interests?
  - Since the cost of debt is lower than equity, should firm use all debt to fund its operation?

The Leverage Effect of Debt

Consider an all-equity firm that is contemplating going into debt. (Maybe some of the original shareholders want to cash out.)

发了$8,000的债，回购了160股。

	Current	Proposed
Assets	$20,000	$20,000
Debt	$0	$8,000
Equity	$20,000	$12,000
Debt/Equity ratio	0.00	2/3
Interest rate	n/a	8%
Shares outstanding 流通股票	400	240
Share price	$50	$50

Without Debt

Under three possible state of the economy: recession, expected, and expansion

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest	0	0	0
Net income	$1,000	$2,000	$3,000
EPS	$2.50	$5.00	$7.50
ROA	5%	10%	15%
ROE	5%	10%	15%

Current Shares Outstanding = 400 shares

With Debt

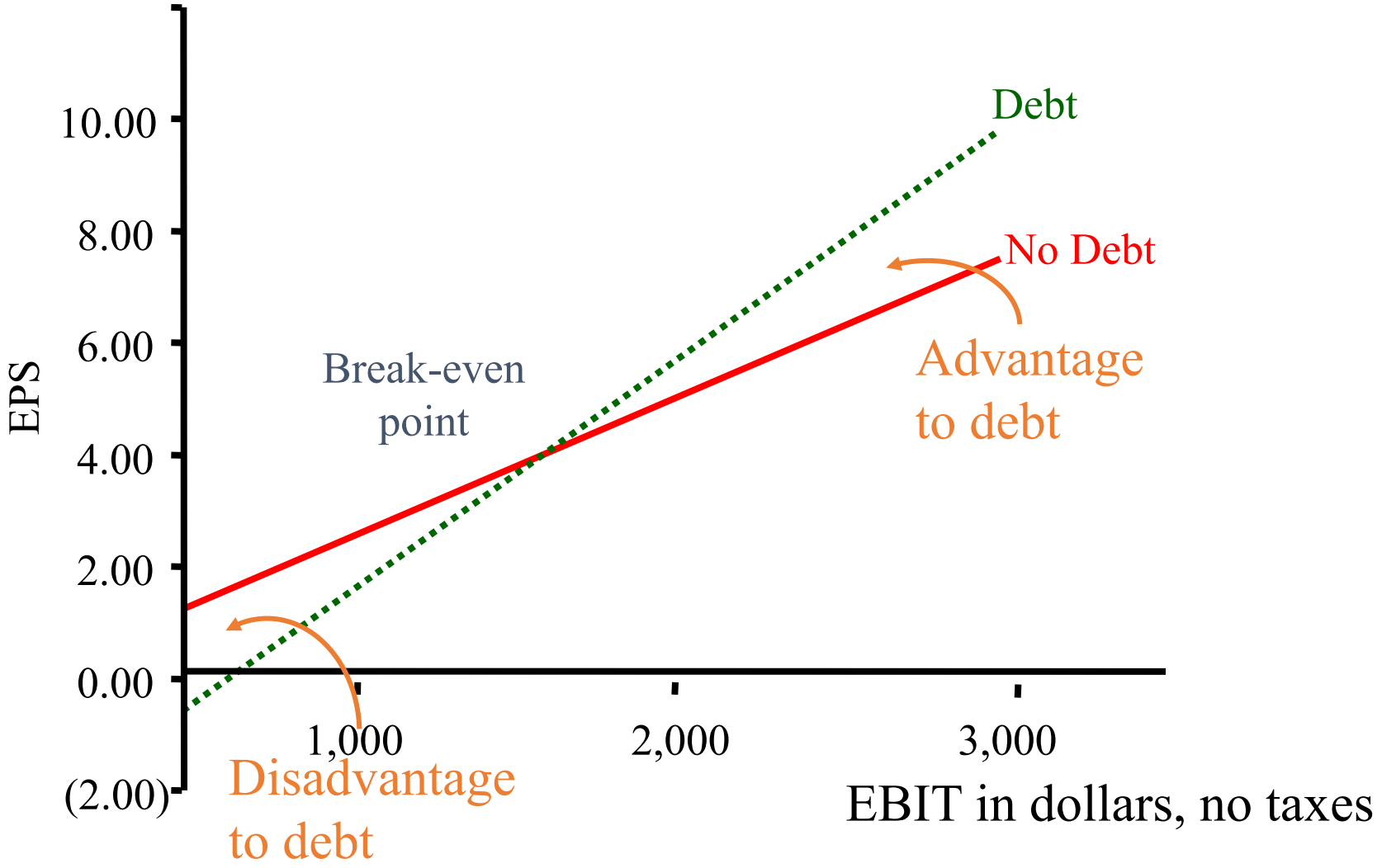
Under three possible state of the economy: recession, expected, and expansion

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest	**640**	**640**	**640**
Net income	$360	$1,360	$2,360
EPS	$1.50	$5.67	$9.83
ROA	1.8%	6.8%	11.8%
ROE	3.0%	11.3%	19.7%

Proposed Shares Outstanding = 240 shares

Debt and EPS

Debt serves as a leverage. In good state, the EPS is higher than EPS without debt. In bad state, the EPS is lower than EPS without debt.



Leverage Effect of Debt

- Debt serves as a leverage(财务杠杆）：
  - In good state, the EPS is higher than EPS without debt.
  - In bad state, the EPS is lower than EPS without debt.
  - More debt, higher leverage, higher firm risk.
- Since leverage increases bankruptcy risk, the optimal strategy should not a 100% debt capital structure.
- Managers should choose the capital structure to maximize **firm value** since it will be most beneficial to shareholders.

MM Proposition I (No Taxes)

Modigliani and Miller (MM)

Without taxes, firm value is irrelevant to its capital structure.

$$V_L = V_U$$

V_L : Levered firm value

V_U : Unlevered firm value

Assumptions of MM Model

- Homogeneous expectations
- Homogeneous business risk classes
- Perpetual cash flows
- Perfect capital markets:
  - Perfect competition
  - Firms and investors can borrow/lend at the same rate
  - Equal access to all relevant information
  - No transaction costs
  - **No taxes**

Why MM Proposition I Holds

- Recall: firm value equals the PV of future free cash flows generated by the firm.
- The difference between with-debt and without-debt is the interest expense. Without taxes, it affects a firm's operating cash flow, but does not affect free cash flows.
- The overall WACC is also not affected since firm business risk is unchanged (Recall issuing more debt increases the risk of equity). Business risk is different from financial risk. Therefore, the valuation remains.

同时增加了 risk of equity 和 expected return

Quick question: Why issuing more debt will not reduce WACC?

MM Proposition II (No Taxes)

Leverage increases the risk and return to **stockholders**

$$R_s = R_0 + (B / S_L)\,(R_0 - R_B)$$

R_B is the interest rate (cost of debt)

R_s is the return on (levered) equity (cost of equity)

R_0 is the return on unlevered equity (cost of capital)

B is the value of debt

S_L is the value of levered equity

Why MM Proposition II Holds

The derivation is straightforward: WACC is the same for the two firms!

$$R_{WACC} = \frac{B}{B+S} \times R_B + \frac{S}{B+S} \times R_S$$

Then set $R_{WACC} = R_0$

$$\frac{B}{B+S} \times R_B + \frac{S}{B+S} \times R_S = R_0$$

multiply both sides by $\frac{B+S}{S}$

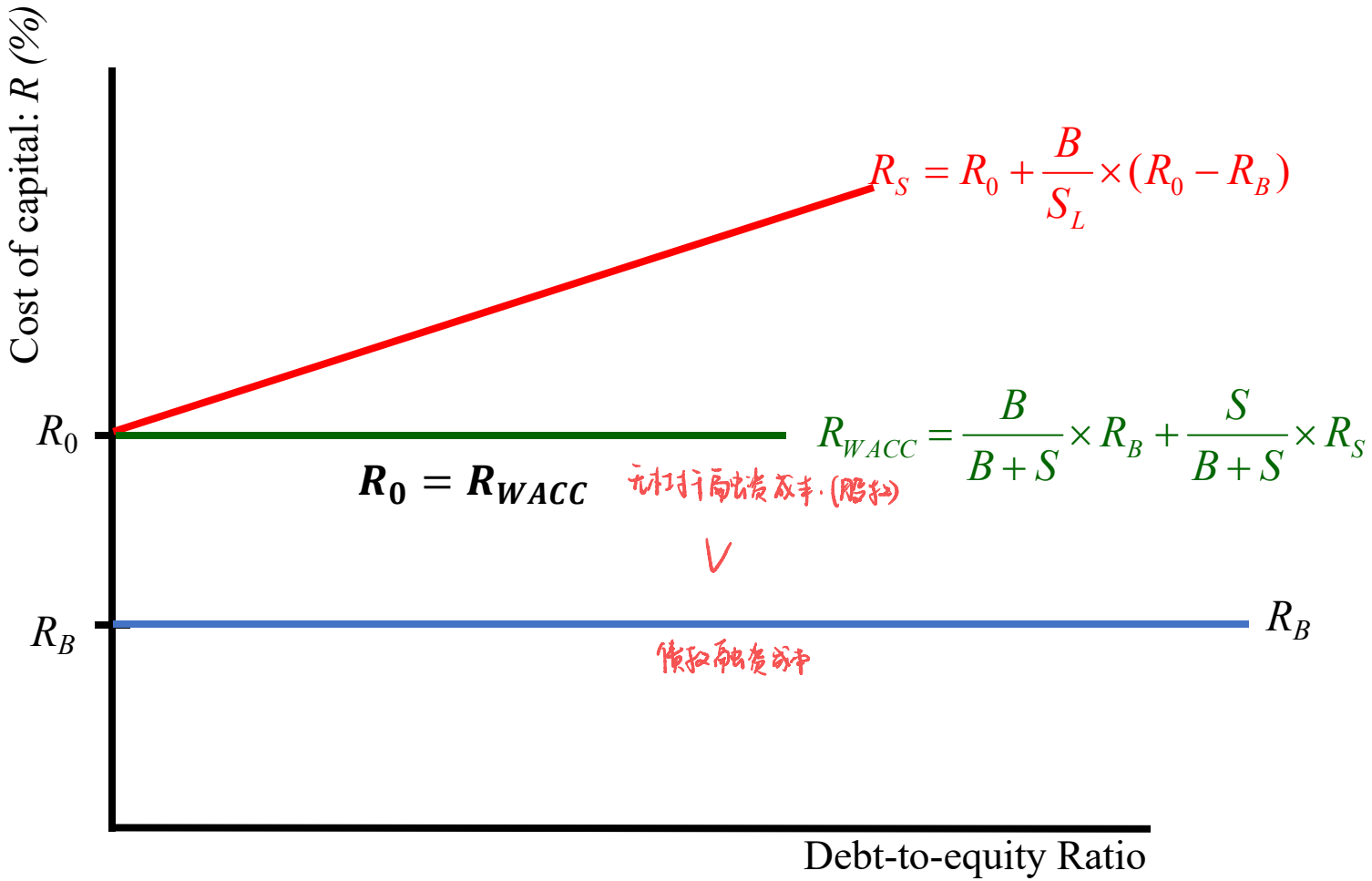
$$\frac{B+S}{S} \times \frac{B}{B+S} \times R_B + \frac{B+S}{S} \times \frac{S}{B+S} \times R_S = \frac{B+S}{S} R_0$$

$$\frac{B}{S} \times R_B + R_S = \frac{B+S}{S} R_0$$

$$\frac{B}{S} \times R_B + R_S = \frac{B}{S} R_0 + R_0$$

$$R_S = R_0 + \frac{B}{S}(R_0 - R_B)$$

MM Proposition II (No Taxes)



Quick question: how stock beta changes after issuing debt?

MM Proposition I (with Taxes):

Firm value increases with leverage

$$V_L = V_U + T_C B$$

V_L : Levered firm value

V_U : Unlevered firm value

T_C: Corporate tax rate 所得税率

B: debt value

$T_C B$: the PV of **tax shield** 税盾

MM Proposition II (with Taxes):

Some of the increase in equity risk and return is offset by the interest **tax shield**

$$R_S = R_0 + (B/S) \times (1\text{-}T_C) \times (R_0 - R_B)$$

R_B is the interest rate (cost of debt)

R_S is the return on equity (cost of equity)

R_0 is the return on unlevered equity (cost of capital)

B is the value of debt

S is the value of levered equity

Why MM Proposition I (with Taxes) Holds?

The total cash flow to all stakeholders is

$$(EBIT - R_B B) \times (1 - T_C) + R_B B$$

The present value of this stream of cash flows is V_L

Clearly $(EBIT - R_B B) \times (1 - T_C) + R_B B =$

$$= EBIT \times (1 - T_C) - R_B B \times (1 - T_C) + R_B B$$

$$= EBIT \times (1 - T_C) - \cancel{R_B B} + R_B B T_C \cancel{+ R_B B}$$

The present value of the first term is V_U

The present value of the second term is $T_C B$ **(we call it PV of tax shield)**

$$V_L = V_U + T_C B$$

Why MM Proposition I (with Taxes) Holds?

All Equity

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest	0	0	0
EBT	$1,000	$2,000	$3,000
Taxes (*Tc* = 35%)	$350	$700	$1,050
Total Cash Flow to S/H	$650	$1,300	$1,950

Levered

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest ($800 @ 8%)	640	640	640
EBT	$360	$1,360	$2,360
Taxes (*Tc* = 35%)	$126	$476	$826
Total Cash Flow	$234+640	$884+$640	$1,534+$640
(to both S/H & B/H):	$874	$1,524	$2,174
$EBIT(1\text{-}Tc)+T_C R_B B$	$650+$224	$1,300+$224	$1,950+$224
	$874	$1,524	$2,174

Why MM Proposition II (with Taxes) Holds?

Start with M&M Proposition I with taxes: $V_L = V_U + T_C B$

Since $V_L = S + B \Rightarrow S + B = V_U + T_C B$

$$V_U = S + B(1 - T_C)$$

cash flow $SR_S + BR_B = V_U R_0 + T_C B R_B$

$S + B = V_U + T_C B$

The cash flows from each side of the balance sheet $V_L = V_U + T_C B$ must equal:

$$SR_S + BR_B = V_U R_0 + T_C B R_B$$

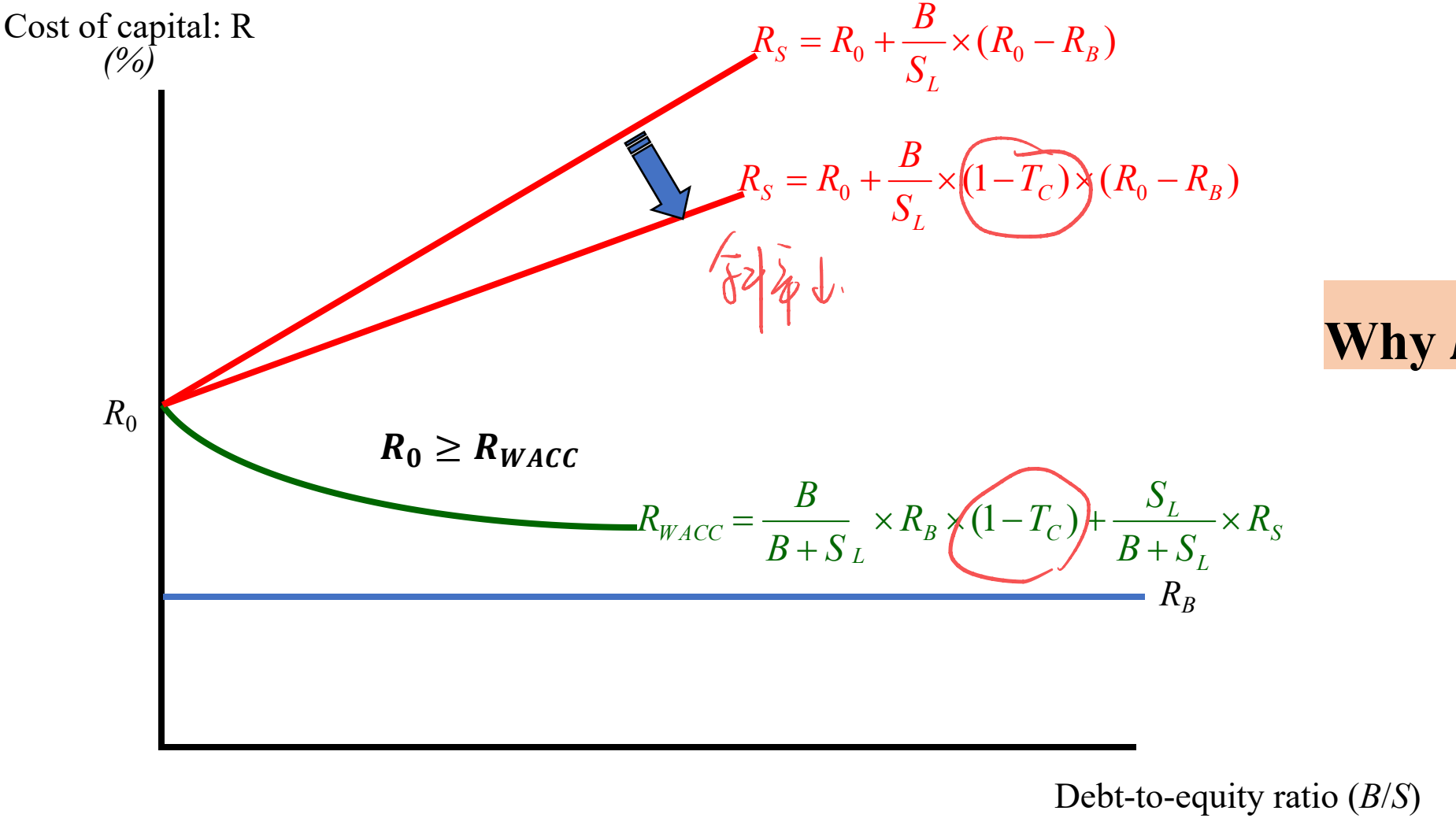
$$SR_S + BR_B = [S + B(1 - T_C)]R_0 + T_C R_B B$$

Divide both sides by S

$$R_S + \frac{B}{S} R_B = [1 + \frac{B}{S}(1 - T_C)]R_0 + \frac{B}{S} T_C R_B$$

Which quickly reduces to $$R_S = R_0 + \frac{B}{S} \times (1 - T_C) \times (R_0 - R_B)$$

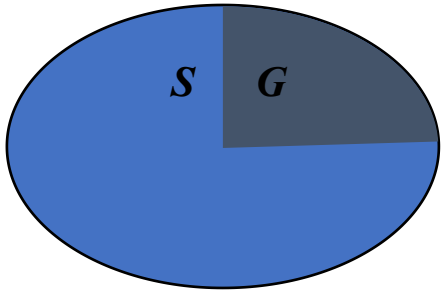
Financial Leverage and WACC



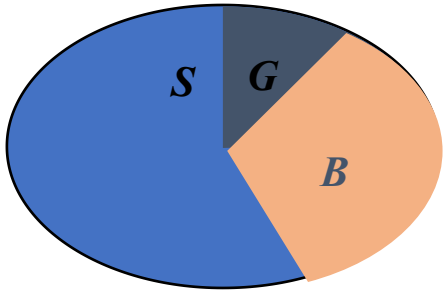
Why $\boldsymbol{R_0 \geq R_{WACC}}$?

Total Cash Flow to Investors

All-equity firm



Levered firm



- S, B, and G represent stockholder, bondholder, and the government, respectively.
- The levered firm pays less in taxes than does the all-equity firm. Thus, the sum of the debt and the equity of the levered firm is greater than the equity of the unlevered firm. Note: G does not belong to the firm anymore.
- This is how cutting the pie differently can make the pie "larger." The government takes a smaller slice of the pie!

Quick Question: Is the WACC the same for the two firms?

Summary: No Taxes

- In a world of no taxes, the value of the firm is unaffected by capital structure.
- This is M&M Proposition I: $V_L = V_U$
- In a world of no taxes, M&M Proposition II states that leverage increases the risk and return to **stockholders**.

$$R_S = R_0 + \frac{B}{S_L} \times (R_0 - R_B)$$

Summary: With Taxes

- In a world of taxes, but no bankruptcy costs, the value of the firm increases with leverage.
- This is M&M Proposition I: $V_L = V_U + T_C B$
- In a world of taxes, M&M Proposition II states that leverage increases the risk and return to stockholders.

$$R_S = R_0 + \frac{B}{S_L} \times (1 - T_C) \times (R_0 - R_B)$$

Other theories on capital structure

- The MM model builds a foundation to explain capital structure decisions. However, it is built upon a perfect world with unrealistic assumptions.
- Academic research seeks to relax these assumptions and propose other theories to explain capital structure in the real world:
  - Tradeoff theory: bankruptcy cost
  - Signaling theory: debt issuance serves as signal for profitability
  - Free cash flow hypothesis: agency conflicts between shareholders and debtholders
  - Pecking order theory: information asymmetry

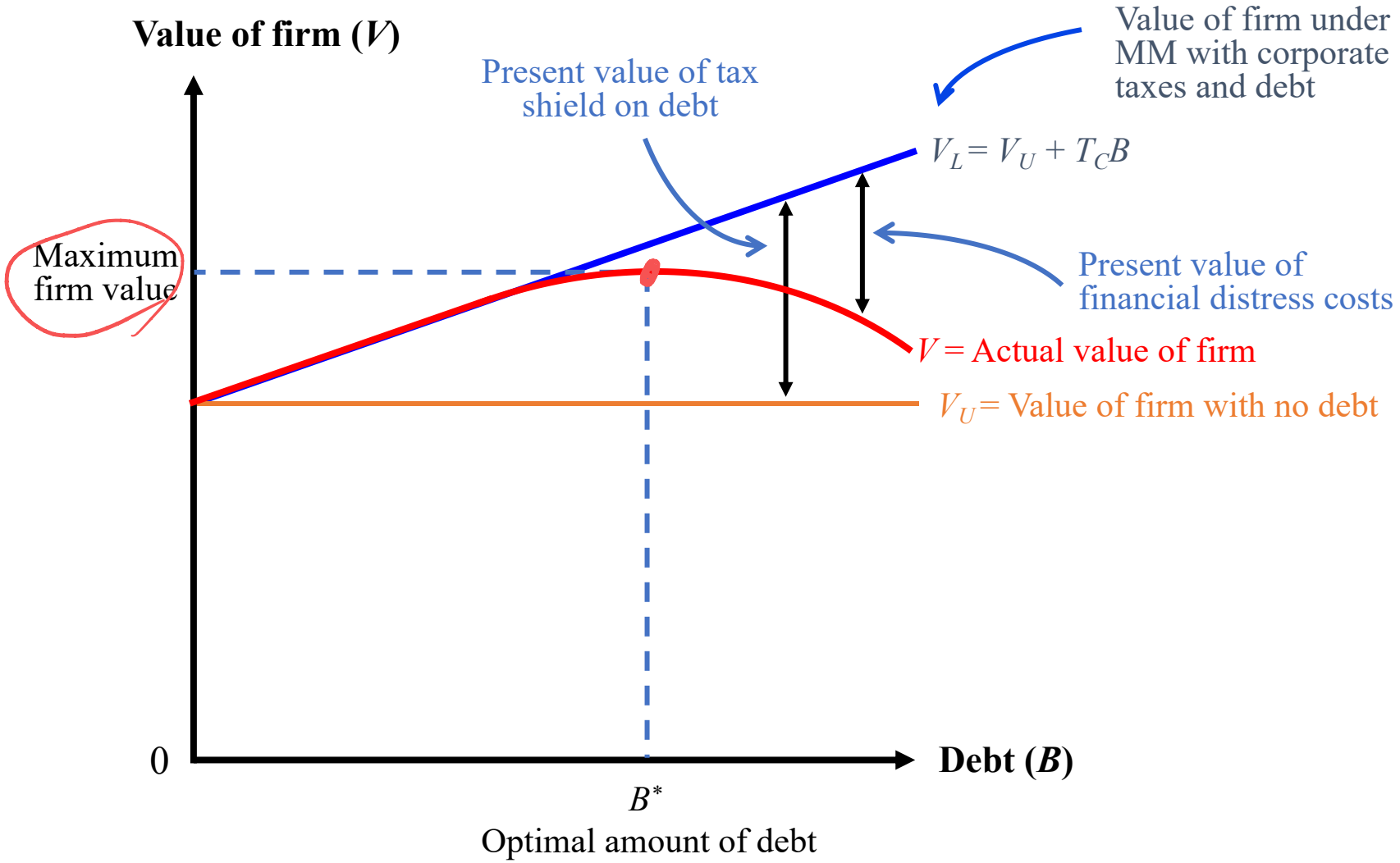
Tradeoff Theory 权衡理论.

- Since $V_L = V_U + T_C B$, the MM Proposition I suggests that firms should take on as much debt as possible.
- However, in the real world, more debt means greater obligations on interest and principle payments, causes higher costs of financial distress. The ultimate distress is bankruptcy.
- Bankruptcy does not lower the cash flows. Rather, it is the cost associated with bankruptcy that lower cash flows.
- **Trade off theory**: Firms trade off between tax subsidy and cost of financial distress.

税收利益

财务困境

Trade off Theory



Signaling Theory

低预期利润→低债务

- Firms with low anticipated profits will take on a low level of debt. In contrast, firms with high anticipated profits will take on a high level of debt.

- Investors view debt as a signal of firm profitability.

- If the manager knows how investors think, he has incentive to fool them by taking on more-than-optimal debt. However, investors will discover it later and the firm will pay the cost in the long run.

Free Cash Flow Hypothesis

- Free Cash Flow Hypothesis: Firms issue debt because it can reduce free cash flow and thus mitigate agency costs.
- Agency conflicts between managers and shareholders: While managers may have motive to partake in perquisites, they also need opportunity. Free cash flow provides this opportunity.
- An increase in dividends should benefit the stockholders by reducing the ability of managers to pursue wasteful activities.
- An increase in debt will reduce the ability of managers to pursue wasteful activities more effectively than dividend increases.

Pecking-Order Theory

- Information asymmetry: managers know the true value of the firm while investors do not.
- When equity is overpriced, managers tend to issue equity. When debt is overpriced, managers tend to issue debt. Since debt is less risky, its mispricing is relatively small.
- Investors know the strategy of managers, and thus refuse to provide capital.
- In equilibrium, **pecking order（优序融资理论）**: Internal financing > debt > equity.

Pecking-Order Theory

- Pecking-order theory states that firms prefer to issue debt rather than equity if internal financing is insufficient.

- Priority: Use internal financing first, Issue debt next, new equity last

- The pecking-order theory is at odds with the tradeoff theory:
  - There is no target D/E ratio
  - Profitable firms use less debt
  - Companies like financial slack

Capital Structure In The Real World

- Most corporations have low Debt-Asset ratios.
- Changes in financial leverage affect firm value.
  - Stock price increases with leverage and vice-versa; this is consistent with M&M with taxes.
  - Another interpretation is that firms signal good news when they lever up.
- There are differences in capital structure across industries and even through time.
- There is evidence that firms behave as if they had a target Debt-Equity ratio.

Profitability and Leverage

- Though many theories exist to explain capital structure, none of them dominates the other. Empirical evidence is inconclusive.

- For example, should profitable firms use more or less debt?
  - Trade off theory predicts: more
  - Pecking order theory predicts: Less
  - Signaling theory predicts: more

- Empirical evidence: Fama and French (2000) documented that profitable firms were less levered as compared to non-profitable firms.