Chapter 16

Capital Structure: Basic Concepts

资本结构：基本概念

Key Concepts and Skills

- Understand the effect of financial leverage (i.e., capital structure) on firm earnings
- Understand homemade leverage
- Understand capital structure theories with and without taxes
- Be able to compute the value of the unlevered and levered firm

Financial Leverage, EPS, and ROE

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

	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	400	240
Share price	$50	$50

EPS and ROE Under Current Structure

	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

EPS and ROE Under Proposed Structure

	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

LEV

	Current	Proposed
Assets	$8,000	$8,000
Debt	$ 0	$4,000
Equity (market and book)	$8,000	$4,000
Interest rate	10%	10%
Market value/share	$ 20	$ 20
Shares outstanding	400	200

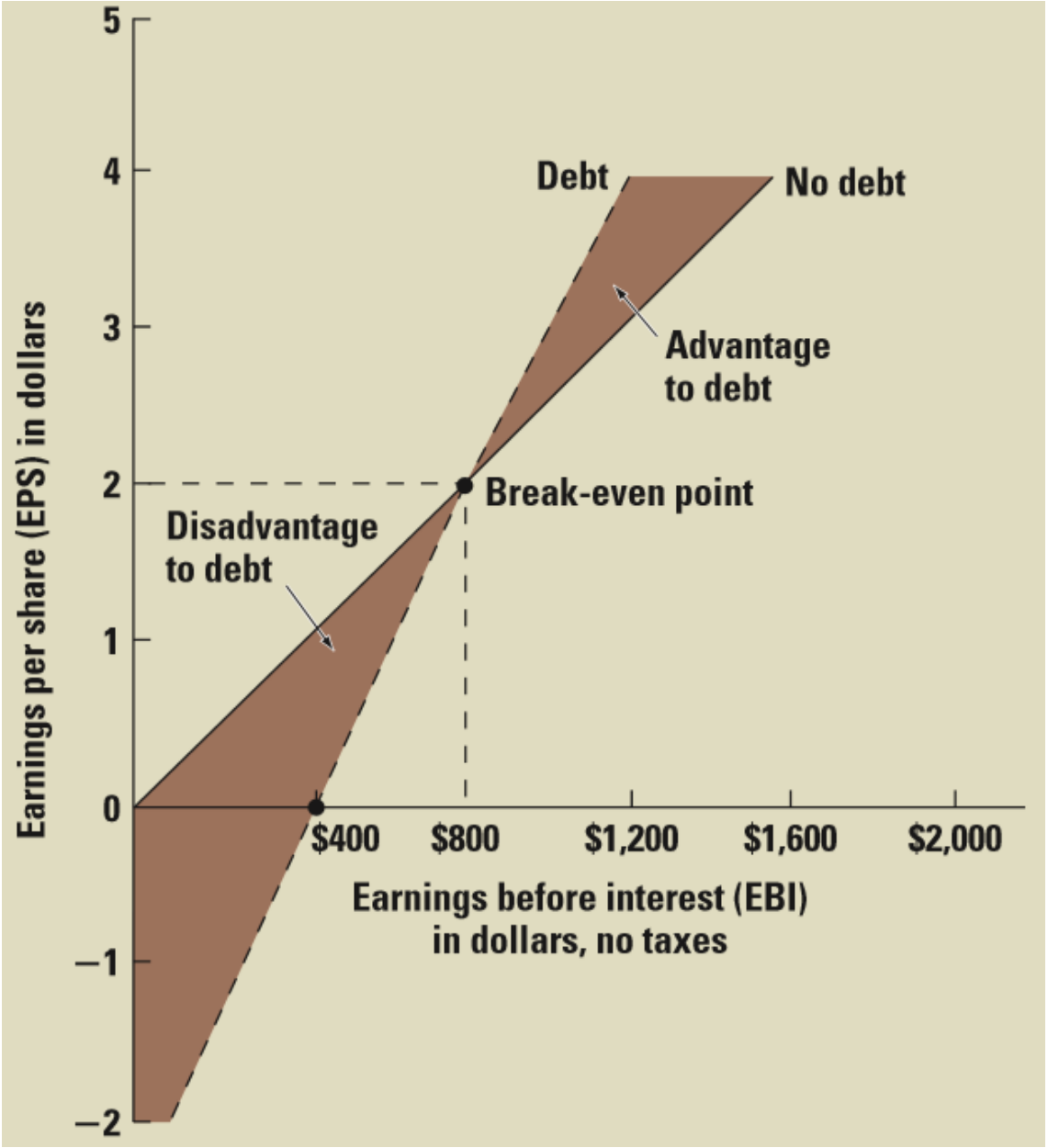
Under current capital structure

	Recession	Expected	Expansion
Return on assets (ROA)	5%	15%	25%
Earnings	$400	$1,200	$2,000
Return on equity (ROE) = Earnings/Equity	5%	15%	25%
Earnings per share (EPS)	$1.00	$3.00	$5.00

Under proposed capital structure

	Recession	Expected	Expansion
Return on assets (ROA)	5%	15%	25%
Earnings before interest (EBI)	$400	$1,200	$2,000
Interest	−400	−400	−400
Earnings after interest	$ 0	$ 800	$1,600
Return on equity (ROE) = Earnings after interest/Equity	0	20%	40%
Earnings per share (EPS)	0	$ 4.00	$ 8.00

LEVERAGE AND RETURNS TO SHAREHOLDERS



Assumptions of the M&M Model

- The Modigliani–Miller theorem (of Franco Modigliani, Merton Miller) is a theorem on capital structure, arguably forming the basis for modern thinking on capital structure.

- M&M Model without taxes
  - Firms and investors can borrow/lend at the same rate
  - No transaction costs
  - No taxes

- M&M Model with taxes
  - Corporations are taxed at the rate t, on earnings after interest
  - No transaction costs
  - Firms and investors can borrow/lend at the same rate

Homemade Leverage: An Example

	Recession	Expected	Expansion
EPS of Unlevered Firm	*$2.50*	*$5.00*	*$7.50*
Earnings for 40 shares	$100	$200	$300
Less interest on $800 (8%)	$64	$64	$64
Net Profits	$36	$136	$236
ROE (Net Profits / $1,200)	3.0%	11.3%	19.7%

We are buying 40 shares of a $50 stock, using $800 in margin.
We get the same ROE as if we bought into a levered firm.

Our personal debt-equity ratio is: $\frac{B}{S} = \frac{\$800}{\$1,200} = 2/3$

Homemade (Un)Leverage: An Example

	Recession	Expected	Expansion
EPS of Levered Firm	*$1.50*	*$5.67*	*$9.83*
Earnings for 24 shares	$36	$136	$236
Plus interest on $800 (8%)	$64	$64	$64
Net Profits	$100	$200	$300
ROE (Net Profits / $2,000)	5%	10%	15%

Buying 24 shares of an otherwise identical levered firm along with some of the firm's debt gets us to the ROE of the unlevered firm.

This is the fundamental insight of M&M

MM Proposition I (No Taxes)

- We can create a levered or unlevered position by adjusting the trading in our own account.
- This homemade leverage suggests that capital structure is irrelevant in determining the value of the firm:

$$V_L = V_U$$

MM Proposition II (No Taxes)

- Proposition II
  - 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

MM Proposition II (No Taxes)

The derivation is straightforward:

$$R_{WACC} = \frac{B}{B+S} \times R_B + \frac{S}{B+S} \times R_S \qquad \text{Then set } R_{WACC} = R_0$$

$$\frac{B}{B+S} \times R_B + \frac{S}{B+S} \times R_S = R_0 \quad \text{multiply both sides by } \frac{B+S}{S}$$

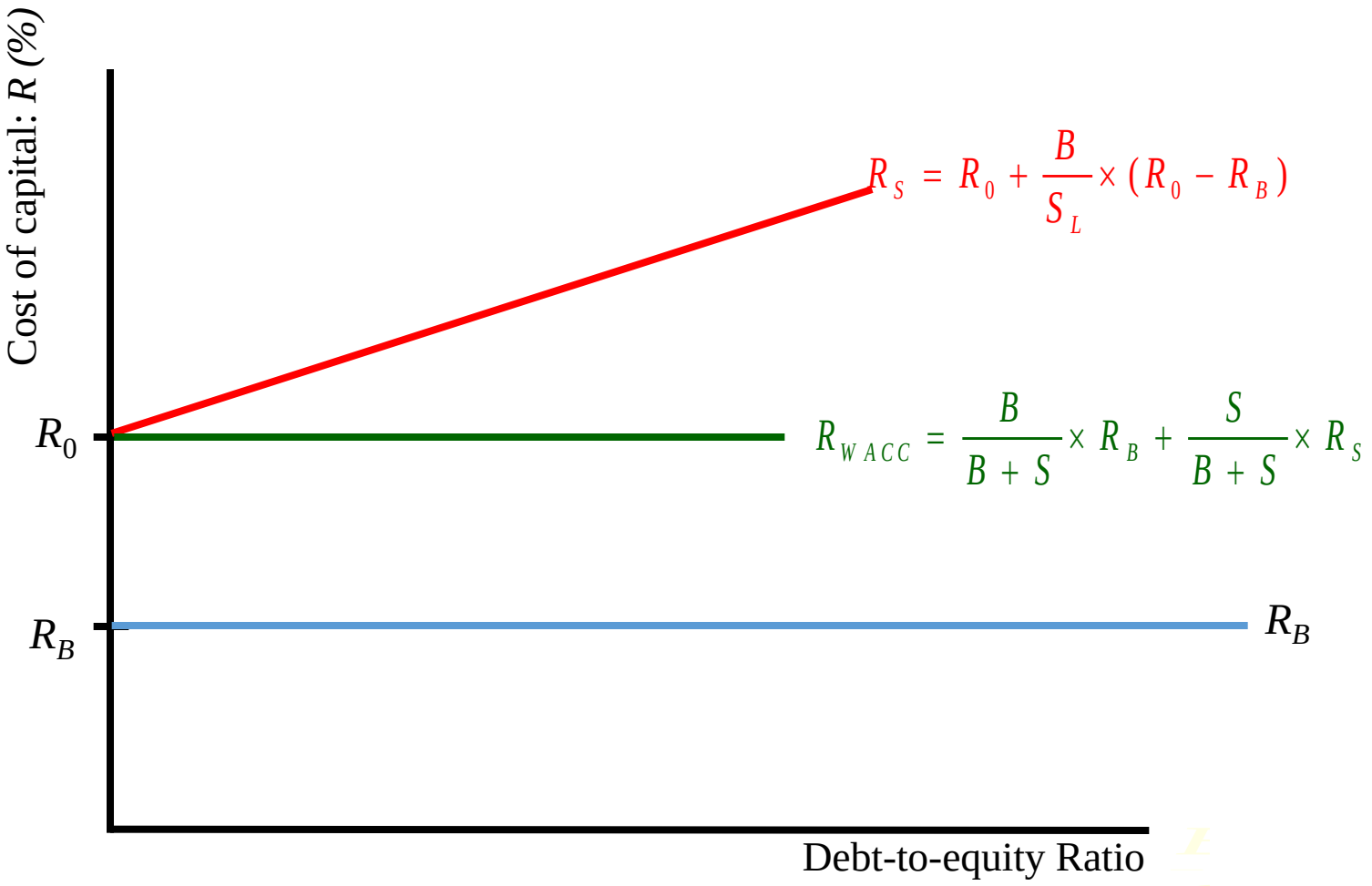
$$\frac{\cancel{B+S}}{S} \times \frac{B}{\cancel{B+S}} \times R_B + \frac{\cancel{B+S}}{\cancel{S}} \times \frac{\cancel{S}}{\cancel{B+S}} \times R_S = \frac{B+S}{S} R_0$$

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

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

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

MM Proposition II (No Taxes)



MM Propositions I & II (With Taxes)

- Proposition I (with Corporate Taxes)
  - Firm value increases with leverage

$$V_L = V_U + T_C B$$

- Proposition II (with Corporate 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

MM Proposition I (With Taxes)

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 $T_C B$

$$\therefore V_L = V_U + T_C B$$

MM Proposition II (With Taxes)

$t_C B$ = Tax shield	S = Equity
V_U = Value of unlevered firm	B = Debt

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

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

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

The cash flows from each side of the balance sheet must equal:

$$S R_S + B R_B = V_U R_0 + T_C B R_B$$

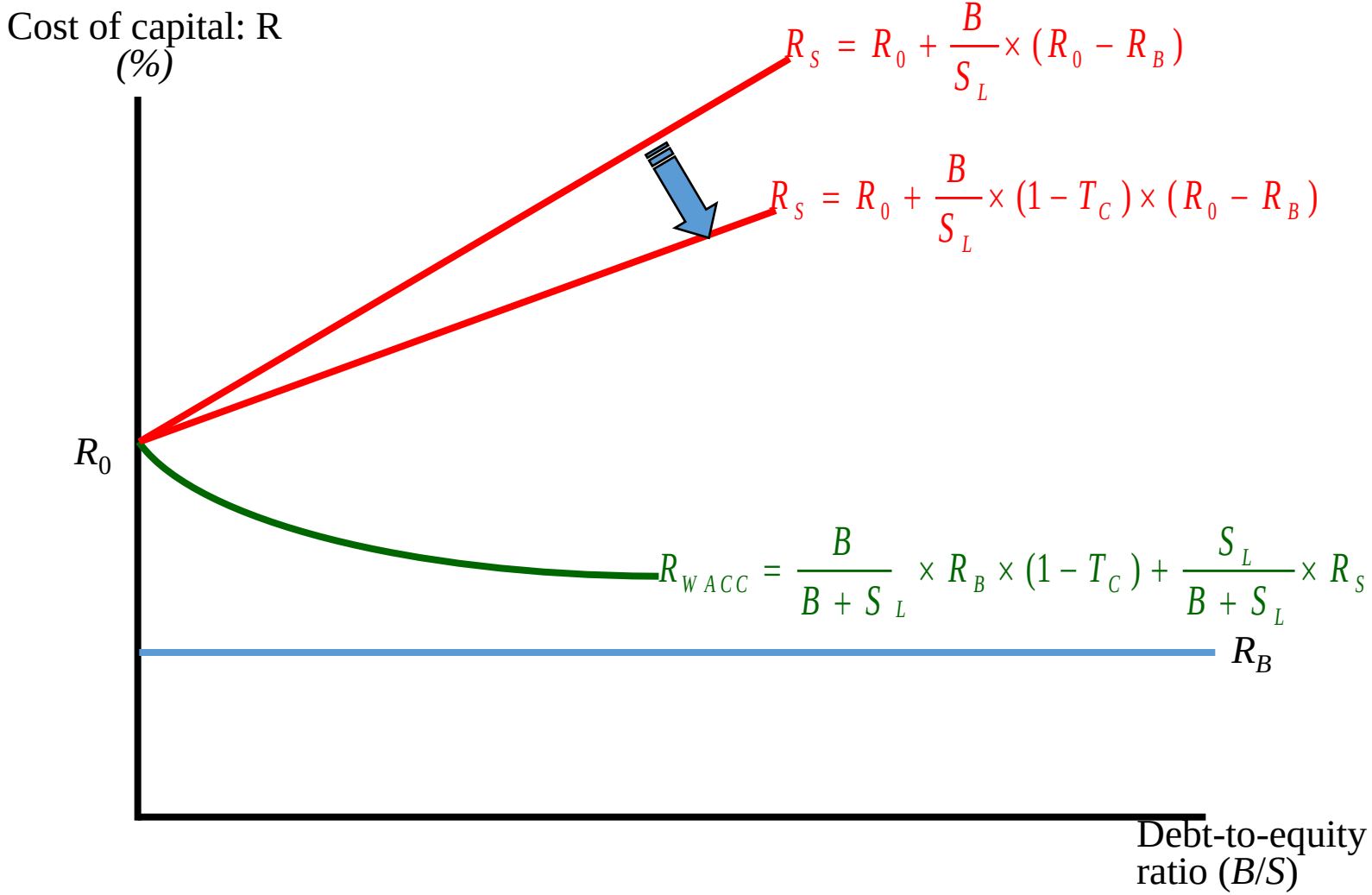
$$S R_S + B R_B = [S + B(1 - T_C)] R_0 + T_C R_B B$$

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

The Effect of Financial Leverage



Total Cash Flow to Investors

All Equity

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

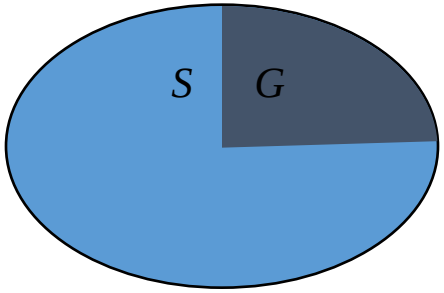
Levered

	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest ($8000 @ 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	$2,174
EBIT(1-Tc)+$T_C R_B B$	$650+$224	$1,300+$224	$1,950+$224
	$874	$1,524	$2,174

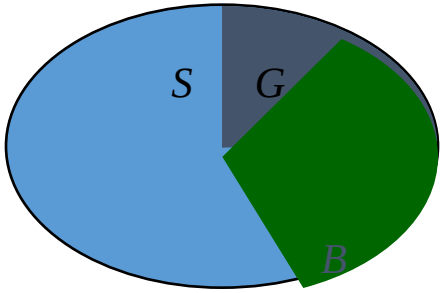
640*0.35

Total Cash Flow to Investors

All-equity firm



Levered firm



The levered firm pays less in taxes than does the all-equity firm.

Thus, the sum of the debt plus the equity of the levered firm is greater than the equity of the unlevered firm.

This is how cutting the pie differently can make the pie “larger.”
-the government takes a smaller slice of the pie!

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:

$$V_L = V_U$$

- Proposition I holds because shareholders can achieve any pattern of payouts they desire with homemade leverage.
- 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: Taxes

- In a world of taxes, but no bankruptcy costs, the value of the firm increases with leverage.
- This is M&M Proposition I:

$$V_L = V_U + T_C B$$

- Proposition I holds because shareholders can achieve any pattern of payouts they desire with homemade leverage.
- In a world of taxes, M&M Proposition II states that leverage increases the risk and return to stockholders.

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

Quick Quiz

- Why should stockholders care about maximizing firm value rather than just the value of the equity?
- How does financial leverage affect firm value without taxes? With taxes?
- What is homemade leverage?