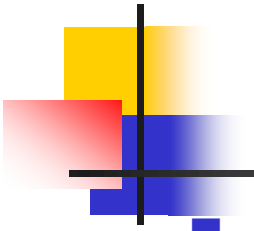
Capital Structure Basic Concepts (Chapter 16)

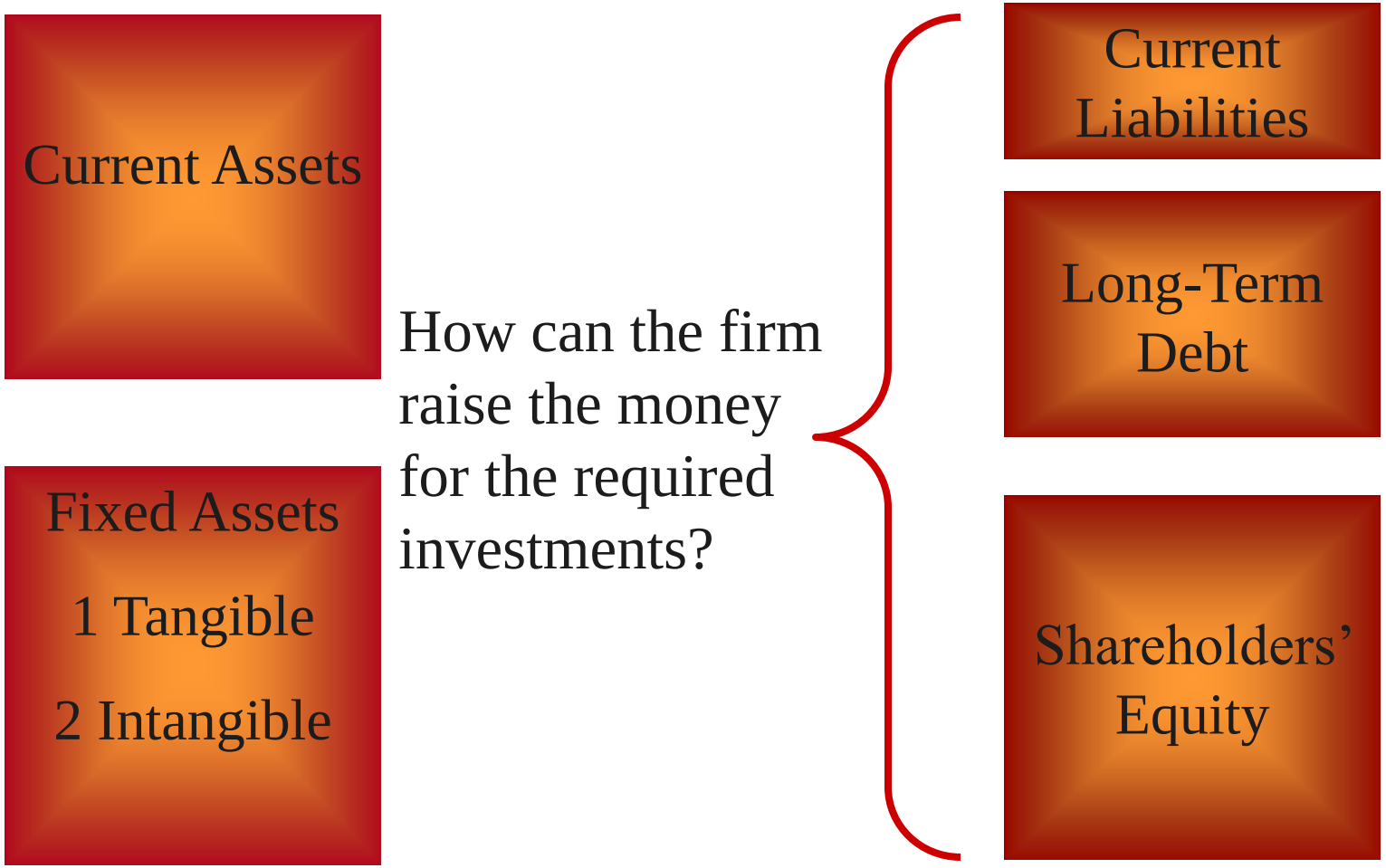
Key Concepts and Skills



- Understand and explain the effect of financial leverage (i.e., capital structure) on firm valuation, cost of capital, and earnings
- Understand and conduct **homemade leverage (and unleveraged)**
- Understand and construct **capital structure arbitrage**
- Understand and explain capital structure theories with and without taxes
- Be able to calculate the value of the unlevered and levered firm

The Balance-Sheet Model of the Firm (Recall: Chapter 1)

The Capital Structure Decision

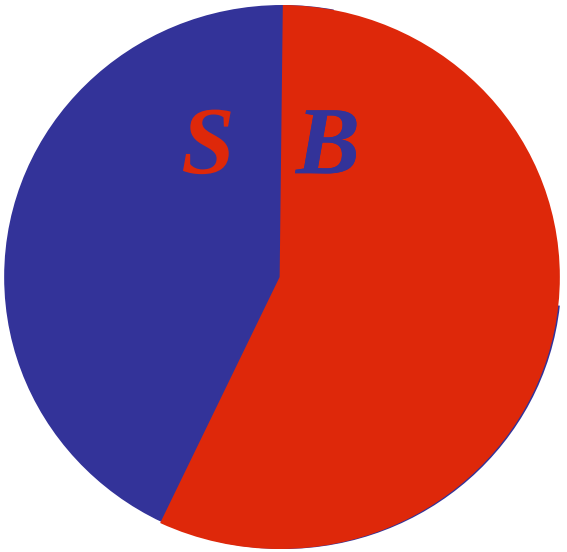


16.1&2 Capital Structure & the Pie

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

  i.e., $V = B + S$

  - The goal of the firm's management is to make the firm as valuable as possible. Hence, the firm should pick the debt-equity ratio that makes the pie as big as possible.



The Capital Structure decision can be viewed as how best to slice up the pie. If how you slice the pie affects the size of the pie, then the capital structure decision matters.

Two Fundamental Questions

- Q1 - Does capital structure (or financing decision), i.e., the mix of debt and equity, affect the total value of the firm?
  - Recall: V = B + S (Firm Value Identity; Pie)
  - Maximization of long-term firm value and hence shareholder interests (i.e., value)
    - Optimal capital structure is one that maximizes long-term firm value!

- Q2 - If it does, then what factors affect the optimal mix of debt and equity?

16.3 Financial Leverage, EPS, and ROE (NO Taxes)

Consider an all-equity firm, i.e., "Current", that is contemplating going into, say, 40% debt financing, i.e., "Proposed". (Maybe some 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 (NO Debt)

	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

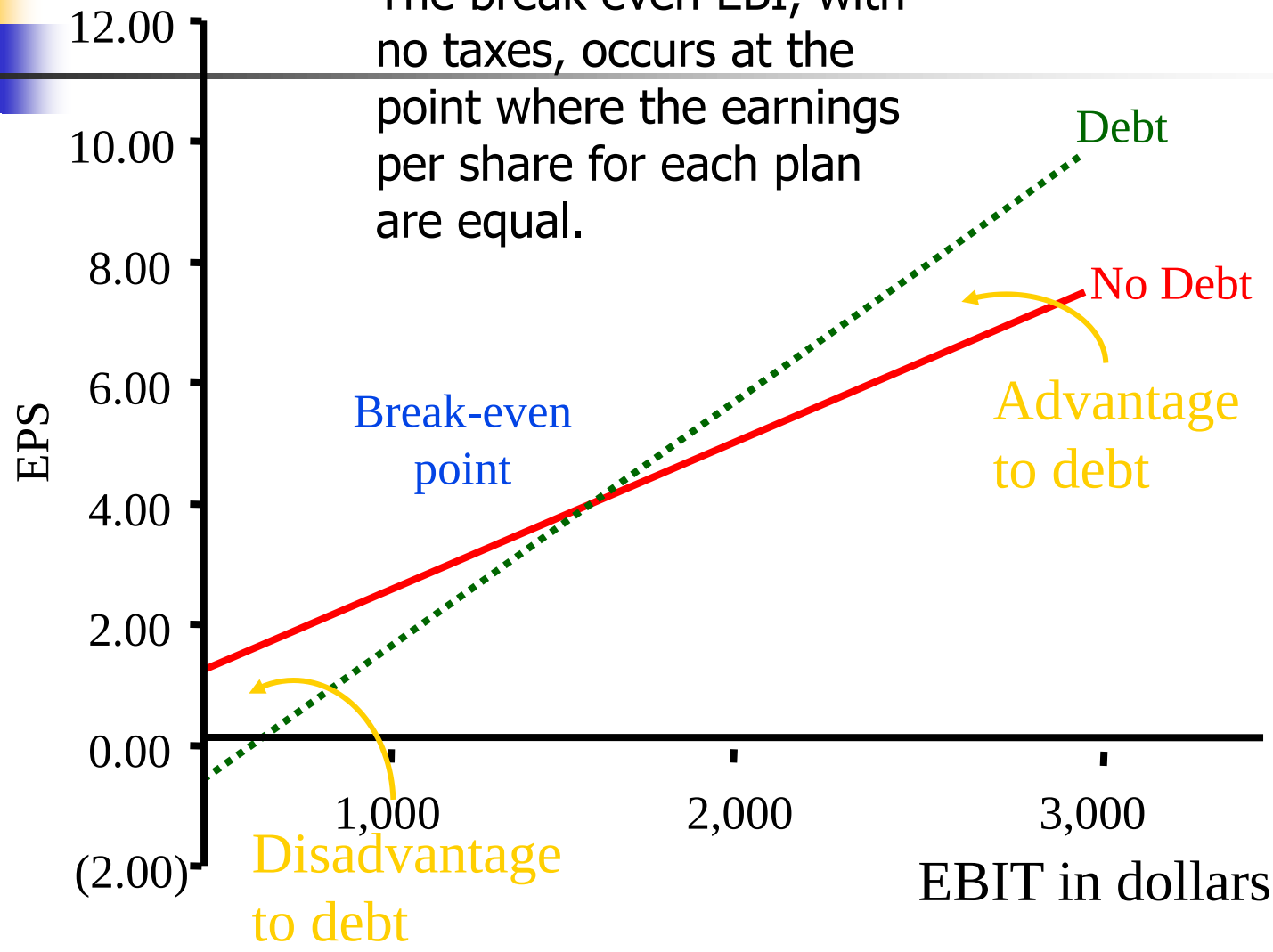
("Proposed" 40% Debt Financing @ 8% rate)

	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

Financial Leverage and EPS

The break-even EBI, with no taxes, occurs at the point where the earnings per share for each plan are equal.



5: Break-even EBI, no tax

You are considering two different capital structures. Plan A consists of 30,000 shares of stock. Plan B consists of 20,000 shares of stock plus $350,000 of debt. The interest rate is 9% and there are no taxes.

What is the break-even level of EBI between these two plans?

What is the break-even level of EPS?

If EBI is $78,000, which plan will produce the higher EPS?

$$\frac{EBI}{30{,}000} = \frac{EBI - (\$350{,}000 \times .09)}{20{,}000}$$

$$20{,}000EBI = 30{,}000EBI - 30{,}000(\$31{,}500)$$

$$10{,}000EBI = \$945{,}000{,}000$$

$$EBI = \$94{,}500$$

$$\text{Break-even EPS} = \frac{\$94{,}500}{30{,}000} = \frac{\$94{,}500 - (\$350{,}000 \times .09)}{20{,}000} = \$3.15$$

$$\text{Unlevered EPS} = \frac{\$78{,}000}{30{,}000} = \$2.60$$

$$\text{Levered EPS} = \frac{\$78{,}000 - (\$350{,}000 \times .09)}{20{,}000} = \$2.33$$

Capital Structure

- Examine capital structure under strict simplifying assumptions (Chapter 16)
  - Foundation of Modern Corporate Finance

- Add back market imperfections such as bankruptcy costs and agency problems, in an attempt to explain the capital structure observed in practice (Chapter 17)

16.4 Modigliani and Miller (AER 1958)

- Assumptions of the original M&M model:
  - All physical assets are owned by corporations;
  - Perfect competitive and frictionless capital markets (no taxes, transactions costs or bankruptcy costs), i.e., no contracting costs;
  - Corporations can issue only two types of securities – risky equity and risk-free debt;
  - Both individuals and corporations can borrow or lend at the risk-free rate;
    - Note – It's ok with risky debt as long as corporations and individuals can borrow or lend at the same interest rate, i.e., **homemade leverage/unleverage** is allowed!

Modigliani and Miller (AER 1958)

- Assumptions of M&M model, continued
  - Symmetric information;
    - ➔ No information asymmetry on growth options
  - Homogeneous and rational expectations;
  - Homogeneous business risk classes;
    - ➔ EBIT is not affected by debt financing
  - Exogenous investment decisions;
    - ➔ Preceding the financing decisions
  - Zero growth – thus all cash flow streams are perpetuities (for simplifying the analysis)

Modigliani and Miller (1958) Proposition I - NO taxes

- Capital structure is **irrelevant** to firm value
  - "The market value of any firm is independent of its capital structure and is given by capitalizing its expected cash flows at the rate of return appropriate to its (business) risk class."

Capital structure is **irrelevant** to WACC

- The favorable impact of the increasing use of (lower-cost) debt capital on the WACC is perfectly offset by the rise in the cost of equity in the capital structure.

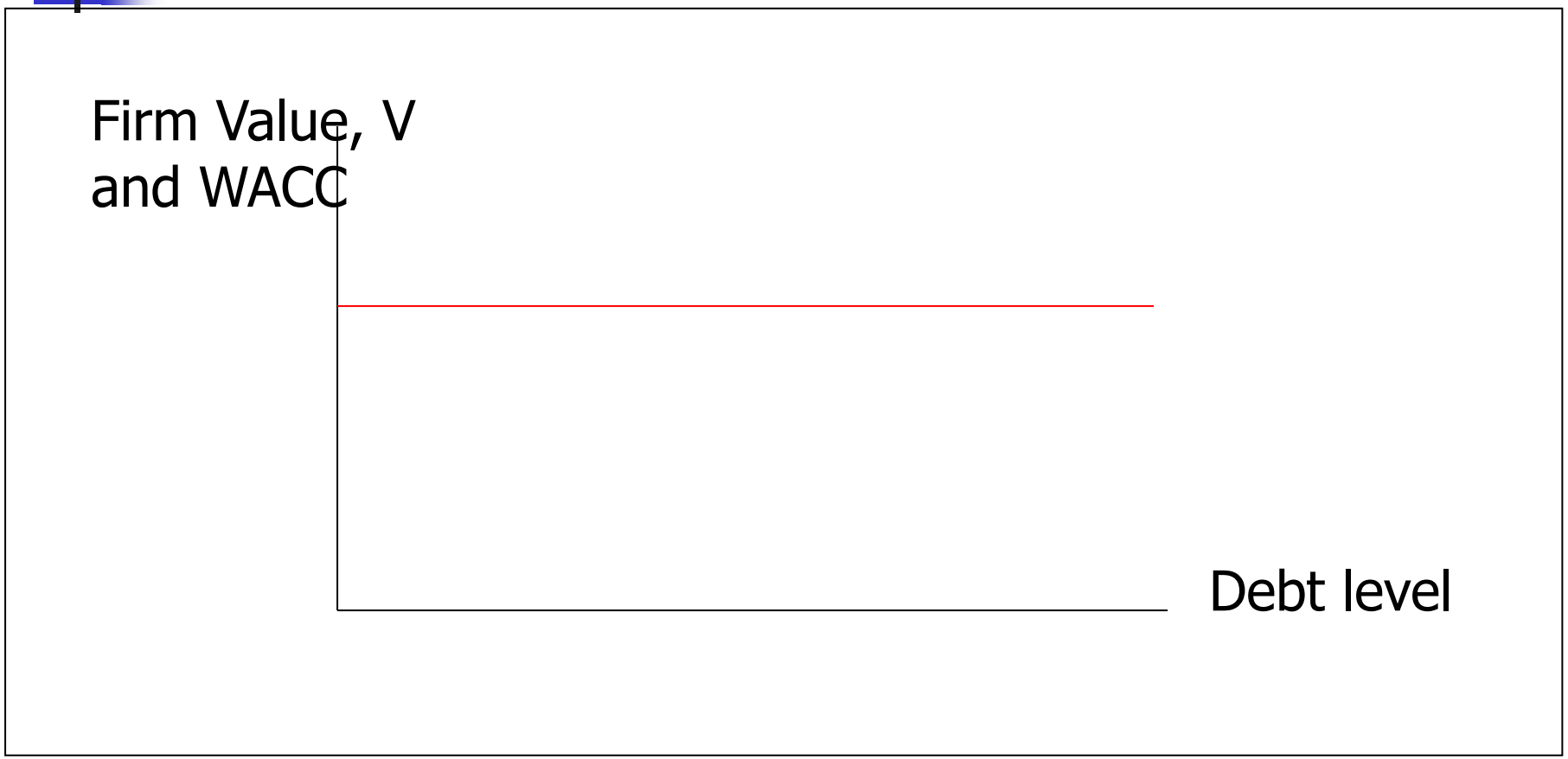
Equations M&M Proposition I (NO taxes)

- V_U = EBIT / Ro (i.e., unlevered cost of capital)
- V_L = EBIT / WACC

- **$V_U = V_L$**
  - Firm value is **independent** of financing decision

- **$WACC = B/(B+S)*R_B + S/(B+S)*R_S$**
  - Cost of capital is **independent** of financing decision

Firm Value under M&M Prop I (NO taxes)



Homemade Leverage: An Example

(Ref: Slide #7)	Recession	Expected	Expansion
*EPS (**Unlevered** Firm)*	*$2.50*	*$5.00*	*$7.50*
Earnings (40 shares)	$100	$200	$300
Less interest ($800@8%)	$64	$64	$64
Net Profits	$36	$136	$236
ROE (Net Profits / $1,200)	3.0%	11.3%	19.7%

*Let's buy 40 shares (i.e., 10% ownership) of the $50 stock, and borrow $800 to finance the purchase, i.e., **homemade leverage**. We get the same ROE as if we bought into the **levered** firm.* (ref: Slide #8)

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

<Note – Personal leverage has the same ratio as that of corporate leverage!)

Homemade (Un)Leverage: An Example

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

Let's buy 24 shares of an otherwise identical levered firm along with $800 of the firm's debt, i.e., **homemade unleverage**. These transactions produce the ROE of the **unlevered** firm. (ref: Slide #7)

This is the fundamental insight of M&M (1958)'s Capital Structure Irrelevancy!

Homemade Leverage (No Tax)

Utilsworth, Inc., is an all-equity firm with EBI of $460,000. There are 115,000 shares of stock outstanding at a market price of $40 a share. Utilsworth has just decided to issue $1.15 million of debt at a rate of 8.5% to repurchase shares of stock. Katie owns 25,000 shares of this stock and wants to use homemade leverage to offset the leverage being assumed by the firm. Ignore taxes.

How many shares of stock must Katie sell to achieve her goal if she loans out the funds from the stock sale at 8.5% interest?

Homemade Leverage (No Tax)

$$\text{Interest} = \$1{,}150{,}000 \times .085 = \$97{,}750$$

$$\text{Shares repurchased} = \frac{\$1{,}150{,}000}{\$40} = 28{,}750 \text{ shares}$$

$$\text{Shares outstanding with debt} = 115{,}000 - 28{,}750 = 86{,}250$$

Homemade Leverage (No Tax)

		Weights
Stock: 86,250 × $40	= $3,450,000	75%
Debt:	= $1,150,000	25%
Total:	$4,600,000	100%

Homemade Leverage (No Tax)

Investment = 25,000 × $40 = $1,000,000

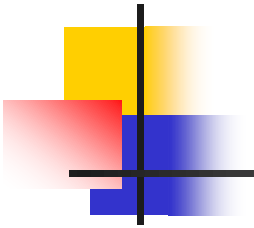
Stock:
75% of $1,000,000 = $750,000
$750,000 ÷ $40 = 18,750 shares

Shares to be sold:
25,000 shares - 18,750 shares = 6,250 shares
Sale proceeds = 6,250 shares × $40 = $250,000

Loan out:
25% of $1,000,000 = $250,000

Example on M&M I
(At Equilibrium)

	Firm U	Firm L (B/S=1)
Operating Income	$100,000	$100,000
Interest paid	0	$30,000
Net Income	$100,000	$70,000
Discount Rate	R_O=10%	WACC=10%
Total firm value, V	$1,000,000	$1,000,000
Required R_S	10%	14%
MV Equity, S	$1,000,000	$500,000
Interest rate, R_B	NA	6%
MV debt, B	$0	500,000



- Calculate value of unlevered firm:
  - V_U = \$100,000 / .10 = \$1,000,000
- Calculate value of levered firm:
  - S = \$70,000 / .14 = \$500,000
  - B = \$30,000 / .06 = \$500,000
  - V_L = S + B = \$1,000,000
    - V_L = \$1,000,000 = V_U !

Example on M&M I cont'd (Disequilibrium Values; i.e., Misvaluation of Firms U vs L!

	Firm U	Firm L
Operating Income	$100,000	$100,000
Interest paid	0	$30,000
Net Income	$100,000	$70,000
Discount Rate	R_O=10%	WACC=9.434%
Total firm value, V	$1,000,000	$1,060,000
Required R_S	10%	say 12.50%
MV Equity, S	$1,000,000	$560,000
Interest rate, R_B	NA	6%
MV Debt, B	$0	500,000

Disequilibrium Values

- Calculate value of unlevered firm:
  - V_U = \$100,000 / .10 = \$1,000,000
- Calculate value of levered firm:
  - S = \$70,000 / .125 = \$560,000
  - B = \$30,000 / .06 = \$500,000
  - V_L = 1,060,000
    - V_L = \$1,060,000 > \$1,000,000 = V_U !
      - V_L (or V_U) is relatively over- (or under-) priced!

Proving M&M Proposition I using Homemade Leverage (Determine Relative Misvaluation)

- Assume the two firms, U and L, have the same operating risk and can borrow at the risk-free rate. Suppose Jane owns 1% of Firm L's stock. Jane can make an arbitrage profit by selling her shares of Firm L's overpriced stock, borrowing on personal account (i.e., homemade leverage) to duplicate the leverage level of her original position in Firm L, and buying Firm U's stock.

Capital Structure Arbitrage (Construction of Arbitrage Portfolio with ZERO initial investment)

- Sell Firm L shares currently owned (1% of $560,000) for $5,600.
  - i.e., Unload corporate leverage via selling S_L
- Borrow an amount equivalent to 1% of Firm L's debt (1% of $500,000) at 6% interest for $5,000.
  - i.e., Homemade leverage
- Jane has $10,600 after these two transactions.
- Purchase 1% of Firm U's stock. This requires $10,000.
  - **Note – Arbitrage Profit of $600 at t=0!**

Capital Structure Arbitrage
(ZERO Net Cash Flow from Arbitrage Portfolio)

- Jane expects to receive 1% on Firm U's EBIT. (.01 * $100,000 = $1,000)
- Jane pays interest on the borrowed money. (.06 * $5,000 = $300)
- Jane has $700 left after paying interest. ($1,000 - $300 = $700), i.e., **the SAME amount of cash flow** she would have had received from her original position in Firm L, i.e., 1% of S_L. (.01 * $70,000 = $700)

Concluding Remark

- In the disequilibrium example, the return on levered equity is too low, compared to the return on unlevered equity. This means the price of the levered equity is too high. Rational investors will sell the overpriced levered equity and buy the unlevered equity, and substitute personal/homemade leverage for corporate leverage.

- For two firms with exactly the same business characteristics and different financial leverage levels, if they are differently valued, investors can do capital structure arbitrage by short-selling the stocks of the higher-value (overpriced) firm, and using the proceeds to buy the stocks of the lower-value (underpriced) firm, which creates profits. These arbitrage activities (market forces) will cause the value of the higher-value (overpriced) firm to equal to the value of the lower-value (underpriced) firm, all other factors equal.

Modigliani and Miller (1958) Proposition II - NO taxes

- The required rate of return of stock (R_s) is equal to the appropriate capitalization rate for a pure equity stream in that risk class, R_o, plus a risk premium related to the level of financial risk.
  - While WACC is independent of the capital structure, R_S increases as B/S_L (i.e., financial leverage and hence financial risk) increases!

M&M Proposition II (NO taxes)

$R_{WACC} = [B/(B+S_L) * R_B] + [S_L/(B+S_L) * R_S]$, where $R_{WACC}=R_O$ in a NO tax world!

➔ **$R_S = R_O + B/S_L * (R_O - R_B)$**

Note: In the absence of debt, the required return on equity, R_S, equals the required return on the firm's assets, R_o. By adding debt, the variability and hence the riskiness of cash flows available to stockholders increases.

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

M&M Proposition II (NO Taxes)

The derivation is straightforward:

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

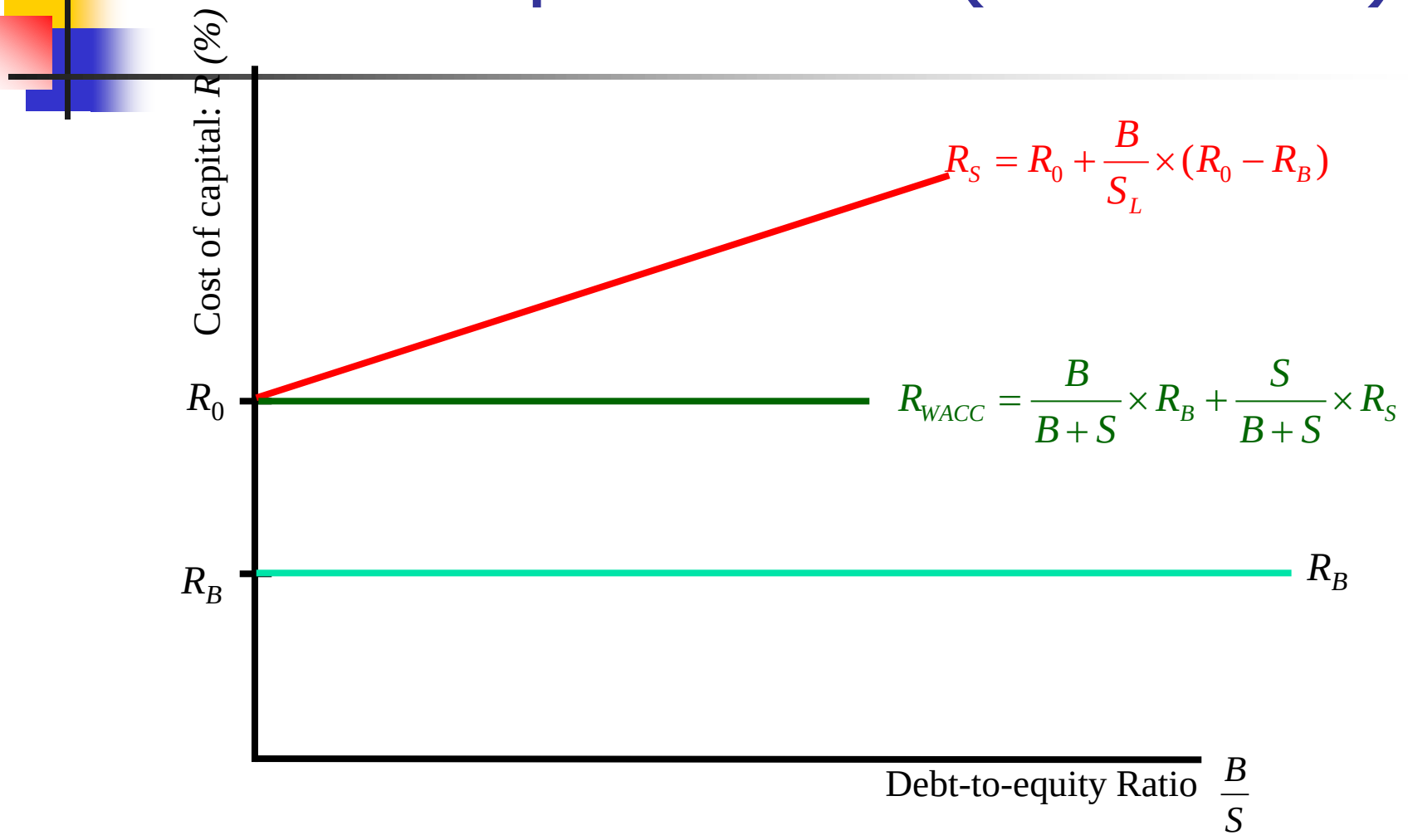
$$\frac{\cancel{B+S}}{S} \times \frac{B}{\cancel{B+S}} \times R_B + \frac{\cancel{B+S}}{\cancel{S}} \times \frac{\cancel{S}}{\cancel{B+S}} \times R_S = \frac{B+S}{S} R_0$$

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

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

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

M&M Proposition II (NO Taxes)



M&M Proposition II (NO taxes) - Example

$R_S = R_O + B/S_L * (R_O - R_B)$

(Reference Slide #24 for data)

➔ $R_S = .10 + 500K/500K * (.10 - .06)$

➔ $R_S = .10 + 1 * (.04)$

➔ $R_S = .14$

M&M Proposition II (NO taxes) - Example

Designer Interiors is currently an all-equity firm with a cost of capital of 14%. Should the firm opt to borrow money, it can do so at 8.5%. Ignore taxes.

What is the firm's current cost of equity?

What will the cost of equity be if the firm changes its structure to a debt-equity ratio of .7?

What will the firm's WACC be if the debt-equity ratio is .7?

M&M Proposition II (NO taxes) - Example

$$R_S = R_0 + \frac{B}{S}(R_0 - R_B)$$
$$= .14 + \frac{.7}{1}(.14 - .085)$$
$$= .14 + .0385$$
$$= .1785$$
$$= 17.85\%$$

$R_0 = R_{WACC} = 14\%$

$$R_{WACC} = \frac{S}{B+S}(R_S) + \frac{B}{B+S}(R_B)$$
$$= \frac{1}{1.7}(.1785) + \frac{.7}{1.7}(.085)$$
$$= .105 + .035$$
$$= .14$$
$$= 14\%$$

M&M Propositions (NO taxes) - Summary

- 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.

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

16.5 Modigliani and Miller (1963) Effect of Corporate Taxes

- Proposition I (with Corporate Taxes)
- **$V_L = V_U$ + PV of interest tax shield**

OR $V_L = V_U + T_C * B$

  - For two firms with the same business risk, the **optimal debt ratio** is the one that minimizes WACC and maximizes firm value involves 100% leverage (i.e. all debt financed)!
    - The favorable impact of the increasing use of (even lower after-tax cost) debt capital on the WACC is now greater than the rise in the cost of equity, and hence the WACC falls, and firm value increases, continuously with higher debt usage.

M&M (1963) Prop 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 perpetual stream of cash flows is V_L

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

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

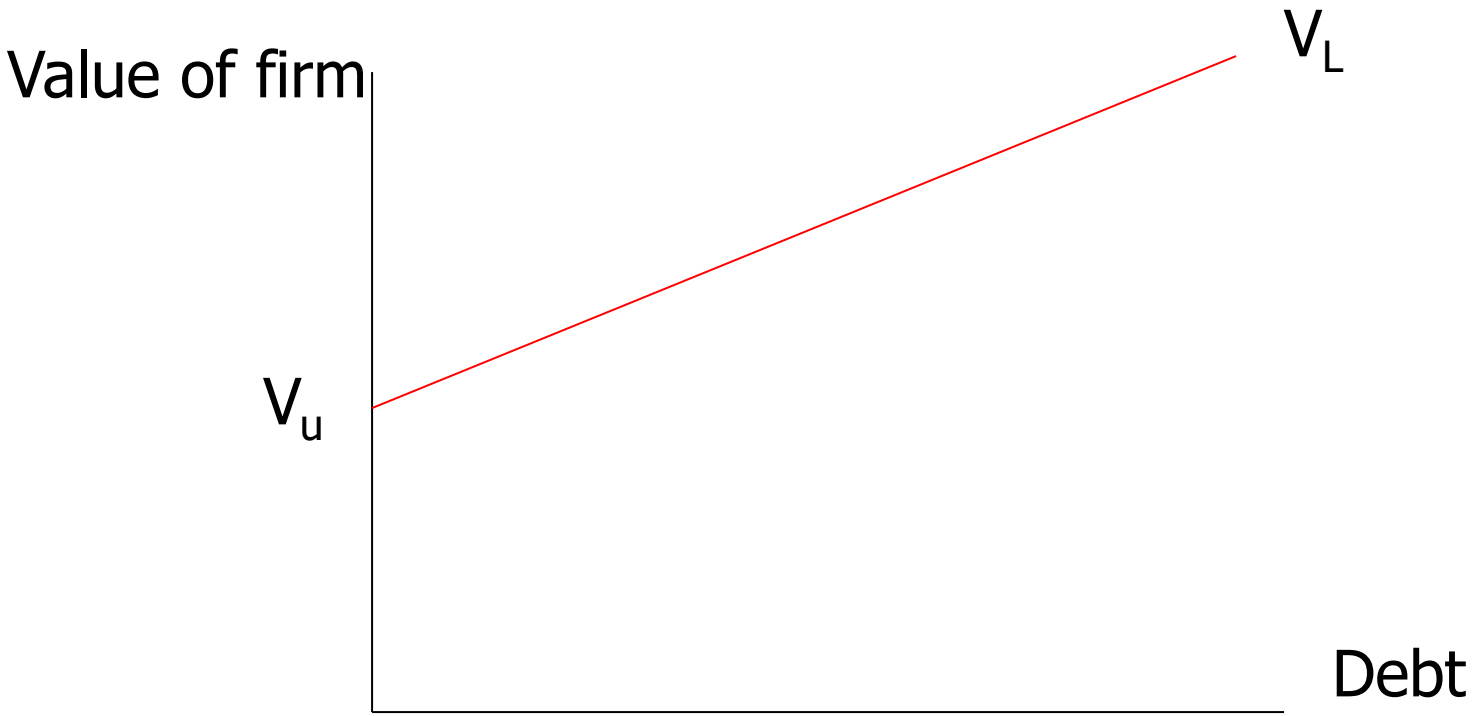
$$= EBIT \times (1 - T_C) - \cancel{R_B B} + R_B B T_C + \cancel{R_B B}$$

The present value of the first term is V_U = EBIT*(1-Tc)/Ro

The present value of the second term is $T_C B$ = R_B*B*Tc/R_B
(for perpetual debt)

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

Value of Levered Firm with Corporate Taxes



Example (Ref Slide #26)

	Firm U	Firm L
Operating Income	$100,000	$100,000
Interest	$ 0	$30,000
Taxable Income	$ 100,000	$ 70,000
Tax @ 35%	$35,000	$24,500
Net Income	$65,000	$45,500
Interest + NI	$65,000	$75,500

Calculate Firm Values

- V_U = \$65,000 / .10 = \$650,000

- V_L = \$650,000 + [.35 *.06*500,000]/.06
  = \$650,000 + [.35*500,000]
  = \$650,000 + \$175,000
  = \$825,000

OR V_L = \$45,500/.14 + \$30,000/.06

➔ V_L = \$325,000 (i.e., S_L) + \$500,000 (i.e., B)

➔ V_L = \$825,000

MM Proposition I (With Taxes)

Dover United is an all-equity firm with earnings before interest and taxes of $68,400. The unlevered cost of capital is 11.4%. The company is considering adding $40,000 of debt with a coupon rate of 9%. The debt will sell at par. The tax rate is 34%.

What will the value of Dover United be after they add the debt to the capital structure?

What is the value of the levered equity?

MM Proposition I (With Taxes)

$$V_L = V_U + t_C B$$

$$V_L = \frac{EBIT \times (1 - t_c)}{R_0} + t_C B$$

$$= \frac{\$68,400 \times (1 - .34)}{.114} + (.34 \times \$40,000)$$

$$= \$396,000 + \$13,600$$

$$= \$409,600$$

$$V_B = \$40,000$$

$$V_S = V_L - V_B$$

$$= \$409,600 - \$40,000$$

$$= \$369,600$$

M&M (1963)
Effect of Corporate Taxes

- Proposition II (with corporate taxes)
  - The required return of stock (R_s) is equal to the appropriate capitalization rate for a pure equity stream in that risk class, R_o, plus a risk premium related to the level of financial risk. The premium is *adjusted for the interest tax shield*.

Equation – M&M (1963) Proposition II (with taxes)

- **$R_S = R_O + B/S_L * (R_O - R_B) * (1 - T_C)$**

- Example –

$R_S = .10 + \$(500K/325K)*(.10-.06)*(1-.35) = .14$

M&M (1963) Prop II (With Taxes)

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

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

$$V_U = S_L + B * (1 - T_C)$$

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

$$S_L * R_S + B * R_B = V_U * R_0 + T_C * B * R_B$$

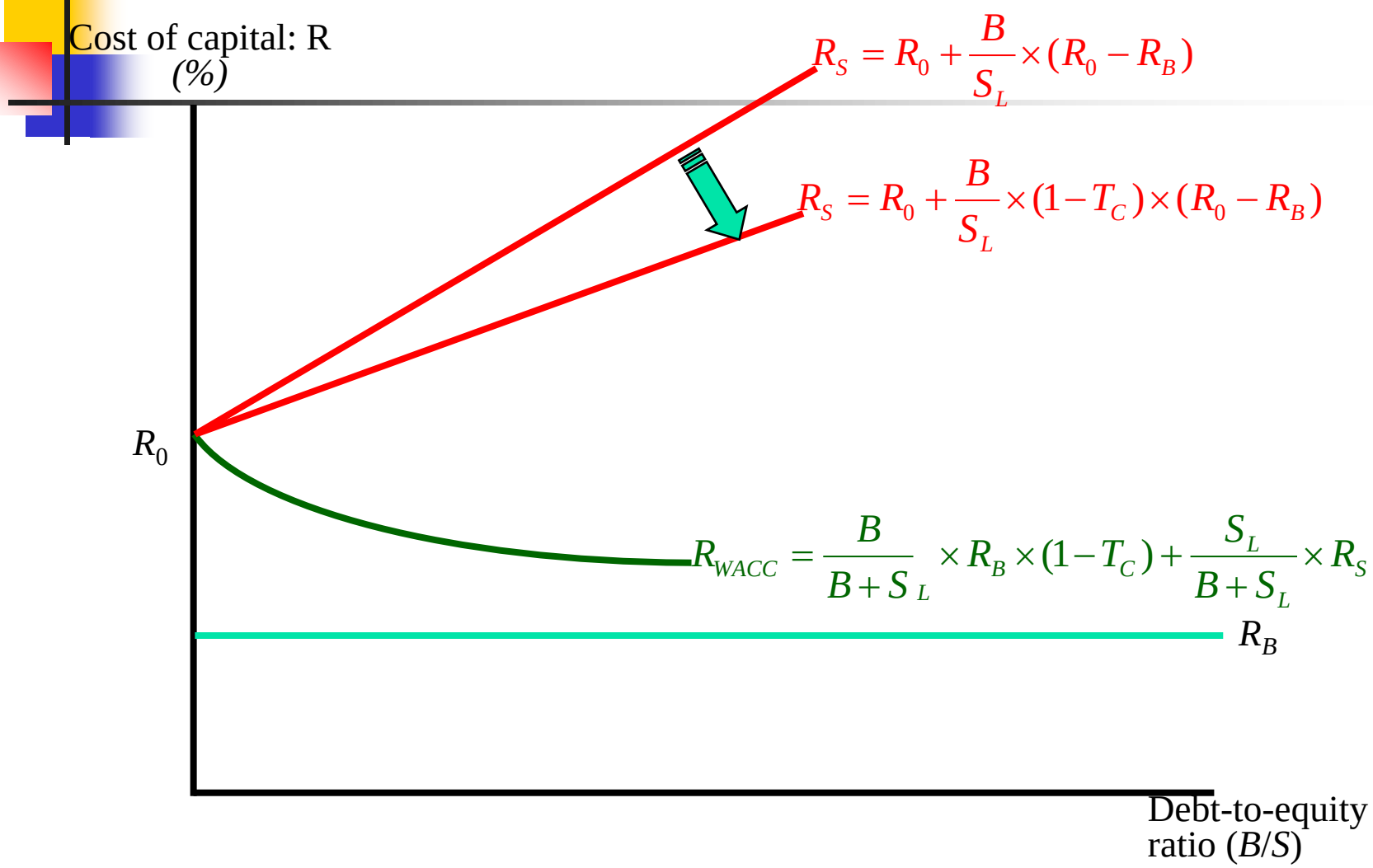
$$S_L * R_S + B * R_B = [S_L + B * (1 - T_C)]R_0 + T_C * R_B * B$$

Divide both sides by S_L

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

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

The Effect of Financial Leverage



Total Cash Flow to Investors

All Equity

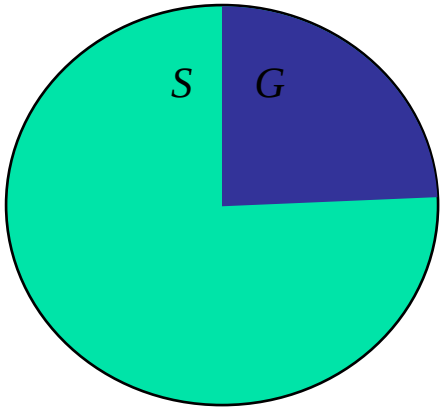
	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest	0	0	0
EBT	$1,000	$2,000	$3,000
Taxes (*T*c = 21%)	$210	$420	$630
Total Cash Flow to S/H	$790	$1,580	$2,370

Levered

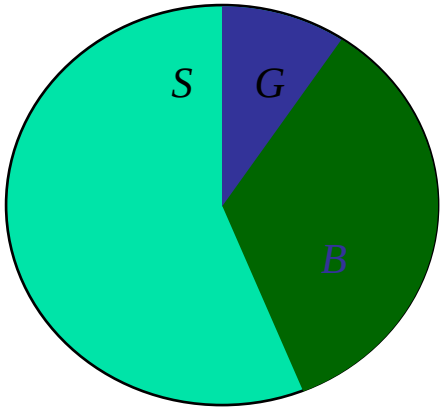
	Recession	Expected	Expansion
EBIT	$1,000	$2,000	$3,000
Interest ($800 @ 8%)	640	640	640
EBT	$360	$1,360	$2,360
Taxes (*Tc* = 21%)	$75.6	$285.6	$495.6
Total Cash Flow	$284.4+640	$1,074.4+$640	$1,864.4+$640
(to both S/H & B/H):	$924.4	$1,714.4	$2,504.4
$EBIT(1-Tc)+T_C R_B B$	$790+$134.4	$1,580+$134.4	$2,370+$134.4
	$924.4	$1,714.4	$2,504.4

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!

MM Proposition II (With Taxes)

Charleston Mills has $645,000 in bonds outstanding that are selling at par. The value of the equity is $829,000. The bonds have a 7.5% coupon rate and pay interest annually. The expected EBIT is $160,000 and the unlevered cost of capital is 12%. The tax rate is 35%.

What is the levered cost of equity?

MM Proposition II (With Taxes)

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

$$= .12 + \frac{\$645{,}000}{\$829{,}000} \times (1 - .35) \times (.12 - .075)$$

$$= .12 + .0228$$

$$= .1428$$

$$= 14.28\%$$

Summary: NO Taxes (M&M 1958)

- **In a world of no taxes, the value, V, and the cost of capital, WACC, 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 (or unleverage).
- 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 (M&M 1963)

- In a world of taxes, but no bankruptcy costs, the value of the firm increases with leverage.
- This is M&M (1963) 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 (1963) Proposition II states that leverage increases the risk and return to stockholders.

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