CAPITAL STRUCTURE
IN PERFECT CAPITAL MARKETS

Capital Structure

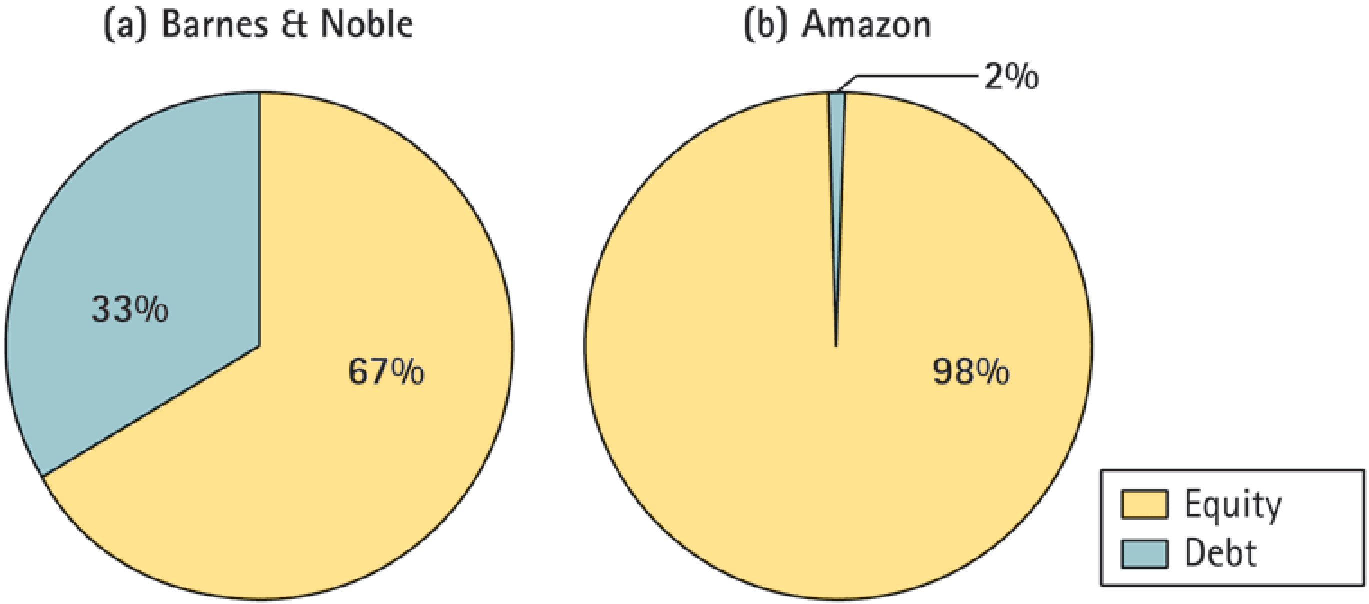
Capital structure: The **mix** of debt, equity, and other sources of capital that finances a project/firm

Main questions for the next lectures:

- Why do some firms have a lot of debt and other firms almost no debt at all?
- Does capital structure affect the value of a project/firm?
- If so, what is the optimal capital structure that maximizes value?

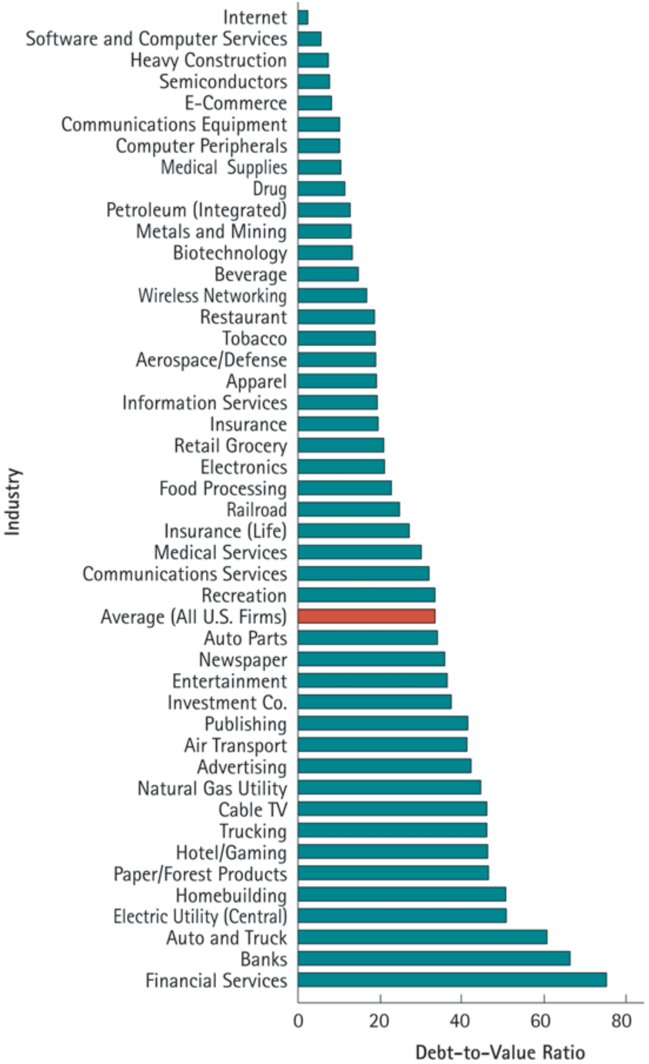
Capital structure also relevant in other (non-corporate finance) settings: e.g., how much debt to use for financing a house, etc…

In practice, different firms tend to choose very different capital structures

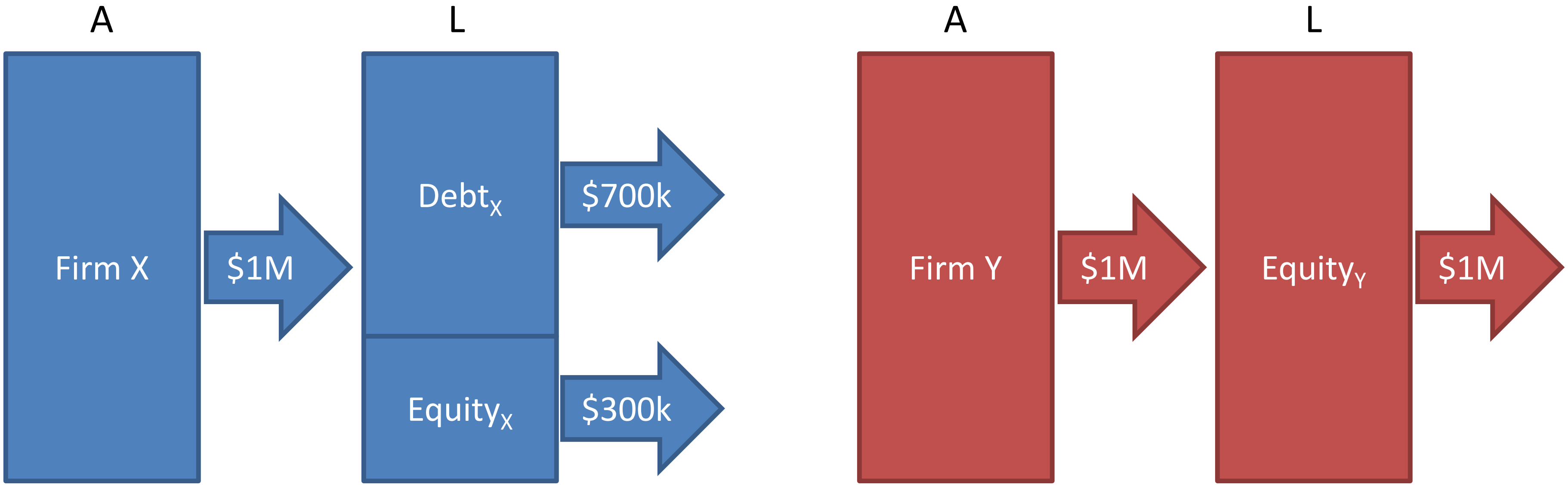


Source: Authors' calculations from http://finance.google.com (July 2010).

Debt-to-Value Ratio [D/(E + D)] for Select Industries



Suppose Firm X and Firm Y both have *perpetual* expected FCFs of $1 million.
They have the **same business risk**, but **different capital structures**.
Which firm is worth more?



$$V_X = V_{D,X} + V_{E,X} = \frac{\$700k}{r_{D,X}} + \frac{\$300k}{r_{E,X}}$$

$$V_Y = V_{E,Y} = \frac{\$1M}{r_{E,Y}}$$

Modigliani and Miller (MM) Proposition 1

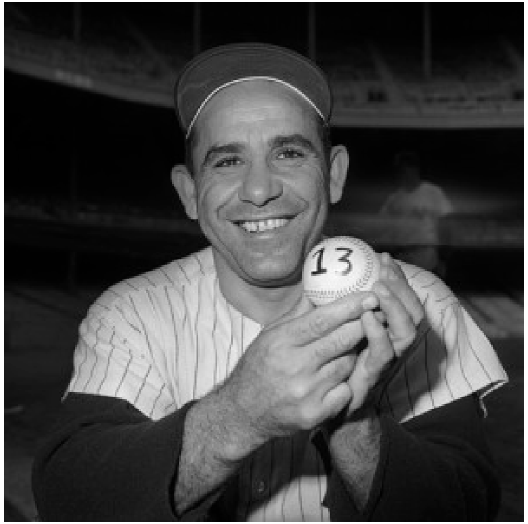
- In perfect capital markets, the total value of a firm is not affected by its capital structure!
- The only thing that matters for firm value is
    1. the expected free cash flows, and
    2. the systematic risk of those cash flows
- Different capital structures only change the **allocation** of these cash flows between various securities

On “Slicing a Pie”

<u>Conservation of Value:</u>

The size of a pie is independent of how it is sliced

(as long as nothing is lost during the slicing…)



“You better cut the pizza in six pieces because I'm not hungry enough to eat eight.”

(quote usually attributed to Yogi Berra)

The assumption: Perfect capital markets

- *Perfect capital markets* describes a set of assumptions:
  1. Securities are fairly priced (*i.e.*, P=PV(cash flows))
  2. No transaction, issuance, trading costs
  3. No taxes
  4. Capital structure does not affect investment policy and cash-flows
     - E.g., no bankruptcy costs, no effect of leverage on a firm's business decisions
- We realize the real world is not a perfect capital market!
  — But, understanding how capital structure works in this setting helps us focus in on *what features in the real world that matter*

Example: Capital Structure for a Coffee Shop

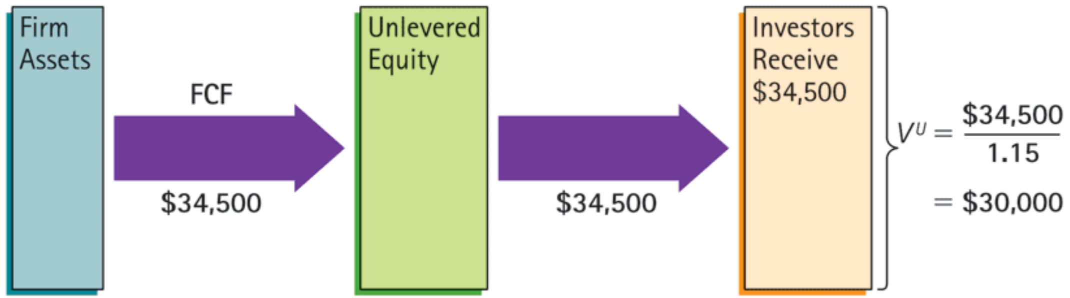
- You're raising money for a coffee shop that will operate for one year
- Suppose r_a is 15% (the asset/unlevered cost of capital):
  E.g., r_f is 5%, and $r_{risk\ premium}$ (based on the asset beta) of 10%
- The coffee shop will produce FCF of either \$27,000 if demand is weak, or \$42,000 if demand is strong
- *Expected* FCF next year is \$34,500

$$\rightarrow EV = \frac{E[FCF]}{1+r_u} = \frac{34{,}500}{1.15} = \$30{,}000$$

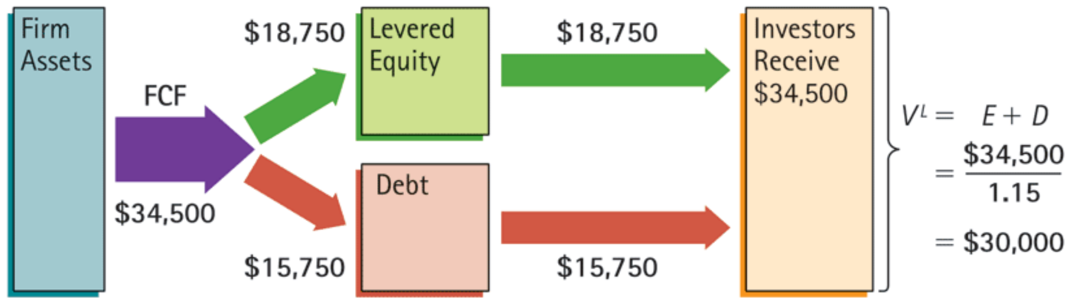
- Remember: we typically use r_{wacc} to discount FCFs, but here $t_c = 0\%$ so r_{wacc} = r_u
- Suppose you can borrow up to \$25,000 at an r_d of 5%
  - Bonus question: Why do we know r_d must be exactly 5% (the risk-free rate) if you were to borrow \$25,000?
- Now you are choosing between:
  A. Financing the coffee shop with all equity
  B. Borrowing \$15,000 (and thus promise to pay back \$15,750 next year), and financing the rest with equity
- How might this choice affect the enterprise value (EV) of the company?

Unlevered Versus Levered Cash Flows (in "Perfect Capital Markets")

Option A: All-equity



Option B: Borrow $15,000 at $r_d = 5\%$, rest equity



Example: Arbitrage and MM1

- Suppose we two firms like in the previous example, which are identical except in their capital structure and EVs
- Firm A is unlevered, and it has a value of $30,000 (all equity)
- Firm B is levered; and has debt worth $15,000, and an equity value of $15,500
- Does MM1 hold?

Solution

- MM 1 states: Because these firms have identical cash flows, their total values should be the same
- But if Firm A has a value of $30,000 and Firm B has a total value of $15,500 (equity) + $15,000 (debt) = $30,500, MM1 doesn’t hold so there is a an arbitrage opportunity!
- We buy the equity of Firm A for $30,000 and sell the equity **and** the debt of Firm B for $30,500 to enjoy an upfront arbitrage profit of $500. Next year, the cash flows from the long and short positions will perfectly cancel each other out.

Example: Leverage and Cost of Capital

- Recall there were two possible cash flows for the coffee shop: \$27,000 ("weak"), or \$42,000 ("strong")
- We can calculate the expected returns without leverage (E=30,000 and D=0) and with leverage (E=15,000 and D=15,000 with r_d=5%) for each scenario:

	Option A: Unlevered firm		**Option B: Levered firm**			
	Equity (E=30,000)		Debt (D=15,000)		Equity (E=15,000)	
Scenario:	Cash flows	Return	Cash flows	Return	Cash flows	Return
Weak	27,000	-10%	15,750	5%	11,250	-25%
Expected	*34,500*	*15%*	*15,750*	*5%*	*18,750*	*25%*
Strong	42,000	40%	15,750	5%	26,250	75%

- In Option B, the expected equity return (r_e) is higher (25% vs. 15% in Option A)
- Why is r_e higher in Option B? Because it is riskier!

But, debt financing is usually cheaper: $r_d < r_e$!

So if we use more debt, won't that reduce the average discount rate (r_{wacc}) and thus increase the PV of a firm's FCFs?

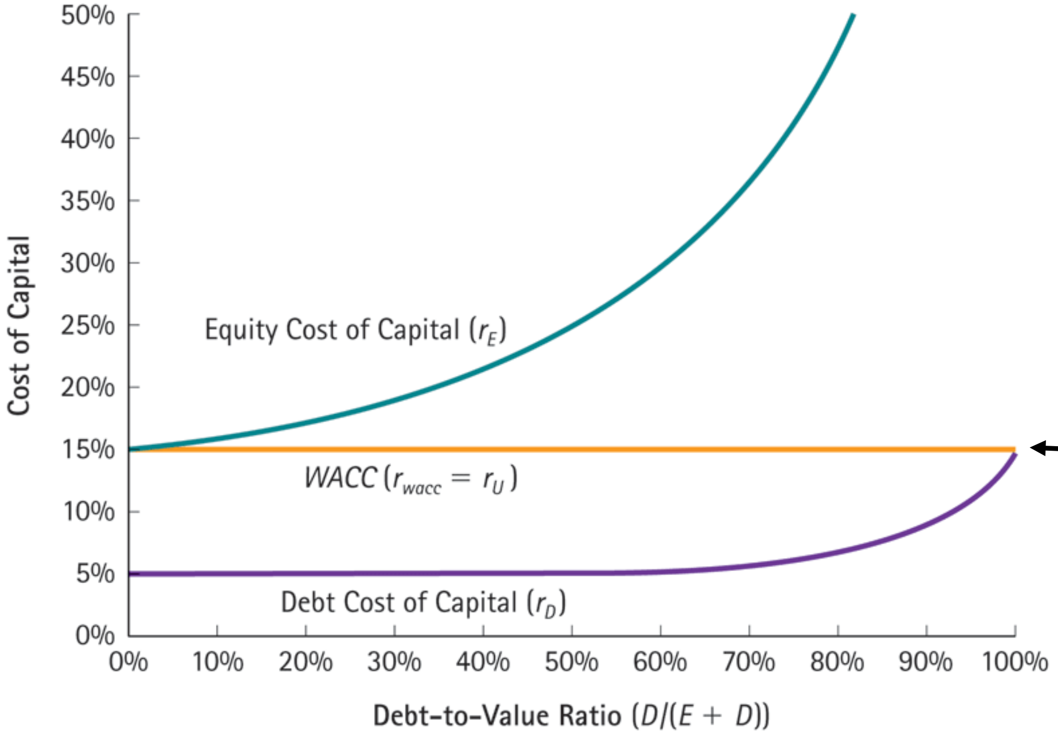
Leverage and Cost of Capital

- Even though debt is cheaper than equity ($r_d < r_e$), using more debt **does not** result in a lower firm (or project) discount rate
- Why? Having more debt increases the firm's cost of capital (expected return) for the remaining equity!
  - Having more debt usually also increase the cost of debt, although this effect is typically smaller
- And, it turns out, the amount by which r_e and r_d become higher **exactly offsets** the fact that we're using a higher fraction of the relatively cheaper debt!

Step back just a moment:
Why is debt cheaper in the first place?

- Short answer: Because debt is less sensitive to systematic risk!
- The firm's business operations (assets) have a fixed amount of systematic risk
  - Measured by asset beta
  - This risk can't be **eliminated**, but only **allocated** to different sources of financial liabilities
- Debt is promised a **fixed payment**, which debt insensitive to this systematic risk
  - Debt only becomes sensitive in the case when the firm is in or close to default
- Leverage increases the sensitivity of both equity and debt to the business' systematic risk
  - With higher leverage, fewer dollars of equity share the risk of being first in line to carry the systematic fluctuations in cash flows
  - With higher leverage, debt gets closer to default (because of a smaller equity cushion)
- Bonus question: What happens to the relative costs of equity and debt if the systematic risk of the business operations is negative (*i.e.*, negative asset beta)?

Figure: Leverage and Cost of Capital



Notice: Stays the same regardless of capital structure!

$$r_{wacc\ (without\ taxes)} = \frac{E}{E+D} * r_e + \frac{D}{E+D} * r_d = r_u$$

MM Proposition II:
Cost of levered equity

- We now know r_e becomes higher with leverage, but *how much higher?*
- MMII: The cost of equity capital, r_e, for a levered firm is:

$$r_e = r_u + \frac{D}{E}(r_u - r_d)$$

where r_u is the unlevered (asset) cost of capital

- r_e is r_u plus a term that's increasing in leverage (D/E)
  (we already saw this formula in the cost of capital lecture)

Example: Cost of levered equity

- Recall from the coffee shop example:
  - If the firm is all-equity financed, the cost of equity is 15%
  - If the firm is financed with \$15,000 debt, the cost of debt is 5%.
  - Using MM II, we can solve for the cost of equity for the levered firm:

$$r_e = r_u + \frac{D}{E}(r_u - r_d)$$

$$= 15\% + \frac{15{,}000}{15{,}000} * (15\% - 5\%) = 25\%$$

- Suppose you borrow only \$6,000 when financing the coffee shop
  - According to MM I, what is the value of equity now?
  - According to MM II, what is the cost of equity (expected return to equity)?

Solution

- The value of the firm does not change: it is still \$30,000
- So if you borrow \$6000, the firm's equity will be worth \$24,000
- The firm will owe debt holders \$6,000 × 1.05 = \$6,300 in one year
- Thus, the expected dollar payoff to equity holders is \$34,500 – \$6,300 = \$28,200,

  for an expected return of \$28,200 / \$24,000 – 1 = 17.5%
- We could also use MM II to get the same result:

$$r_e = r_u + \frac{D}{E}(r_u - r_d)$$

$$15\% + \frac{6,000}{24,000} * (15\% - 5\%) = 17.5\%$$

Example: Cost of levered equity (2)

- Suppose we're in perfect capital markets (e.g., no taxes)
- Honeywell has: $\frac{D}{D+E}$=40%, r_d=7%, and r_e=14%
- Suppose that Honeywell issues equity and uses the proceeds to repay its debt, with the goal of reducing its $\frac{D}{D+E}$ to 20%; and r_d falls to 6% as a result
- How will this transaction affect Honeywell's cost of equity (r_e)? How will it affect r_{wacc}?

Solution

$$r_{(\text{current})wacc} = r_u = \frac{E}{E+D}r_e + \frac{D}{E+D}r_d = 60\% * 14\% + 40\% * 7\% = 11.2\%$$

- So, the new cost of equity at 20% D/V will be:

$$r_e = r_u + \frac{D}{E}(r_u - r_d) = 11.2\% + \frac{0.2}{0.8}(11.2\% - 6\%) = 12.5\%$$

- So:

$$r_{(\text{new})wacc} = 80\% * 12.5\% + 20\% * 6\% = 11.2\%$$

- In other words, in perfect capital markets, the WACC is always the unlevered/asset cost of capital, and doesn't change with leverage

Homemade leverage

- An alternative way of illustrating MM1 is with an arbitrage argument called *"Homemade leverage"*
- Investors can buy securities using a personal loan to "lever up" a firm's cash flows
  - *i.e.*, instead of the firm doing the borrowing, the investors can borrow themselves
- Conversely, investors can hold a portfolio of a firm's bonds and equity securities to "lever down" a firm's equity cash flows
- In perfect capital markets, such leverage by investors can *perfectly substitute* for any leverage choice the firm makes
- Implication: A firm's capital structure choice cannot offer any benefit to its investors!

Homemade leverage: An illustration

- Suppose again that Honeywell has: $\frac{D}{V}$=40%, r_d=7%, and r_e=14%
- Imagine that Honeywell issues equity and pays down all debt
  - What will the new r_e be?
  - r_e=11.2% (the unlevered cost of capital)
- Imagine that you'd like to get an expected return of 14% on your equity investments, so you dislike the fact that Honeywell's equity now has lower risk and lower return!
  - Is there anything you can do?
  - Buy the equity and borrow on your own brokerage account!

Before:

Assets

$r_a = 11.2\%$

Liabilities

D/V = 40%
$r_d = 7\%$

E/V = 60%
$r_e = 14\%$

After:

Assets

$r_a = 11.2\%$

Liabilities

E/V =100%
$r_e = 11.2\%$

After (buy the new equity by borrowing 40% at 7%)

Assets

$r_e = 11.2\%$

Liabilities

D/V = 40%
$r_d = 7\%$

E/V = 60%
$r_e = 14\%$

Common fallacies/mistakes

- "Debt financing increases EPS (earnings per share)→ raises stock price"
  - False!
  - Expected EPS does increase with leverage
  - But, higher leverage also makes these earnings riskier→higher discount rate
  - These effects perfectly cancel, so the share price is unchanged
- "Equity issuances dilute earnings→ firms should instead use debt financing"
  - False!
  - As long as new shares are sold at a fair price, current shareholders don't lose out
  - Cash raised in an equity issuance increases the total value of the firm, and also makes the equity less risky
  - These effects perfectly cancel the effect that new shares "dilute" the firm's earnings

But, the Real World is NOT a MM World!

- Under MM assumptions, capital structure does not matter for a firm's value
  - Although changing the capital structure does change D, E, EPS, P/E, etc…
- In reality, none of the MM assumptions hold
  - Therefore, in the real world, capital structure *does matter*!
- The beauty of MM is not that its lessons hold true in practice
  - MM's beauty is that it tells us *where to look* → Capital structure *matters only* when one or more of the MM assumptions are violated!
  - E.g., taxes can make capital structure matter for value (topic of next lecture)
- MM is also important because it gives us a good framework for thinking about many other corporate finance topics (e.g., payout policy, risk management, M&A, etc.)

An advanced example (Optional!)

Example: Manipulating the P/E ratio

- "Eternity R Us" generates expected EBIT of \$5 million per year in perpetuity
  - Suppose, for simplicity, firm has no capex/NWC or depreciation, and there are no taxes, so EBIT=FCF
- EV=\$50 million
  - D=\$10 million. r_d = 4%
  - E=\$40 million (4 million shares, \$10/share)
- Let's solve for:
  - r_u (*i.e.*, r_a)
  - r_e
  - Earnings per Share (EPS)
  - Price-Earnings ratio (P/E)

Example: Manipulating the P/E ratio (cont.)

- The firm has FCFs of \$5 million per year in perpetuity
- We can solve for r_u by inverting a perpetuity equation:

$$\mathrm{EV} = \frac{FCF}{r_u} \rightarrow r_u = \frac{FCF}{EV} = \frac{5}{50} = 10\%$$

- We can solve for r_e using MM2:

$$r_e = r_u + \frac{D}{E}(r_u - r_d) = 10\% + \frac{10}{40} * (10\% - 4\%) = 11.5\%$$

- Earnings per share (EPS)
  = (EBIT – interest) / #shares
  = (\$5 million – (4% * \$10 million)) / 4 million
  = \$1.15/share
- P/E is: \$10 / \$1.15 = 8.70

Example: Manipulating the P/E ratio (cont.)

- Suppose the CEO decides to change the capital structure to increase the P/E ratio
  - The CEO feels that a higher P/E ratio will “benefit shareholders”
- To do so, the firm announces that it will issue new shares and use the proceeds to buy back all outstanding debt
- Questions:
  - How many shares do we need to issue (and what happens to the share price)?
  - What happens to the P/E ratio?
  - What happens to r_e?

Example: Manipulating the P/E ratio (cont.)

- Let S be the existing number of shares, S_{new} the number of new shares issued, and P_{after} the new share price after the transaction
- Without any debt, the value of equity after the transaction (E_{after}) will be equal to the enterprise value ($50 million)
- We must solve two equations simultaneously:

$$P_{new} = \frac{E_{after}}{S + S_{new}}$$

$$S_{new} * P_{after} = \$10 \text{ million}$$

(we are raising enough new equity to repay all debt)

- Solving these gives us:

S_{new} = 1 million and P_{after} = $10

- Notice: Even though the old shares are getting "diluted", nothing happens to the value of the shares as long as the new shares are sold at the fair price!

Example: Manipulating the P/E ratio (cont.)

- What happens to EPS?

- What happens to the P/E ratio?

- What happens to the cost of equity r_e?

Example: Manipulating the P/E ratio (cont.)

- What happens to EPS?

  EPS goes down to: \$5 / 5 = \$1/share

- What happens to the P/E ratio?

  The P/E ratio goes up to: \$10/\$1 = 10

- What happens to the cost of equity capital?

  The firm is now unlevered so $r_e = r_u = 10\%$

- Are the old shareholders better or worse off after the recapitalization?

Example: Issuing additional risky debt

- The CEO has yet another idea:
- Instead of paying off debt, the CEO considers issuing an additional \$10 million worth of new debt with the same seniority as the old debt (called “pari passu”)
- With this new debt, the debt is riskier and r_d increases from 4% to 6%
- The new money is used to expand the business in a zero NPV project

Questions:

- How much does the firm have to pay on the new debt?
- What happens to the value of the company?
- What happens to the value of the debt?
- What happens to the value of the equity?
- Who is better/worse off?