# CAPITAL STRUCTURE WITH TAXES AND COSTS OF FINANCIAL DISTRESS

# Outline

- We will demonstrate how capital structure **can** affect firm value through:
  1. The tax benefit of debt, and
  2. Costs of financial distress (CFD)
- Show how the *optimal capital structure* trades off these benefits (saving taxes) and costs (financial distress)

# Market imperfections can make capital structure matter

- MM showed that, under certain assumptions, leverage doesn't matter for firm value:
  *"Capital structure is irrelevant!"*
- But, corporate taxes favor debt!
  - Corporations can deduct interest expenses from taxes
  - The **net** cost of paying a dollar to debt investors is therefore only $(1 - t_c)$, because the firm gets a deduction worth $t_c$
  - Paying less money to the government means more money left for investors
    → more debt will therefore increase total firm value!
- How large is this benefit?
  - Each year, the tax deduction is $t_c * r_d * D_t$
  - This amount is called the "Interest Tax Shield" (ITS)

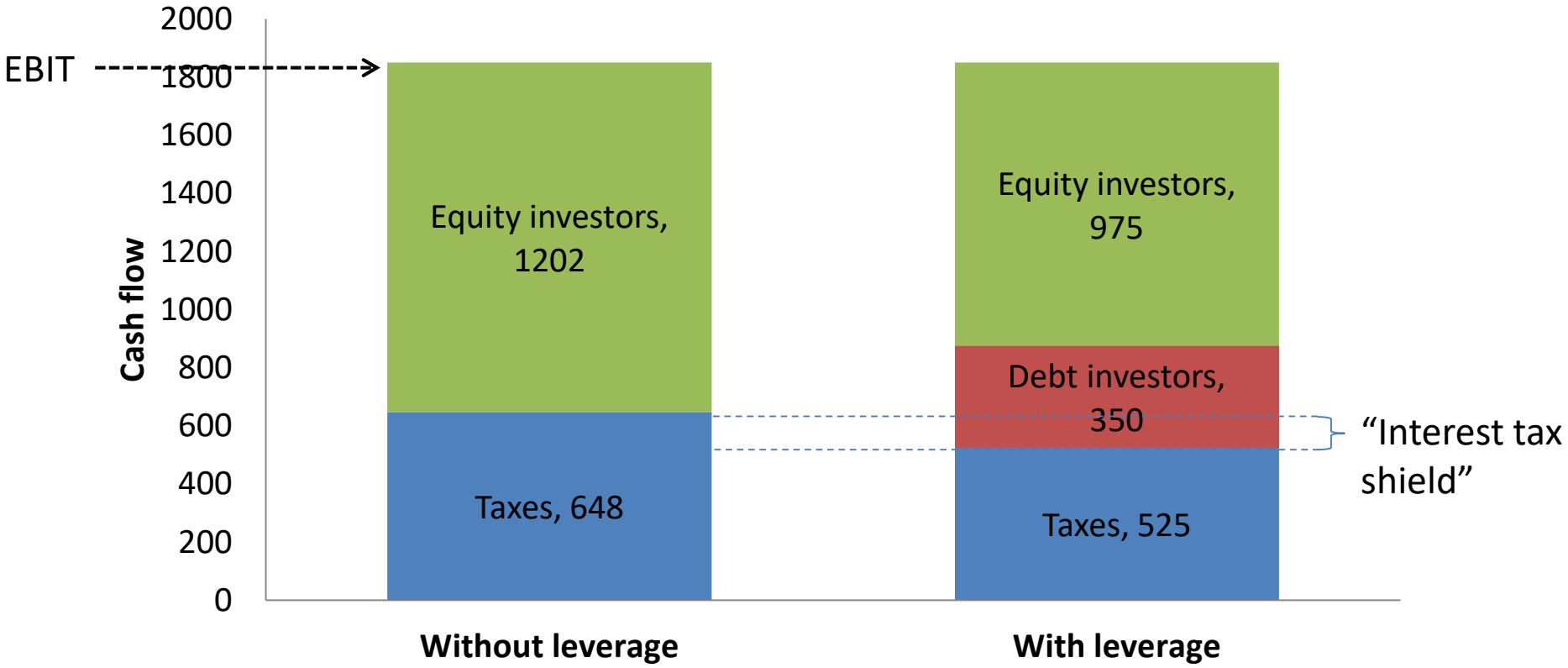
# Example

- Safeway has EBIT of $1.85 billion. The company's interest expense is $350 million, and the corporate tax rate is 35%
- What is Safeway's total payments to all investors ?
- What would the total payments be instead if the firm didn't have any leverage?

| | With Leverage | Without Leverage |
|---|---|---|
| EBIT | $1850 | $1850 |
| Interest expense | -350 | 0 |
| Income before tax | 1500 | 1850 |
| Taxes (35%) | –525 | –648 |
| Net income | $975 | $1202 |

| | With Leverage | Without Leverage |
|---|---|---|
| Interest paid to debt holders | 350 | 0 |
| Income available to equity holders | 975 | 1202 |
| **Total available to all investors** | **$1325** | **$1202** |

# How large is the interest tax shield?



# The interest tax shield increases firm value!

$$FCF\ with\ leverage_t = \ \ FCF\ without\ leverage_t + ITS_t$$

Let's take present values of all these future cash flows:

$$PV(FCF\ with\ leverage)$$
$$= PV(FCF\ without\ leverage) + PV(ITS)$$

This is called *MM Proposition I with taxes*:

$$V_L = V_U + PV(ITS)$$

# How do we calculate $PV(ITS)$?

- To put a value on the PV(ITS), we need cash flows and discount rates!
- Suppose a firm borrows debt $D$ and keeps this debt permanently, the firm's marginal tax rate is $t_c$, and the cost of debt is $r_d$, then:

$$ITS_t = t_c * r_d * D_t$$

- Because the firm keeps this debt permanently, this tax shield can be valued as a perpetuity
- What's the correct discount rate?
- If the debt will always be a *fixed dollar amount*, the tax shield has the same risk as the debt itself, so we can discount the ITS at the cost of debt $r_d$, and then:

$$PV(ITS) = \frac{t_c * r_d * D}{r_d} = t_c * D$$

# Example: PV of interest tax shield

- Suppose ECB Inc. borrows $2 billion by issuing a 10-year bond
- ECB's $r_d$ is 6%, so the interest payments are expected to be around 6%*$2 billion=$120 million each year
- ECB's marginal tax rate is 35%
- By how much will the ITS from this debt increase the value of the company?

**Solution**

- The ITS each year is $t_c * r_d * D = 35\% * \$120 \text{ million} = \$42 \text{ million}$
- Valued as a 10-year annuity and discounted at $r_d$, the tax savings are worth:

$$\text{PV(ITS)} = \$42 \text{ million} * \frac{1}{0.06} * \left(1 - \frac{1}{1.06^{10}}\right) = \$309 \text{ million}$$

- In other words, because the government subsidizes the payment of interest, the associated tax savings increase the value of the company by $309 million!

# Example: Raising debt to repurchase shares

- Midco has 20 million shares outstanding with share price of $15, and no debt
- Midco's $t_c$ is 35%
- Midco is planning to borrow $100 million permanently and use the money to repurchase shares
- How does this transaction affect the value of Midco?

**Solution**

- Before (Without leverage):

$$V_U = (20 \text{ million shares}) \times (\$15/\text{share}) = \$300 \text{ million}$$

- If Midco borrows $100 million permanently:

$$\text{PV(ITS)} = \frac{t_c * r_d * D}{r_d} = \frac{35\% * r_d * 100 \text{ million}}{r_d} = \$35 \text{ million}$$

- The value of the levered firm:

$$V_L = V_U + \text{PV(ITS)} = \$300 \text{ million} + \$35 \text{ million} = \$335 \text{ million}$$

- The value of the new debt is $100 million, so the new value of equity will be:

$$E = V_L - D = \$335 \text{ million} - \$100 \text{ million} = \$235 \text{ million}$$

- Note: Although the value of the firm's equity drops to $235 million, shareholders also receive the $100 million in cash that Midco will pay out through the share repurchase, so they are better off!

# Example: Raising debt to repurchase shares (2)

- What price will Midco be able to repurchase the shares at?
- Suppose Midco were to repurchase its shares at the current price of $15/share, then the firm would repurchase:

$$\$100 \text{ million} \div \$15/\text{share} = 6.67 \text{ million shares}$$

- Midco will then have 20 million − 6.67 million = 13.33 million shares outstanding.
- The total value of equity after the debt issuance and repurchase is $235 million
  - So the new share price would then be $17.625/share
- But, if the shares will be worth $17.625/share after the repurchase, why would shareholders sell their shares back to Midco for $15/share in the first place?
  - No shareholders would want to sell – so this transaction can't happen at that price!

# Example: Raising debt to repurchase shares (2) *[cont.]*

- To resolve this puzzle, note that as soon as investors realize they will issue more debt, the value of the Midco's equity will rise immediately from $300 million to $335 million
- So the share price will rise to $\frac{\$335 \text{ million}}{20 \text{ million shares}} = \$16.75$ per share
- Midco will then repurchase $100 million ÷ $16.75/share = 5.97 million shares, so there are 14.03 million shares remaining
- The remaining shares' value is now $235 million ÷ 14.03 = $16.75
- Therefore, the shareholders who sell their shares are indifferent between selling and holding on to the shares!

# WACC with Taxes

- With tax-deductible interest, the "*effective" cost of debt* is $r_d * (1 - t_c)$
- WACC then becomes the familiar:

$$r_{wacc} = \frac{E}{E+D} r_e + \frac{D}{E+D} r_d (1 - \tau_c) = \frac{E}{E+D} r_e + \frac{D}{E+D} r_d - \frac{D}{E+D} r_d \tau_c$$

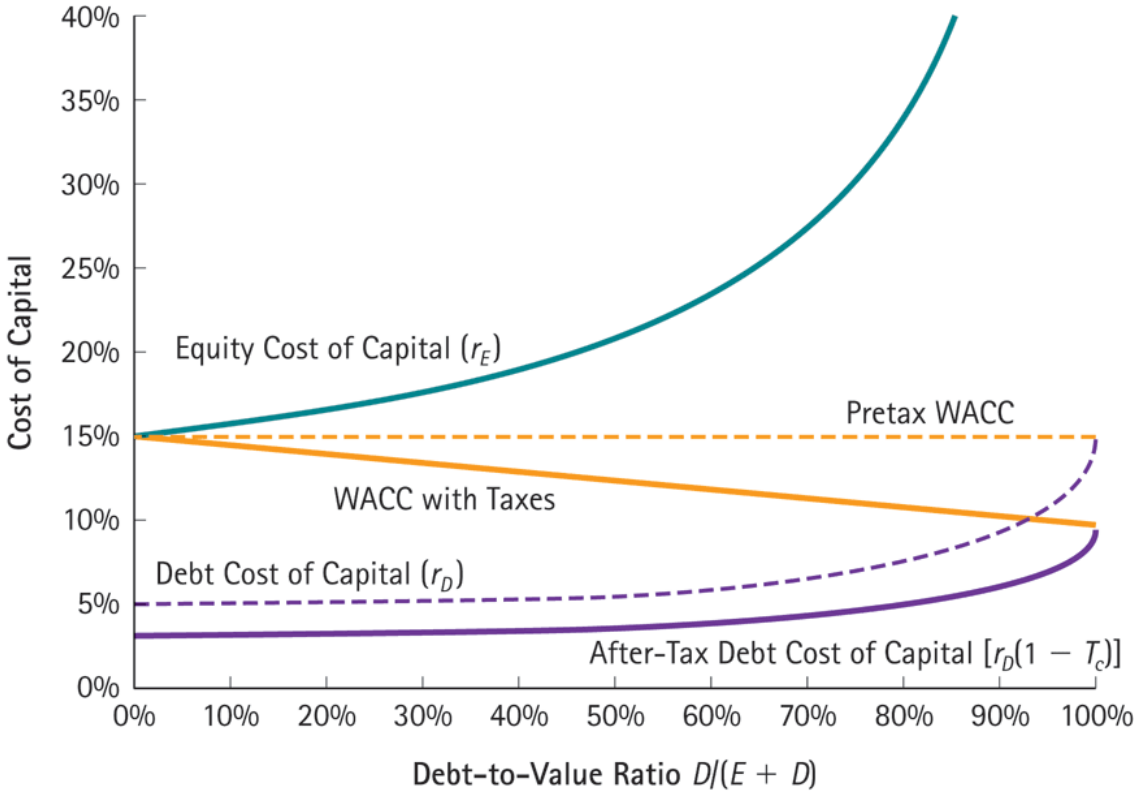
Note!

"Pre-tax" WACC; *i.e.*, $r_a$ or $r_u$

Effect of tax benefit on WACC

- The higher leverage, the more the firm exploits the tax advantage of debt, and the lower the firm's WACC!

# Comparing WACC with and without taxes



# $V_L$ and WACC

- Recall from *MM Proposition I* with taxes that:

$$V_L = V_U + \text{PV}(\text{interest tax shield}) \qquad (1)$$

where $V_U = PV(FCFs\ discounted\ at\ r_u)$

- But we also know from DCF valuation that:

$$V_L = PV(FCFs\ discounted\ at\ r_{wacc}) \qquad (2)$$

- Both of these formulas give us $V_L$ ; but is the answer the same?
- Short answer: Sometimes, but not always! We'll discuss this is more depth when we talk about APV valuation, which uses formula (1)
- More complicated answer:
  - When using (2), we implicitly assume that the firm will seek *a target leverage ratio (D/V)*
  - If the firm does not target a specific *(D/V)* ,we should instead use (1)

# Including Personal Taxes in the Interest Tax Shield

- So far we have only considered corporate taxes $t_c$
- What about personal taxes?
  - E.g., interest income, dividends, and capital gains are all taxed at the personal level too!
- And the tax on interest income is often higher than the tax on dividends and capital gains…
  - This can offset some of the corporate-tax benefits of debt financing!
- To determine the "net" tax benefit of leverage, we need to consider the *combined* effect of both corporate and personal taxes

# Historical Tax Rates in the United States (top rates)

(you obviously don't need to memorize these!)

| Year | Corporate Tax Rate | Interest income tax rate | Dividend tax rate | Capital gains tax rate |
|---|---|---|---|---|
| 1971-1978 | 48% | 70% | 70% | 35% |
| 1979-1981 | 46% | 70% | 70% | 28% |
| 1982-1986 | 46% | 50% | 50% | 20% |
| 1987 | 40% | 39% | 39% | 28% |
| 1988-1990 | 34% | 28% | 28% | 28% |
| 1991-1992 | 34% | 31% | 31% | 28% |
| 1993-1996 | 35% | 40% | 40% | 28% |
| 1997-2000 | 35% | 40% | 40% | 20% |
| 2001-2002 | 35% | 39% | 39% | 20% |
| 2003-2012 | 35% | 35% | 15% | 15% |
| 2013-2017 | 35% | 43.4% | 23.8% | 23.8% |
| 2018- | 21% | 40.8% | 20.8% | 20.8% |

# The combined effect of corporate and personal taxes

*A dollar of EBIT can be directed to investors either as interest on debt or equity income (in the form of dividends or capital gains)*

$t_c$ = corporate tax

$t_{int}$ = personal income tax on interest income

$t_{equity}$ = personal income tax on equity income (capital gains or dividends)

| | **For each EBIT of $1.00** | |
|---|---|---|
| | Paid out as interest | Paid out as equity income |
| Corporate tax | None | $t_c$ |
| Cash flow for investors, after corp. tax | $1.00 | $(1 - t_c)$ |
| Personal tax | $t_{int}$ | $t_{equity}\ (1 - t_c)$ |
| Income to investors after all taxes | $(1 - t_{int})$ | $(1 - t_c) * (1 - t_{equity})$ |

# Effective Tax Advantage of Debt

- Let's denote the *effective tax advantage of debt, after both corporate and personal taxes,* $t^*$:

$$t^* = \frac{(1 - t_{int}) - (1 - t_c)\left(1 - t_{equity}\right)}{1 - t_{int}} = 1 - \frac{(1 - t_c)\left(1 - t_{equity}\right)}{(1 - t_{int})}$$

- $t^*$could even be negative (*i.e.*, a tax advantage for *equity*) if:

$$(1 - t_{int}) < (1 - t_c)\left(1 - t_{equity}\right)$$

- Special case: If the personal tax rates on debt and equity income are the same ($t_{int}$= $t_{equity}$), the formula reduces to $t^*$ = $t_c$
  - *i.e.*, if personal taxes is "neutral", the same tax benefit of debt as if were no personal taxes at all!

# Example: Effective Tax Advantage of Debt

- What was the effective tax advantage of debt in 1995 and 2009?

| Year | Corporate Tax Rate | Average Personal Tax Rate on Equity Income (cap gains and dividends) | Tax Rate on Interest Income |
|---|---|---|---|
| 1995 | 35% | 34% | 40% |
| 2009 | 35% | 15% | 35% |

$$t^* = 1 - \frac{(1 - t_c)\left(1 - t_{equity}\right)}{(1 - t_{int})}$$

$$t^*_{1995} = 1 - \frac{(1 - .35)(1 - .34)}{1 - .40} = 28.5\%$$

$$t^*_{2009} = 1 - \frac{(1 - .35)(1 - .15)}{1 - .35} = 15\%$$

# A complication: Personal tax rates differ

- We just assumed that all investors pay the same income tax rate (namely, the highest personal marginal rate)
- In practice, many investors face lower personal tax rates or don't pay personal taxes at all
  - Across people: E.g., people with lower incomes face lower marginal tax rates
  - Across accounts: Whether investments held in taxable or tax-free account (e.g., 401(k) )
- Each firm should consider the specific tax consequences of their own debt/equity investors when deciding on capital structure

# How to maximize firm value?

## (if the only thing that matters is taxes…)

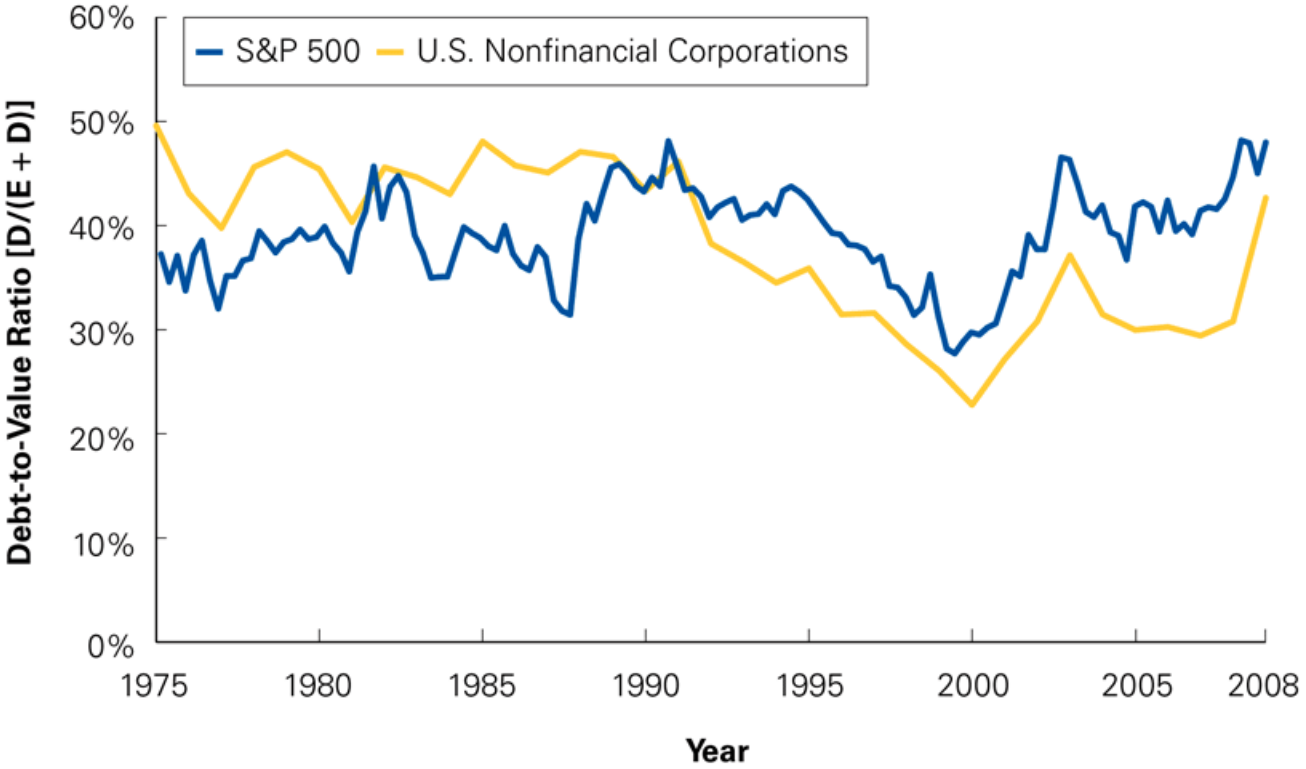
- If increasing debt increases the value of the firm, why not shift to (close to) 100% debt financing?
- E.g., imagine a firm that aims to have interest payments that always exactly equal its EBIT → **then it would never pay any corporate taxes**!
- How much difference to the value would this make?
- If an unlevered firm has value $V_U$, a 100%-levered firm would have value $V_L = V_U + PV(ITS) = V_U + t_c * D = V_U + t_c * V_L$ (because if 100% levered then $D = V_L$)

$$\rightarrow V_{L(\frac{D}{V}=100\%)} = \frac{V_U}{1 - t_c}$$

# The Underleverage Puzzle

- The tax benefit is large, and firms have puzzlingly little leverage given the tax benefit!
- In practice, average leverage (D/V) ratios are around 40%!
  - Firms have puzzlingly little leverage given the tax benefit!
  - The “underleverage puzzle”
- There must exist some large cost(s) that discourage firms from taking on even higher leverage

# Debt-to-Value Ratio of U.S. Firms




Source: Compustat and Federal Reserve, Flow of Funds Accounts of the United States, 2009.

# Costs of Financial Distress

- One reason firms may avoid a lot of debt are *Costs of Financial Distress (CFD)*
- More debt → Greater chance that the firm will default
- Default occurs if a firm fails to make a required payment on its debt
  - Or if the firm violates a debt covenant ("technical default")
- After default, debt-investors can be given rights to the assets of the firm and/or may take legal ownership of the firm through courts in "bankruptcy" process
- Default and bankruptcy can be **very costly** !
  - Involves both *direct* and *indirect* costs
  - These costs reduce the total cash flow available to investors and thus reduce firm value

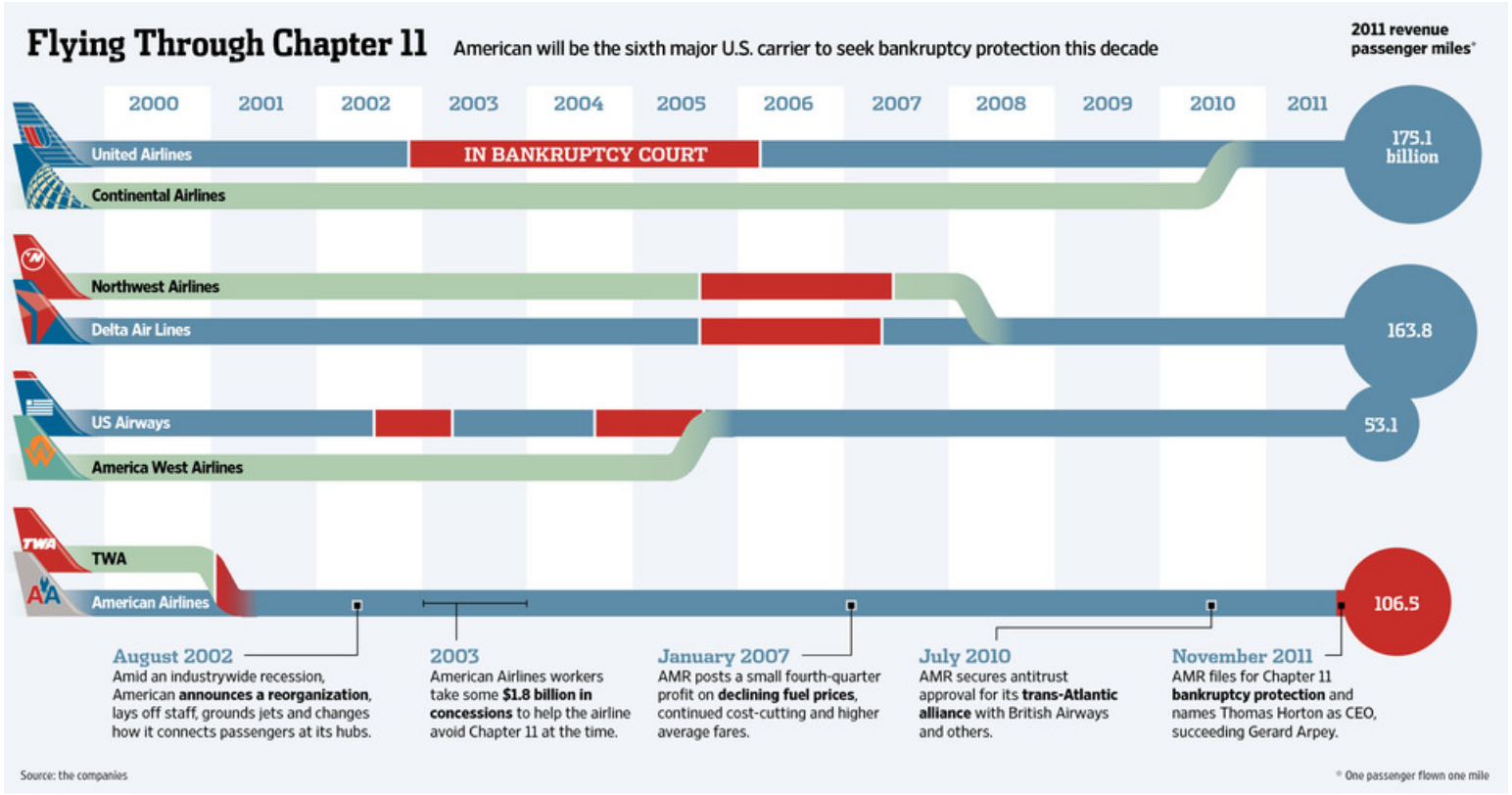
# Largest Bankruptcies in the U.S.

| Company | Bankruptcy Date | Total Assets Pre-Bankruptcy | Description |
|---|---|---|---|
| Lehman Brothers | 15-Sep-08 | $691,063,000,000 | Investment bank |
| Washington Mutual | 26-Sep-08 | $327,913,000,000 | Savings & loan holding company |
| Worldcom | 21-Jul-02 | $103,914,000,000 | Telecommunications |
| General Motors | 6-Jan-09 | $82,290,000,000 | Manufactures & sells cars |
| CIT Group | 11-Jan-09 | $71,000,000,000 | Banking holding company |
| Enron | 12-Feb-01 | $65,503,000,000 | Energy trading, natural gas |
| Conseco | 17-Dec-02 | $61,392,000,000 | Financial services holding company |
| MF Global | 11-Aug-11 | $41,000,000,000 | Financial derivatives broker |
| Chrysler | 30-Apr-09 | $39,300,000,000 | Manufactures and sells cars |
| Thornburg Mortgage | 5-Jan-09 | $36,521,000,000 | Residential mortgage lending |
| Pacific Gas and Electric | 4-Jun-01 | $36,152,000,000 | Electricity and natural gas |
| Texaco | 4-Dec-87 | $34,940,000,000 | Petroleum and petrochemicals |
| Financial Corp of America | 9-Sep-88 | $33,864,000,000 | Financial services |
| Refco | 17-Oct-05 | $33,333,000,000 | Brokerage services |
| IndyMac Bancorp | 31-Jul-08 | $32,734,000,000 | Bank holding company |
| Global Crossing | 28-Jan-02 | $30,185,000,000 | Global telecommunications carrier |

Note! Bankruptcy does not equal extinction: many of these firms still exist, although some have been liquidated or sold to other firms!

# Example: Bankruptcy does not imply the business is shut down

Every major airline (except Southwest) has been through bankruptcy, and most are still flying!



# The U.S. Bankruptcy Code

- Two ways to file for bankruptcy in the U.S.
- Chapter 11: Reorganization
  - More common form of bankruptcy for large corporations.
  - The existing management of the firm (the debtor) must present reorganization plan in court
  - The creditors must vote to accept the plan, and it must be approved by the court
  - If plan is accepted, existing management keeps running the firm
  - Creditors may receive cash payments and/or new debt or equity securities of the firm
- Chapter 7: Liquidation
  - Trustee appointed to sell / liquidate assets
  - Money distributed according to strict priority
    - Secured claims
    - Wages
    - Taxes
    - General unsecured claims (in order of seniority)
    - Equity

# Direct Costs of Financial Distress

- The bankruptcy process is complex, time-consuming, and costly
  - E.g., hiring lawyers and paying court fees costs money that otherwise could be going to investors
  - Prime example: Lehman bankruptcy (over $2 billion in just legal fees)
- Direct costs have been estimated to be on average 3%-4% of the firm's pre-bankruptcy enterprise value
  - Higher for firms that have complex business operations or that have a large numbers of creditors

# Indirect Costs of Financial Distress

- For example:
  - Loss of customers
  - Loss of suppliers
  - Worried employees
  - Fire sales of assets
  - Agency problems, e.g. distorting the firm's investments
- Indirect costs are difficult to measure, but are often thought to be much higher than the direct costs of bankruptcy, around 10% to 20% of a firm's value
- Many indirect costs can be incurred even long before the firm is in actual default, as people start worrying about possible future disruptions

# Optimal Capital Structure: The Tradeoff Theory (1)

- Total value of a levered firm equals the value of the firm without leverage plus the present value of the tax savings from debt, less the present value of financial distress costs:

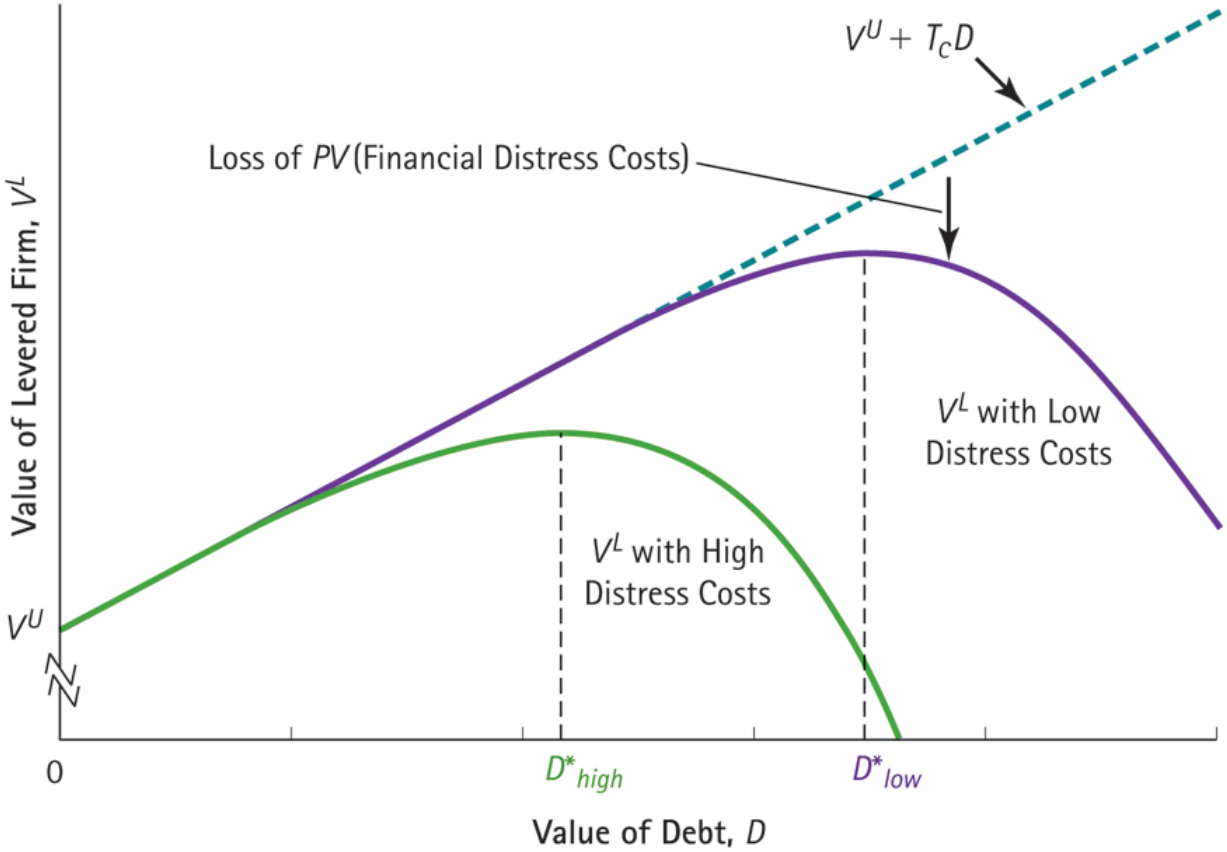
$$V_L = V_U + \text{PV}(\text{Interest tax shield}) - \text{PV}(\text{Costs of financial distress})$$

- The firm chooses its capital structure by trading off the benefits and costs to maximize $V_L$
- $PV(ITS) = t_c * D$ is linearly increasing in *D*
- The $PV(CFD)$ is also increasing in *D* but is convex (because the probability of default is convex)
- For example, suppose $PV(CF\text{D}) = a * D^2$, then:

$$V_L(D) = V_U + t_c * D - a * D^2$$

- Calculus time! What's the optimal $D$ that maximizes $V_L$? (calculus is not required for exams, but still fun!)

# Low expected CFD → Higher optimal leverage



# Optimal Capital Structure: The Tradeoff Theory (2)

- The Tradeoff Theory helps resolve two facts about leverage:
  - Because of CFD, firms don't go to 100% leverage
  - Differences in the magnitude of CFD across firms (e.g., because of differences in the volatility of cash flows or expected bankruptcy costs) can explain some of the differences in leverage across industries
- But, the tradeoff theory can't explain everything…
  - Why do many of the most profitable firms have so little debt?
  - The CFD don't seem big enough to explain the relatively low levels of leverage firms actually choose

# Economic versus Financial Distress

- When analyzing these costs, we must distinguish “Economic Distress” from “Financial Distress”
- Economic Distress arises when a firm’s business operations are producing less cash flows than expected
  - E.g., if sales unexpectedly go down, costs go up, etc…
  - This can happen to a firm *regardless of its leverage*
- Financial Distress are the *extra costs* that firms face when you combine Economic Distress with high leverage, resulting in costly default in the form of CFD
- Main idea: If CFD is zero, defaults don’t matter for firm value because no value is destroyed from the default itself

# Example: Economic Distress

- Armin Inc.'s revenues have declined lately (the value of its existing assets is zero), but is hoping to recover by launching a new product
  - If product is a "Hit," Armin worth $150m next year
  - If product "Flops," Armin worth $80m next year
- 50-50 chance of "hit" or "flop"
- Armin considers issuing debt with a face value of $100m, due next year
- Should we use equity or debt financing?

Note: For simplicity, let's assume $r = 0$, *i.e.* no discounting, in this example

**The “Hit” Scenario:**

- Armin worth $150m if project “hits”
- With only equity financing, E = $150
- With debt financing, must pay $100m to debt holders (so E = $50m)

**The “Flop” Scenario:**

- Now, Armin Inc. is only worth $80m
  - This is economic distress
- With only equity, E = $80m
- With debt financing, must pay $80m to debt holders (and firm will be in default, since they promised $100m)
  - Debt holders lose $20m
  - Equity is wiped out (E = $0)

# Are there any CFD here?

Let's compare the two financing forms

- With only equity financing
  - "Hit": V = E = $150m
  - "Flop": V = E = $80m
- With debt financing
  - "Hit": V = E + D = $50m + $100m = $150m
  - "Flop": V = E + D = $0 + $80m = $80m
- The *expected* value to investors is the same under the two financing forms:

$$V_0 = 0.5 * 150 + 0.5 * 80 = \$115\text{m}$$

- There are *no* costs of financial distress (CFD)!

# Introducing Costs of Financial Distress

- Let's continue the Armin example
- Suppose if Armin defaults, lawyers will cost $20m
- If lawyers get $20m, Armin will only be able to repay $60m to debtholders in the flop scenario
  - The flop scenario happens with 50% probability, so PV[CFD] = $10m

# What is CFD Here…?

Let’s compare the two financing forms

- With only equity financing
  - “Hit”: V = E = $150m
  - “Flop”: V = E = $80m
- With debt financing
  - “Hit”: V = E + D = $50m + $100m = $150m
  - “Flop”: V = E + D = $0 + *$60m = $60m*
- Now expected value with equity financing is $115m and expected value with debt financing is $105m !
  - The difference is the expected CFD

# Who pays for the CFD?

- Even though the debtholders will suffer the financial distress costs *ex post*, it is the equity holders who will pay for the CFD *ex ante*
- Why? Because the debtholders aren't stupid and will pay less for the debt if there are CFD!
- How much will debtholders pay the firm for the debt (face value $100m)?
- Debtholders will pay the PV of the expected future cash flows!
  - Without CFD, D = $90 (they get $100m if "Hit", $80m if "Flop")
  - With CFD, D = $80 (they get $100m if "Hit", $60m if "Flop")

# Example: Who pays for the CFD? (1)

- Let's say the required investment in the project is $90m
- Armin has no cash so they need to issue equity or debt to pay for it

**A. All equity financing**

- With all equity financing, we will issue $90m of new shares to finance project
- Total value of the firm is $115m
  - Value of new equity is $90m
  - Value to existing shareholders is $25m (the new shareholders pay a fair "zero-NPV" price, so the existing (old) shareholders get the entire NPV of the project)

# Example: Who pays for the CFD? (2)

**B. Debt financing (without CFD)**

- To raise debt with a value of D=90, we have to issue debt with a Face Value of $100m
  - Why?
- We invest the $90m in project
- Value of the existing equity is $25m:
  - If we “hit”, equity receives $50m (and debt gets 100)
  - If we “flop”, equity receives zero (and debt gets 80)
  - So present The value of the firm is D=90, E=25, EV=115
    - Notice: the same result for existing equity holdings as with new equity financing!

# Example: Who pays for the CFD? (3)

**Debt financing (with $20m CFD)**

- Now to raise D = $90m, we need to issue debt with a face value of $120m
  - Why?
- We invest this $90m in project
- Value of equity is now only $15m
  - If we “Hit”, equity receives $30m
  - If we “Flop”, equity receives zero
- Takeaway: When securities are fairly priced, the current shareholders of the firm will bear the cost of any PV(CFD)