Capital Structure

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Finance Theory II
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The Key Questions of Corporate Finance

- **Valuation:** How do we distinguish between good investment projects and bad ones?

- **Financing:** How should we finance the investment projects we choose to undertake?

(Real) Investment Policy

- "Which projects should the firm undertake?"
  - Open a new plant?
  - Increase R&D?
  - Scale operations up or down?
  - Acquire another company?

- We know that real investments can create value
  - Discounted Cash Flow (DCF) analysis
  - Positive NPV projects add value
  - We revisit this in the course's "Valuation" module (Part II)

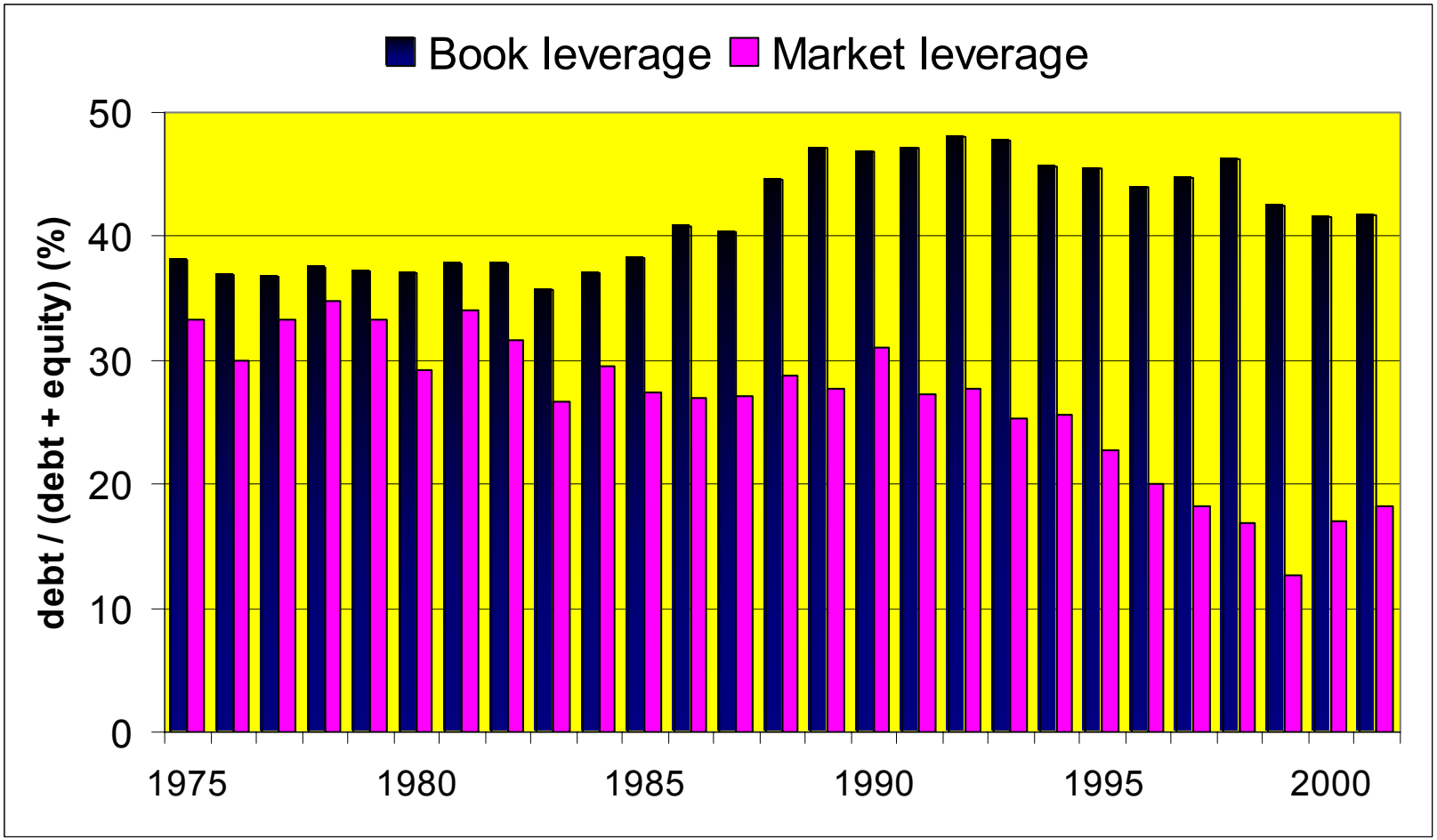
Financing Policy

- Real investment policies imply funding needs
  - We have tools to forecast the funding needs to follow a given real investment policy (from Wilson Lumber)
- But what is the best source of funds?
  - Internal funds (i.e., Cash)?
  - Debt (i.e., borrowing)?
  - Equity (i.e., issuing stock)?
- Moreover, different kinds of ...
  - Internal funds (e.g., cash reserves vs. cutting dividends)
  - Debt (e.g., Banks vs. Bonds)
  - Equity (e.g., VC vs. IPO)

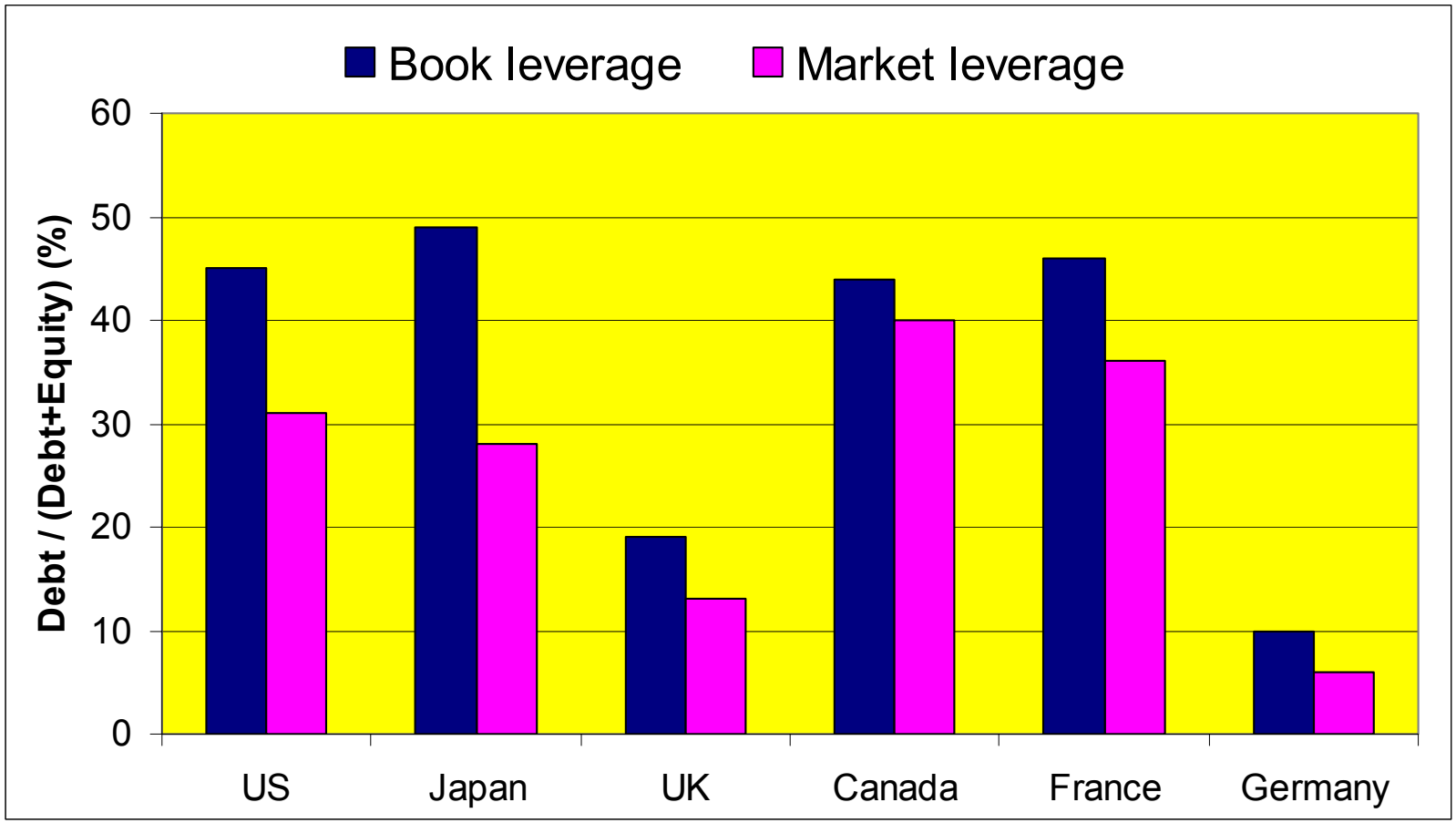
Choosing an Optimal Capital Structure

- Is there an “optimal” capital structure, i.e., an optimal mix between debt and equity?
- More generally, can you add value on the RHS of the balance sheet, i.e., by following a good financial policy?
- If yes, does the optimal financial policy depend on the firm’s operations (Real Investment policy), and how?
- We study this in the course’s “Financing” module (Part I).

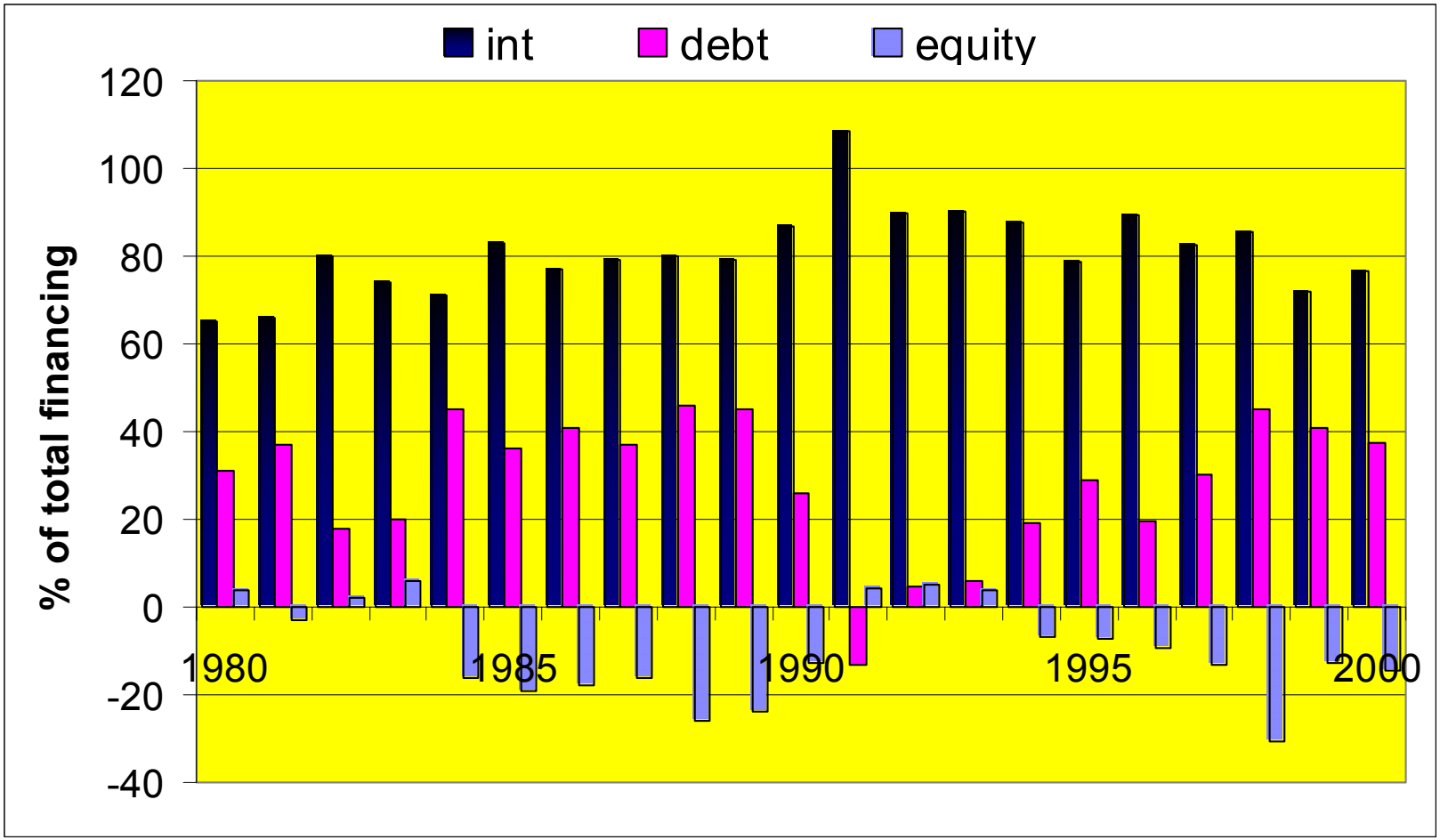
Capital Structures: US Corporations 1975-2001



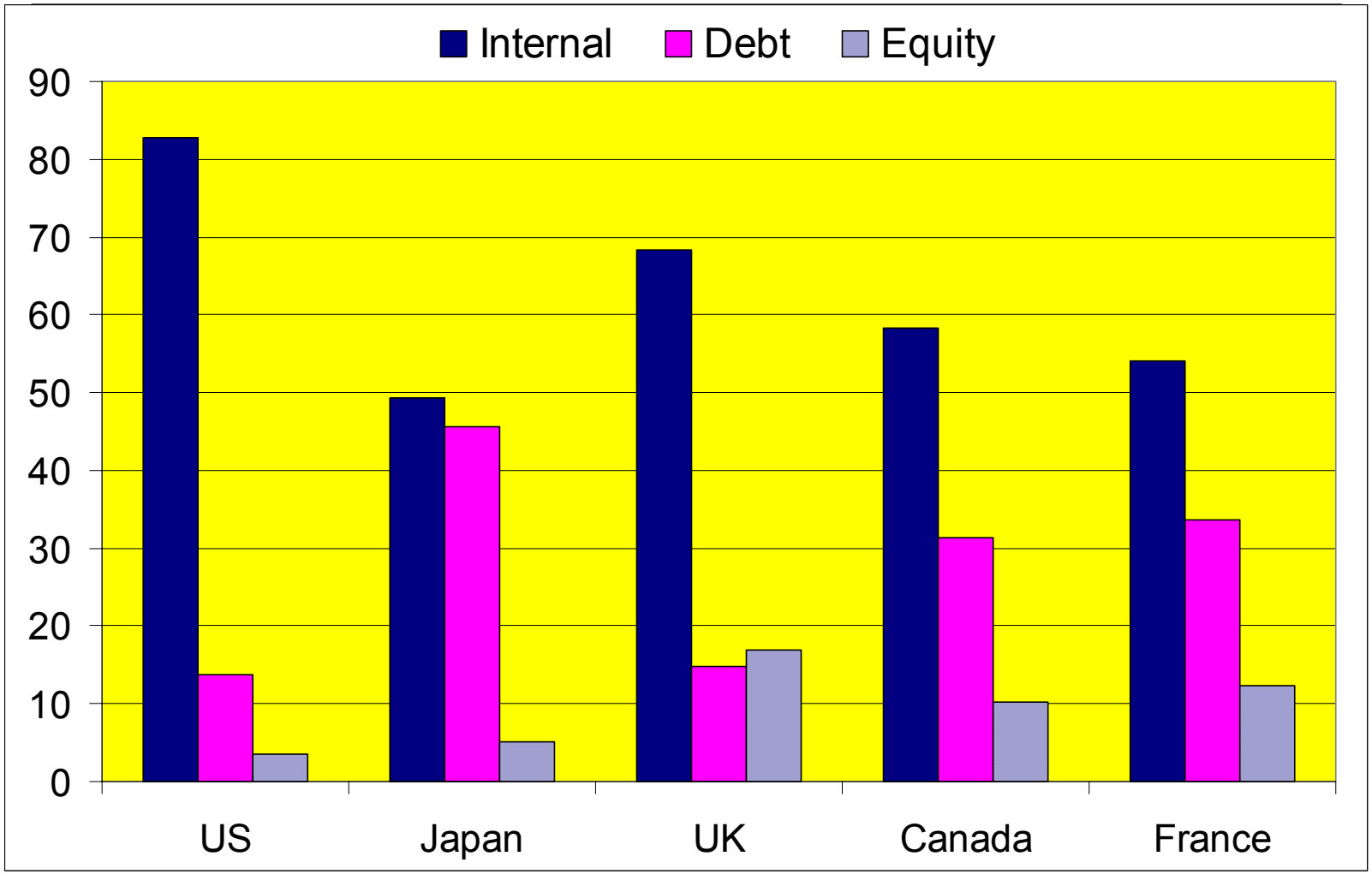
Capital structure, International 1991



Sources of Funds: US Corporations 1980-2000



Sources of Funds: International 1990-94



Examples: Capital structure, 1997

Industry	Debt / (Debt + Equity) (%)
High leverage	
Building construction	60.2
Hotels and lodging	55.4
Air transport	38.8
Primary metals	29.1
Paper	28.2
Low leverage	
Drugs and chemicals	4.8
Electronics	9.1
Management services	12.3
Computers	9.6
Health services	15.2

Plan of Attack

1. **Modigliani-Miller Theorem:**
   → Capital Structure is irrelevant

2. **What's missing from the M-M view?**
   → Taxes
   → Costs of financial distress

3. **"Textbook" view of optimal capital structure:**
   → The choice between debt and equity

4. **Apply/confront this framework to several business cases**
   → Evaluate when its usefulness and its limitations

M-M's "Irrelevance" Theorem

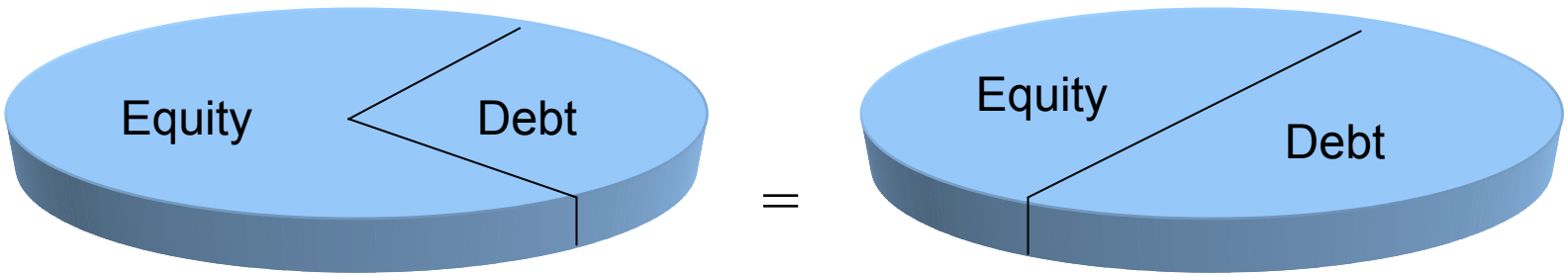
Assume

- Market efficiency and no asymmetric information
- No taxes
- No transaction or bankruptcy costs
- Hold constant the firm's investment policies

Then

- The value of the firm is independent of its capital structure
  - **Financing decisions do not matter!**

MM Theorem: Proof 1 (pie theory)*



* Credit to Yogi Berra

MM Theorem: Proof 2 (market efficiency)

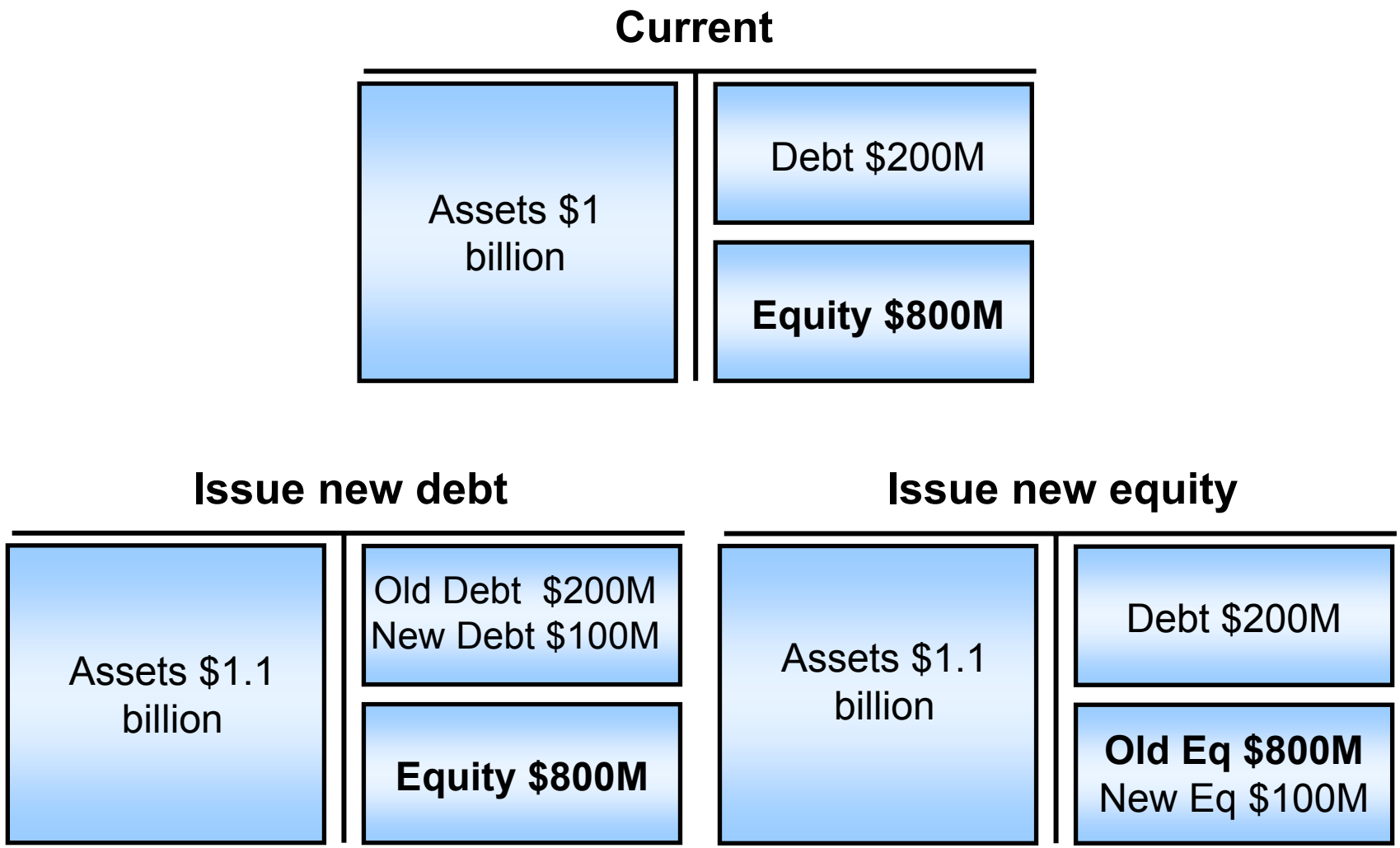
Your firm decides to raise $100 million.

- **Debt financing**
  - You sell bonds worth $100 million and receive $100 million in cash.
- **Equity financing**
  - You sell stock worth $100 million and receive $100 million in cash.

MM Theorem: Proof 2 (market efficiency)

- All purely financial transactions are zero NPV investments, i.e., no arbitrage opportunity.
- Thus, they neither increase nor decrease firm value.

MM Theorem: Example



MM Theorem: Proof 3

- Consider two firms with identical assets (in $M):

Asset value next year:	Firm A	Firm B
In state 1:	160	160
In state 2:	40	40

- Firm A is all equity financed:
  - Firm A's value is V(A) = E(A)
- Firm B is financed with a mix of debt and equity:
  - Debt with one year maturity and face value $60M
  - Market values of debt D(B) and equity E(B)
  - Firm B's value is (by definition) V(B) = D(B) + E(B)
- MM says: V(A) = V(B)

MM Theorem: Proof 3

- Firm A's equity gets all cash flows
- Firm B's cash flows are split between its debt and equity with debt being senior to equity.

Claim's value next year	Firm A (Equity)	Firm B	
		Debt	Equity
In state 1:	160	60	100
In state 2:	40	40	0

- In all (i.e., both) states of the world, the following are equal:
  - The payoff to Firm A's equity
  - The sum of payoffs to Firm B's debt and equity
- By value additivity, $E(A) = D(B) + E(B)$

M-M Intuition 1

- If Firm A were to adopt Firm B's capital structure, its total value would not be affected (and vice versa).
- This is because ultimately, its value is that of the cash flows generated by its *operating assets* (e.g., plant and inventories).
- The firm's financial policy divides up this cashflow "pie" among different claimants (e.g., debtholders and equityholders).
- But the size (i.e., value) of the pie is *independent* of how the pie is divided up.

Example, cont.

- In case you forgot where value additivity comes from…

- Assume for instance that market values are:
  - → D(B) = $50M
  - → E(B) = $50M

- MM says: V(A) = D(B)+E(B) = $100M

- Suppose instead that E(A) = $105M.
- Can you spot an arbitrage opportunity?

Example, cont.

- Arbitrage strategy:
  - Buy 1/1M of Firm B's equity for $50
  - Buy 1/1M of Firm B's debt for $50
  - Sell 1/1M of Firm A's equity for $105

	Today	Next year State 1	Next year State 2
Firm B's equity	-$50	+$100	$0
Firm B's debt	-$50	+$60	+$40
Subtotal	-$100	**+$160**	**+$40**
Firm A's equity	+$105	**-$160**	**-$40**
Total	+$5	$0	$0

⇨ **Note:** Combining Firm B's debt and equity amounts to "undoing Firm B's leverage" (see shaded cells).

M-M: Intuition 2

- Investors will not pay a premium for firms that undertake financial transactions that they can undertake themselves (at the same cost).

- For instance, they will not pay a premium for Firm A over Firm B for having less debt.

- Indeed, by combining Firm B's debt and equity in appropriate proportions, any investor can in effect "unlever" Firm B and reproduce the cashflow of Firm A.

The Curse of M-M

- M-M Theorem was initially meant for capital structure.

- But it applies to all aspects of financial policy:
  - capital structure is irrelevant.
  - long-term vs. short-term debt is irrelevant.
  - dividend policy is irrelevant.
  - risk management is irrelevant.
  - etc.

- Indeed, the proof applies to all financial transactions because they are all zero NPV transactions.

Using M-M Sensibly

- M-M is not a literal statement about the real world. It obviously leaves important things out.

- But it gets you to ask the right question: How is this financing move going to change the size of the pie?

- M-M exposes some fallacies such as:
  - WACC fallacy
  - Win-Win fallacy
  - EPS fallacy

WACC Fallacy: "Debt is Better Because Debt Is Cheaper Than Equity."

- Because (for essentially all firms) debt is safer than equity, investors demand a lower return for holding debt than for holding equity. (True)
- The difference is significant: 4% vs. 13% expected return!
- So, companies should always finance themselves with debt because they have to give away less returns to investors, i.e., debt is cheaper. (False)
- What is wrong with this argument?

WACC Fallacy (cont.)

- This reasoning ignores the “hidden” cost of debt:
  - **Raising more debt makes existing equity more risky**
  - Is it still true when default probability is zero?
- Milk analogy: Whole milk = Cream + Skimmed milk
- People often confuse the two meanings of “cheap”:
  - Low cost
  - Good deal
- More on this in the “Valuation” module (Part II).

EPS Fallacy: “Debt is Better When It Makes EPS Go Up.”

- EPS can go up (or down) when a company increases its leverage. (True)
- Companies should choose their financial policy to maximize their EPS. (False)
- What is wrong with this argument?

EPS Fallacy (cont.)

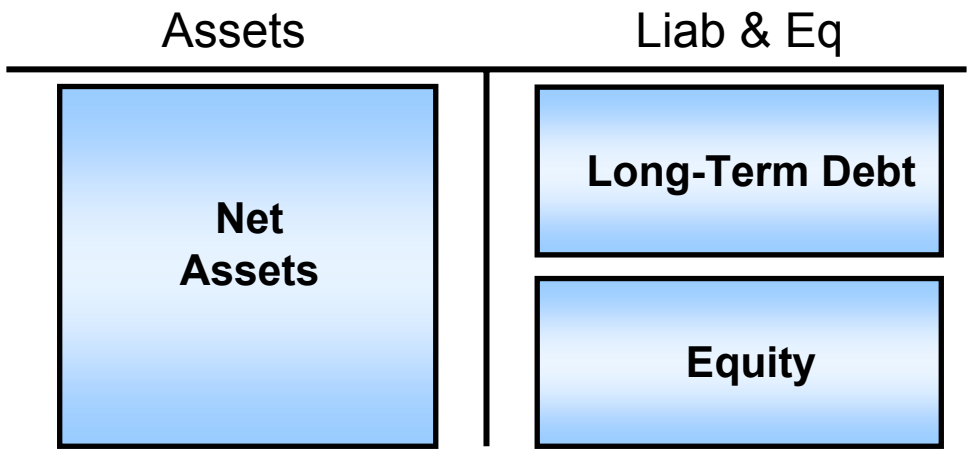
- EBI(T) is unaffected by a change in capital structure (Recall that we assumed no taxes for now).
- Creditors receive the safe (or the safest) part of EBIT.
- Expected EPS might increase but EPS has become riskier!

Remarks:

- Also tells us to be careful when using P/E ratios, e.g. comparing P/E ratios of companies with different capital structures.
- Further confusing effect in share-repurchases: The number of shares changes as well as expected earnings.

Leverage, returns, and risk

Firm is a portfolio of debt and equity



Therefore …

$$r_A = \frac{D}{A} r_D + \frac{E}{A} r_E \qquad \text{and} \qquad \beta_A = \frac{D}{A} \beta_D + \frac{E}{A} \beta_E$$

Leverage, returns, and risk

Asset risk is determined by the type of projects, not how the projects are financed

- Changes in leverage do not affect r_A or β_A
- Leverage affects r_E and β_E

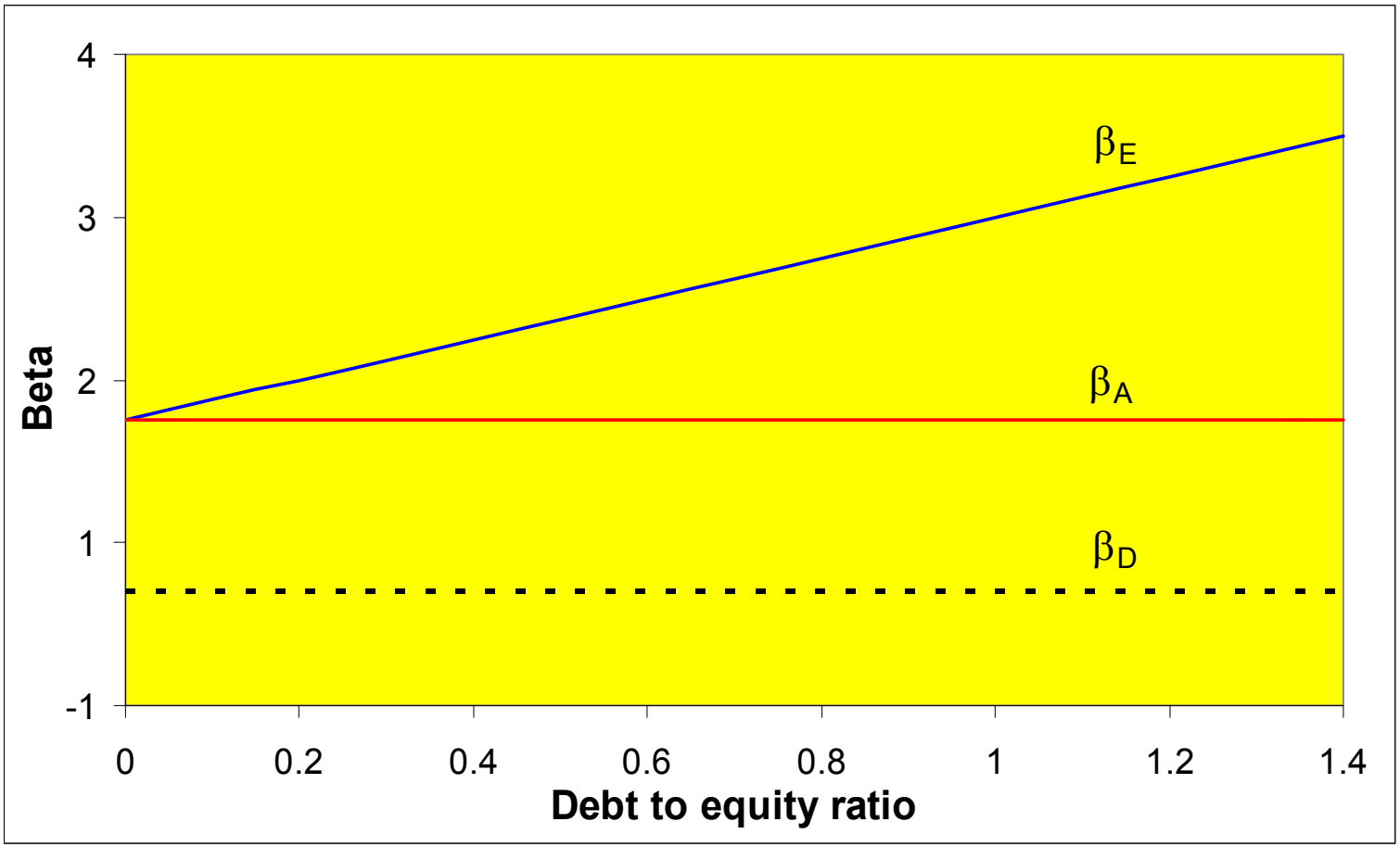
$$\beta_A = \frac{D}{V}\beta_D + \frac{E}{V}\beta_E$$

$$\beta_E = \beta_A + \frac{D}{E}(\beta_A - \beta_D)$$

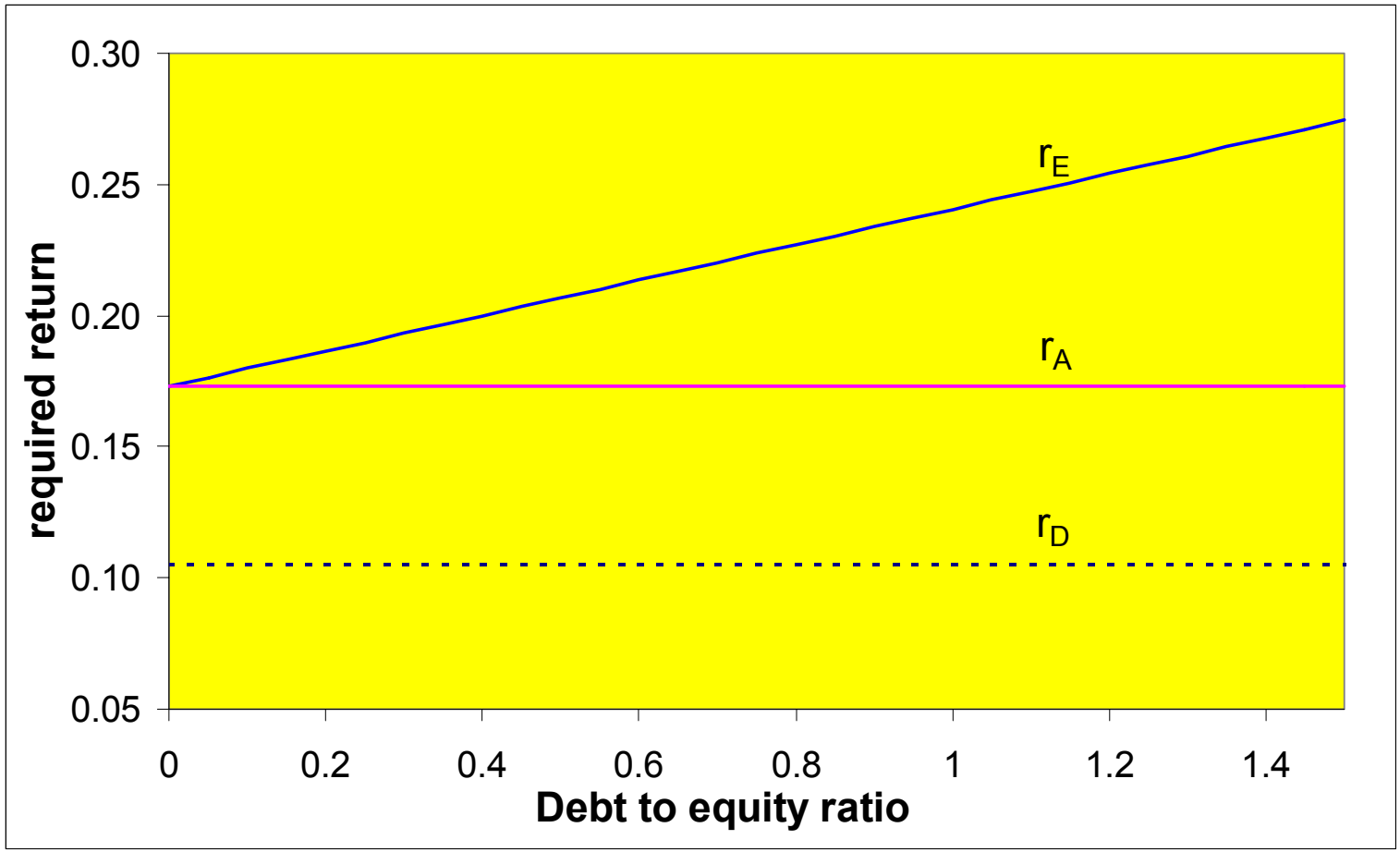
$$r_A = \frac{D}{V}r_D + \frac{E}{V}r_E$$

$$r_E = r_A + \frac{D}{E}(r_A - r_D)$$

Leverage and beta



Leverage and required returns



Example

Your firm is all equity financed and has $1 million of assets and 10,000 shares of stock (stock price = $100). Earnings before interest and taxes next year will be either $50,000, $125,000, or $200,000 depending on economic conditions**. These earnings are expected to continue indefinitely. The payout ratio is 100%.**

The firm is thinking about a leverage recapitalization, selling $300,000 of debt and using the proceeds to repurchase stock. The interest rate is 10%.

How would this transaction affect the firm's EPS and stock price? Ignore taxes.

Current: all equity

	Bad	Expected	Good
# of shares	10,000	10,000	10,000
Debt	$0	$0	$0
EBIT	$50,000	$125,000	$200,000
Interest	0	0	0
Net income	$50,000	$125,000	$200,000
EPS	$5	$12.50	$20

Expected EPS = $12.5

Stock price = $100

r_E = DPS / price = EPS / price = 12.5%

Recap: 30% debt

	Bad	Expected	Good
# of shares	7,000	7,000	7,000
Debt (r=10%)	$300,000	$300,000	$300,000
EBIT	$50,000	$125,000	$200,000
Interest	30,000	30,000	30,000
Net income	$20,000	$95,000	$170,000
EPS	$2.86	$13.57	$24.29

Expected EPS = $13.57

$r_E = r_A + D/E\ (r_A - r_D) = 0.125 + (0.30/0.70)\ (0.125 - 0.10) = 13.57\%$

Stock price = DPS / r_E = EPS / r_E = $100

Win-Win Fallacy: "Debt Is Better Because Some Investors Prefer Debt to Equity."

- Investors differ in their preferences and needs, and thus want different cash flow streams. (True)
- Example: Young professionals vs. Retirees
- The sum of what all investors will pay is greater if the firm issues different securities (e.g., debt and equity) tailored for different clienteles of investors (Financial Marketing). (False)
- What is wrong with this argument?

Win-Win Fallacy (cont.)

- This reasoning assumes incomplete markets, i.e., that:
  - There are indeed clienteles for different securities
  - These clienteles are “unsatisfied”, i.e., that investors cannot replicate the security at the same or even lower cost.

- A large unsatisfied clientele for corporate debt is unlikely, as there exist close substitutes to any particular firm’s debt.

- Also, financial intermediaries are in the business of identifying unsatisfied clientele.

- Win-Win situation is more likely for more exotic securities or sophisticated financial arrangement

Practical Implications

- When evaluating a decision (e.g., the effect of a merger):
  - → Separate financial (RHS) and real (LHS) parts of the move
  - → MM tells that most value is created on LHS

- When evaluating an argument in favor of a financial decision:
  - → Understand that it is wrong under MM assumptions
  - → What departures from MM assumptions does it rely upon?
  - → If none, then this is very dubious argument.
  - → If some, try to assess their magnitude.

What's Missing from the Simple M-M Story?

- Taxes:
  - → Corporate taxes
  - → Personal taxes

- Costs of Financial Distress

Capital Structure and Corporate Taxes

- Different financial transactions are taxed differently:
  - → Interest payments are tax exempt for the firm.
  - → Dividends and retained earnings are not.
  - → Etc.

- Financial policy matters because it affects a firm's tax bill.

Debt Tax Shield

Claim: Debt increases firm value by reducing the tax burden.

- **Example:** XYZ Inc. generates a safe $100M annual perpetuity. Assume risk-free rate of 10%. Compare:
  - 100% debt: perpetual $100M interest
  - 100% equity: perpetual $100M dividend or capital gains

	100% Debt	**100% Equity**
Income before tax	Interest Income $100M	Equity income $100M
Corporate tax rate 35%	0	-$35M
Income after tax	$100M	$65M
Firm value	**$1,000M**	**$650M**

Intuition

- MM still holds: The pie is unaffected by capital structure.

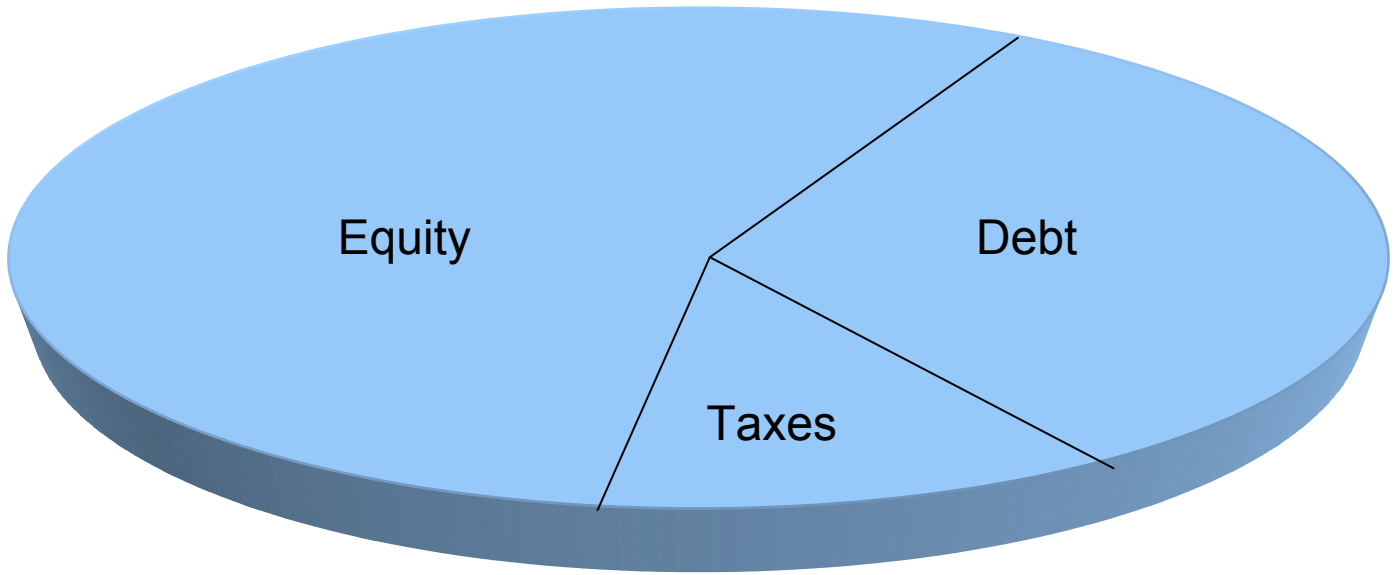
  Size of the pie = Value of *before-tax* cashflows

- But the IRS gets a slice too

- Financial policy affects the size of that slice.

- Interest payments being tax deductible, the PV of the IRS' slice can be reduced by using debt rather than equity.

“Pie” Theory



Example

In 2000, Microsoft had sales of $23 billion, earnings before taxes of $14.3 billion, and net income of $9.4 billion. Microsoft paid $4.9 billion in taxes, had a market value of $423 billion, and had no long-term debt outstanding.

Bill Gates is thinking about a recapitalization, issuing $50 billion in long-term debt (rd = 7%) and repurchasing $50 billion in stock. How would this transaction affect Microsoft's after-tax cashflows and shareholder wealth?

Microsoft: Balance sheet in $ millions

Item	1997	1998	1999	2000
Cash	8,966	13,927	17,236	23,798
Current assets	10,373	15,889	20,233	30,308
Current liabs	3,610	5,730	8,718	9,755
LT debt	0	0	0	0
Bk equity	9,797	15,647	27,485	41,368
Mkt equity	155,617	267,700	460,770	422,640
Sales	11,358	14,484	19,747	22,956
EBIT	5,314	7,117	11,891	14,275
Taxes	1,860	2,627	4,106	4,854
Net income	3,454	4,490	7,785	9,421
Oper CF	4,689	6,880	10,003	13,961

Microsoft, 2000 ($ millions)

	No Debt	Debt
EBIT	$14,275	$14,275
Interest (r × 50,000)	0	3,500
Earnings before taxes	$14,275	$10,775
Taxes (34%)	4,854	3,664
After-tax earnings	$9,421	$7,111
Cashflow to debtholders	$0	$3,500
Cashflow to equityholders	$9,421	$7,111
Total cashflows to D & E	$9,421	$10,611

Tax savings of debt

Marginal tax rate = τ

Taxes for unlevered firm……τ EBIT

Taxes for levered firm……... .τ (EBIT – interest)

Interest tax shield ……..τ **interest**

Interest = r_d D

Interest tax shield (each year) **= τ r_d D**

Note: only interest, not principal, payments reduce taxes