CHANGES TO CAPITAL STRUCTURE

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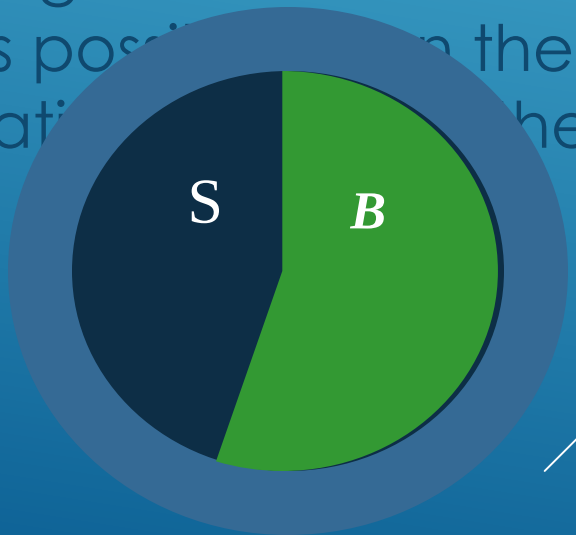
THE CAPITAL STRUCTURE QUESTION AND THE PIE THEORY

- **Definition**: Capital Structure is the mix of financial securities used to finance the firm.
- The value of a firm is defined to be the sum of the value of the firm's debt and the firm's equity.
- V = B + S
- If the goal of the management of the firm is to make the firm as valuable as possible, the firm should pick the debt-equity ratio that makes the pie as big as possible.



THE CAPITAL-STRUCTURE QUESTION

There are really two important questions:

1. Why should the stockholders care about maximizing ***firm*** value? Perhaps they should be interested in strategies that maximize ***shareholder*** value.

2. What is the ratio of debt-to-equity that maximizes the shareholder's value?

As it turns out, changes in capital structure benefit the stockholders *if and only if* the value of the firm increases.

Note: When we talk about a change in capital structure, we usually hold other things constant. Thus, an increase in debt financing implies that equity will be repurchased (and vice versa) so that overall assets remain unchanged.

FINANCIAL LEVERAGE AND RETURN TO SHAREHOLDERS (EPS)

Example (No Tax):

There are two identical firms (A and B) on the market. V=$100,000 for both firms.

Firm A is an all equity firm, and it has 10,000 shares outstanding with $10/share.

Firm B has a capital structure of 50% of debt and 50% of equity. Firm B has 5,000 shares outstanding with $10/share. The interest rate for the debt is 10% / year.

Assuming the next year's EBIT could be $8,000 if the economy is in recession or $12,000 if the economy is in boom.

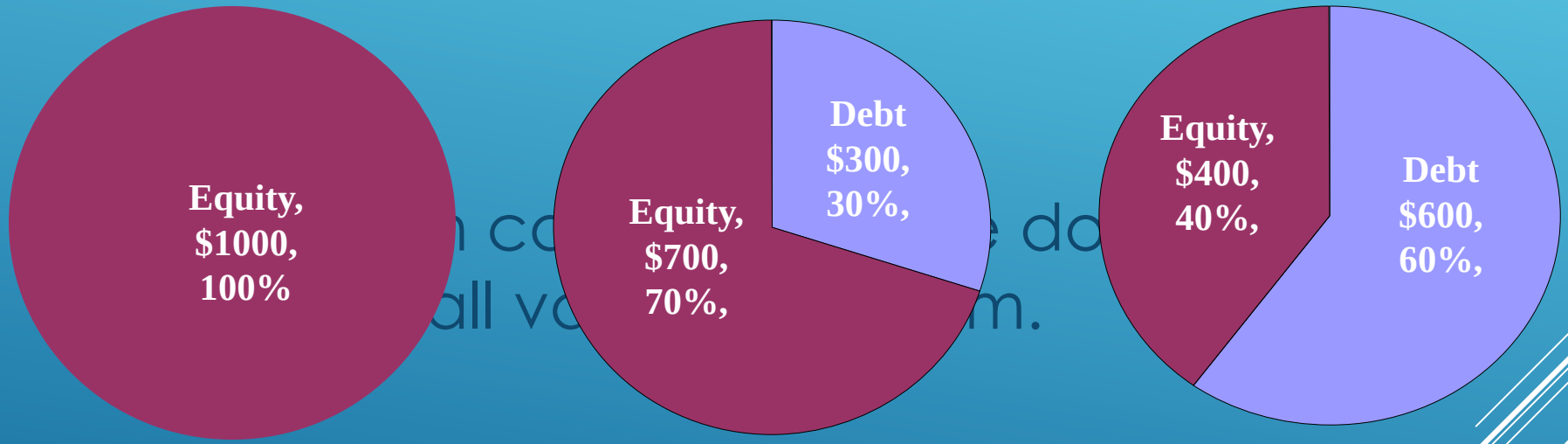
- **Calculate the EPS for both firms under two states of economy**.
- **Calculate the breakeven point of the EPS and EBIT.**

Is There An Optimal Capital Structure?

Modigliani and Miller – No Tax Case

- M&M began looking at capital structure in a very simplified world so that we would know what does or does not matter.
  - Assume no taxes
  - No transaction costs
    - Including no bankruptcy costs
    - Investors can borrow/lend at the same rate (the same as the firm).
  - No information asymmetries
  - A fixed investment policy by the firm

M&M NO TAX: RESULT



Total Firm Value = S+B

Does not change (the pie is the same size in each case, just the slices are different).

THE M&M PROPOSITIONS I & II (NO TAXES)

- **Proposition I**
  - Firm value is not affected by leverage

$$V_L = V_U$$

- **Proposition II**
  - Leverage increases the risk and return to stockholders

$$r_s = r_0 + (B / S)(r_0 - r_B)$$

r_B is the interest rate (cost of debt)

r_s is the cost of equity for the levered firm

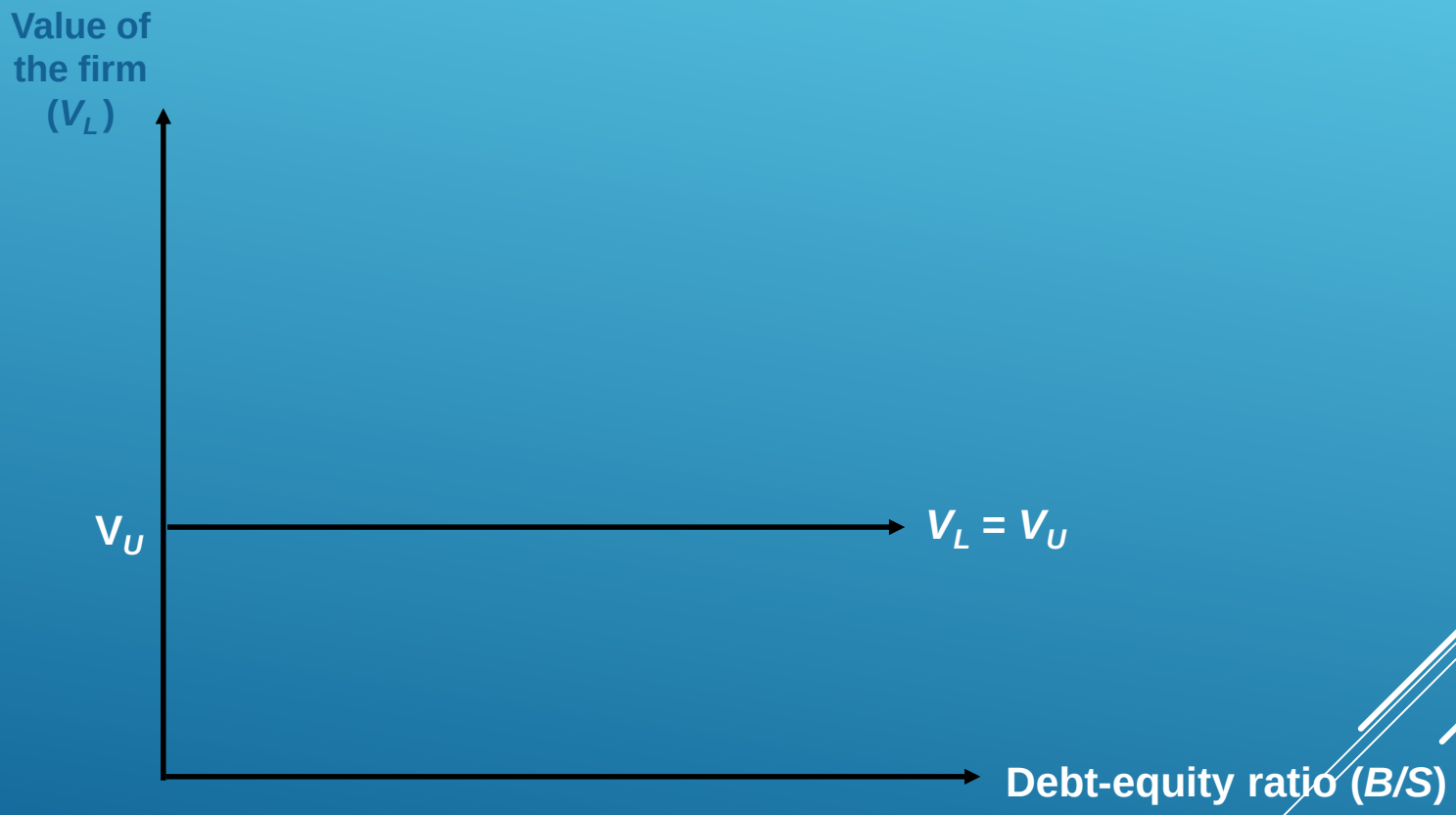
r_0 is the cost of capital for the all-equity firm

B is the value of debt

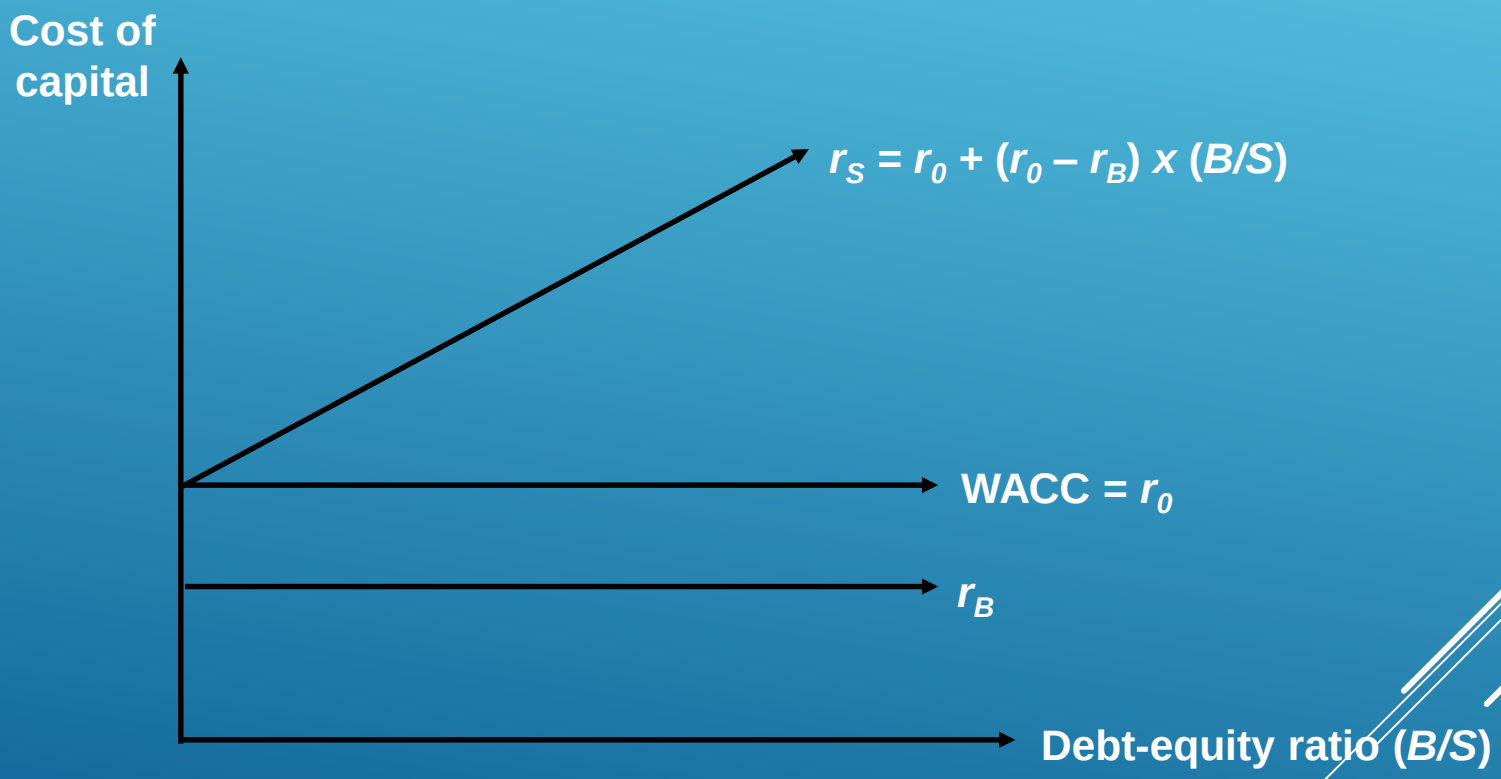
S is the value of levered equity

Note: Proof of Propositions is required

The Value of a Levered Firm Under MM Proposition I with No Corporate Taxes



The Cost of Equity, the Cost of Debt, and the Weighted Average Cost of Capital: MM Proposition II with No Corporate Taxes



M&M WITH CORPORATE TAXES

- When corporate taxes are introduced, then debt financing causes a positive benefit to the value of the firm.
- The reason for this is that debt interest payments reduce taxable income and thus reduce taxes.
  - Thus with debt, there is more after-tax cash flow available to security holders (equity and debt) than there is without debt.
  - Thus the value of the equity and debt securities combined is greater.

In general, a company's tax shields = Debt ×Interest × T_C

$= B \times r_B \times T_C$

If the savings are in perpetuity

$$PV = \frac{r_B \times B \times T_C}{r_B} = T_C \times B$$

This represents the increase in the value in the levered firm over the unlevered firm.

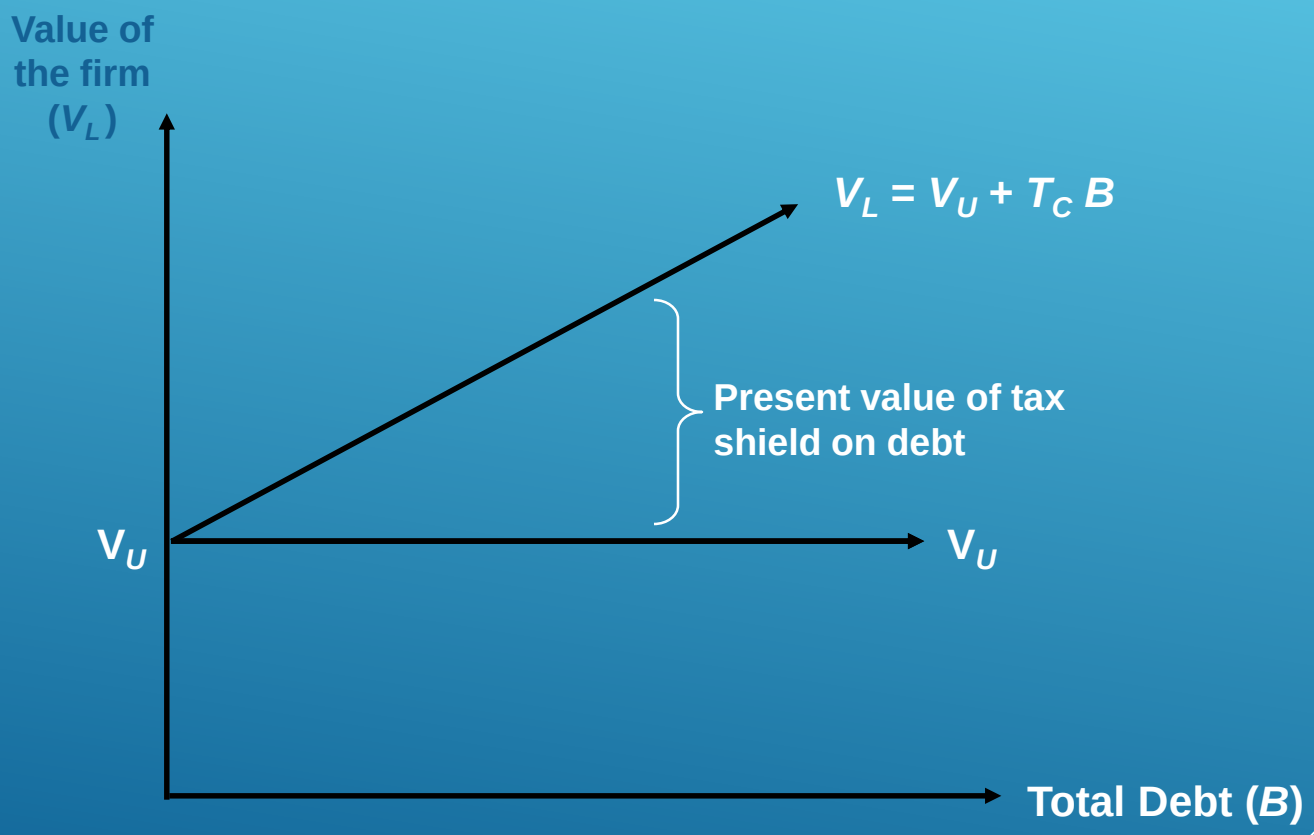
M&M PROPOSITION I (WITH CORPORATE TAXES)

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

$$V_L = V_U + T_C B$$

  - T_C B is the present value of the taxes saved because of the interest payment.
  - These interest tax shields increase the total value of the firm.

The Value of a Levered Firm Under MM Proposition I with Corporate Taxes



M&M PROPOSITION II (WITH CORP. TAXES)

- **Proposition II (with Corporate Taxes)**
  - This proposition is similar to Prop. II in the no tax case, however, now the risk and return of equity does not rise as quickly as the debt/equity ratio is increased because low-risk tax cash flows are saved.
  - Some of the increase in equity risk and return is offset by interest tax shield

$$r_S = r_0 + (B/S)\times(1-T_C)\times(r_0 - r_B)$$

r_B is the interest rate (cost of debt)

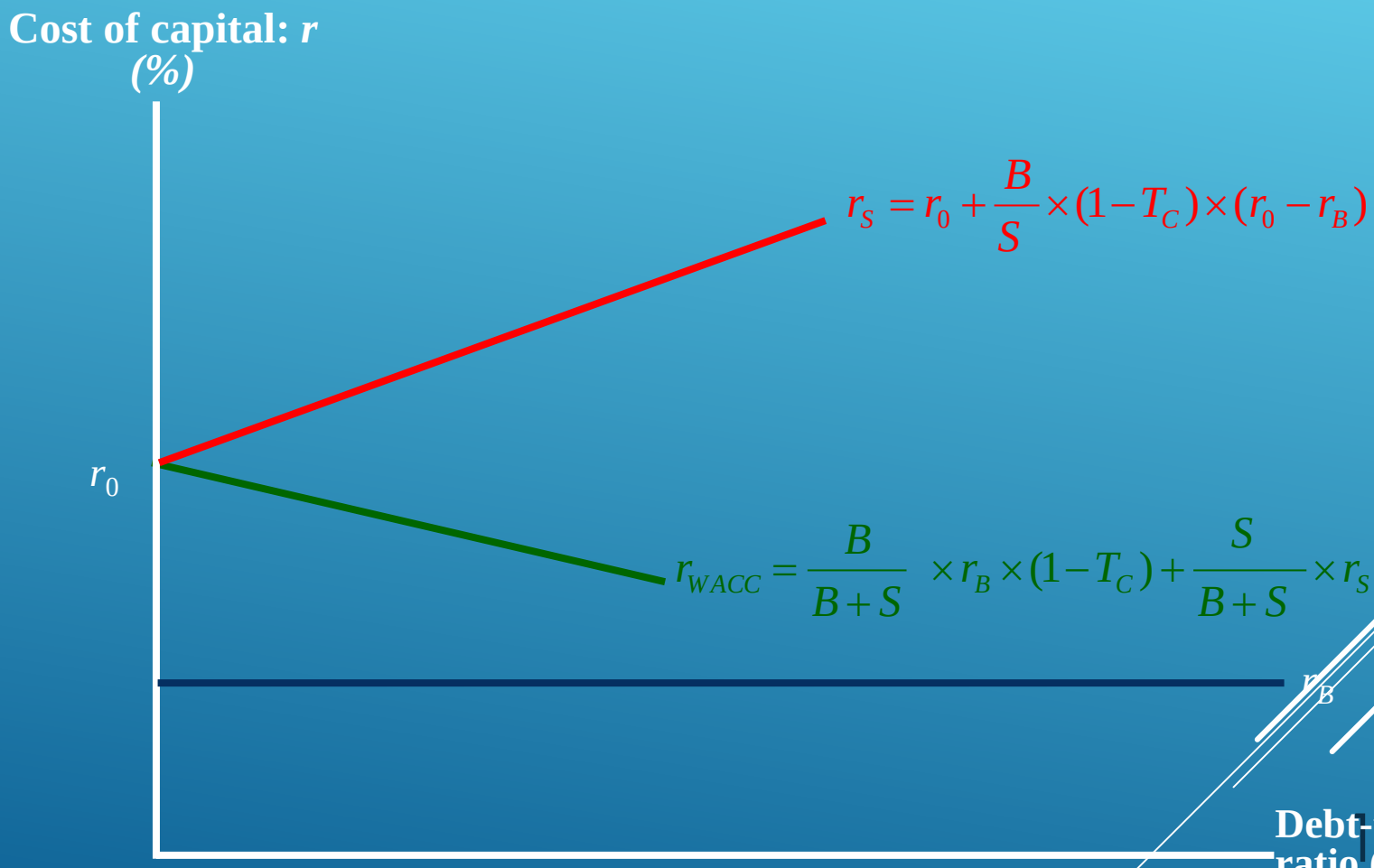
r_s is the cost of equity for the levered firm

r_0 is the cost of capital for the all-equity firm

B is the value of debt

S is the value of levered equity

THE EFFECT OF FINANCIAL LEVERAGE ON THE COST OF DEBT AND EQUITY CAPITAL



- Impact of indirect costs
  - NOPAT goes down due to lost customers and drop in productivity
  - Investment in capital goes up due to increase in net operating working capital (accounts payable goes up as suppliers tighten credit).

(Continued…)

- Additional debt can affect the behavior of managers.
  - Reductions in agency costs: debt "pre-commits," or "bonds," free cash flow for use in making interest payments. Thus, managers are less likely to waste FCF on perquisites or non-value adding acquisitions.
  - Increases in agency costs: debt can make managers too risk-averse, causing "underinvestment" in risky but positive NPV projects.

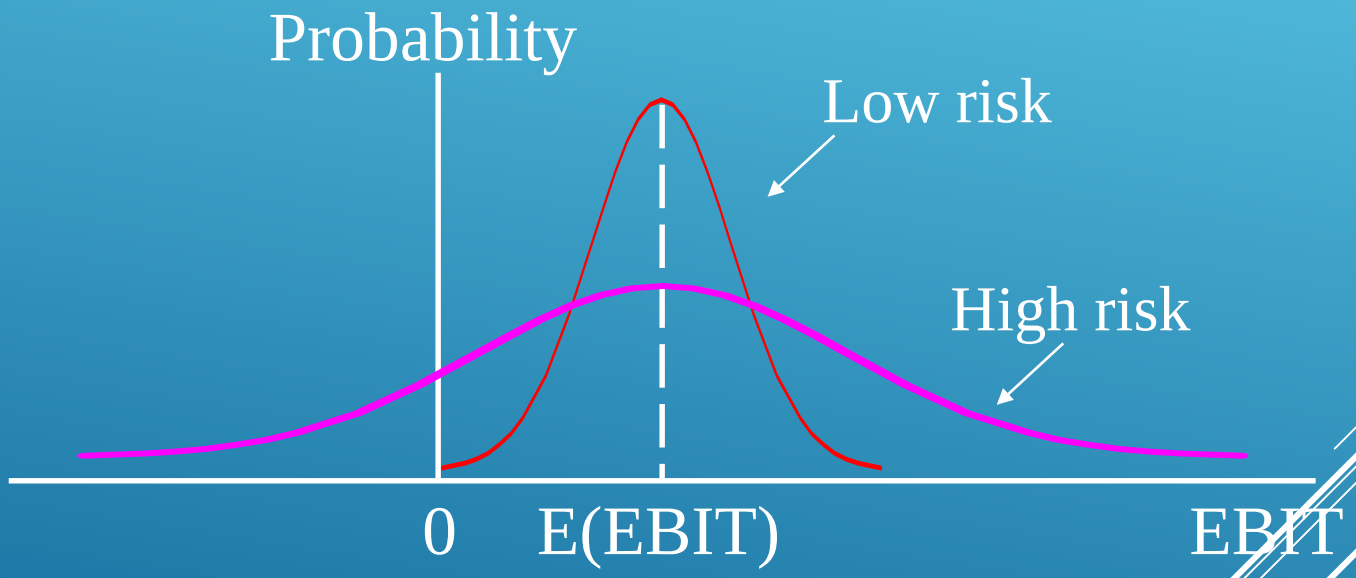
(Continued…)

ASYMMETRIC INFORMATION AND SIGNALING

- Managers know the firm's future prospects better than investors.
- Managers would not issue additional equity if they thought the current stock price was less than the true value of the stock (given their inside information).
- Hence, investors often perceive an additional issuance of stock as a negative signal, and the stock price falls.

WHAT IS BUSINESS RISK?

- Uncertainty about future pre-tax operating income (EBIT).



- Note that business risk focuses on operating income, so it ignores financing effects.

FACTORS THAT INFLUENCE BUSINESS RISK

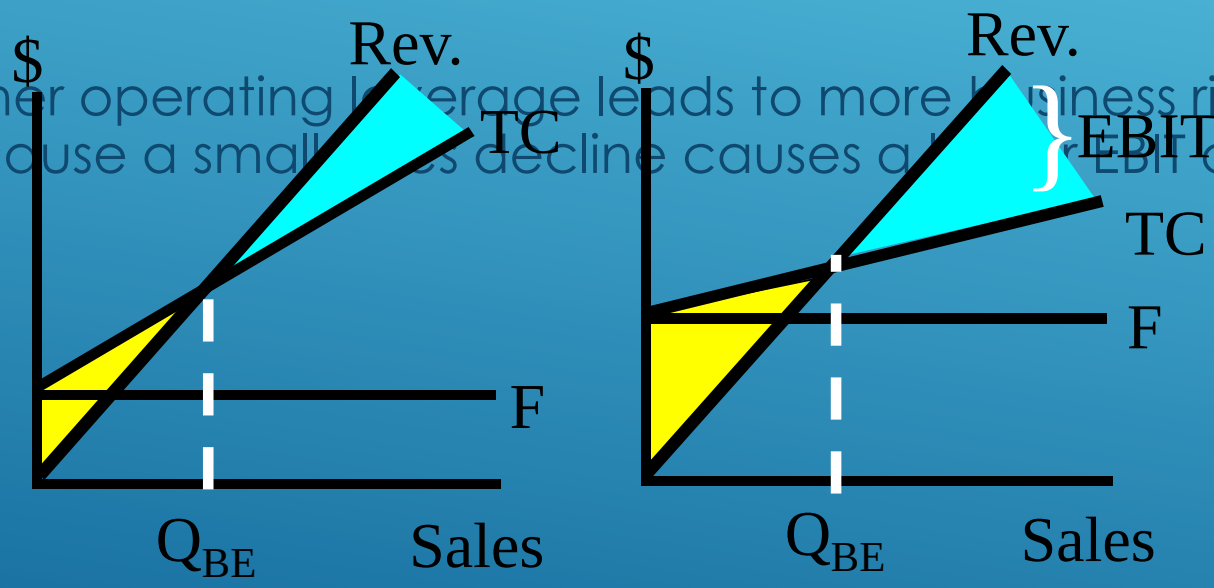
- Uncertainty about demand (unit sales).
- Uncertainty about output prices.
- Uncertainty about input costs.
- Product and other types of liability.
- Degree of operating leverage (DOL).

WHAT IS OPERATING LEVERAGE, AND HOW DOES IT AFFECT A FIRM'S BUSINESS RISK?

- Operating leverage is the change in EBIT caused by a change in quantity sold.
- The higher the proportion of fixed costs within a firm's overall cost structure, the greater the operating leverage.

(More...)

- Higher operating leverage leads to more business risk, because a small sales decline causes a large EBIT decline.



(More...)

OPERATING BREAKEVEN

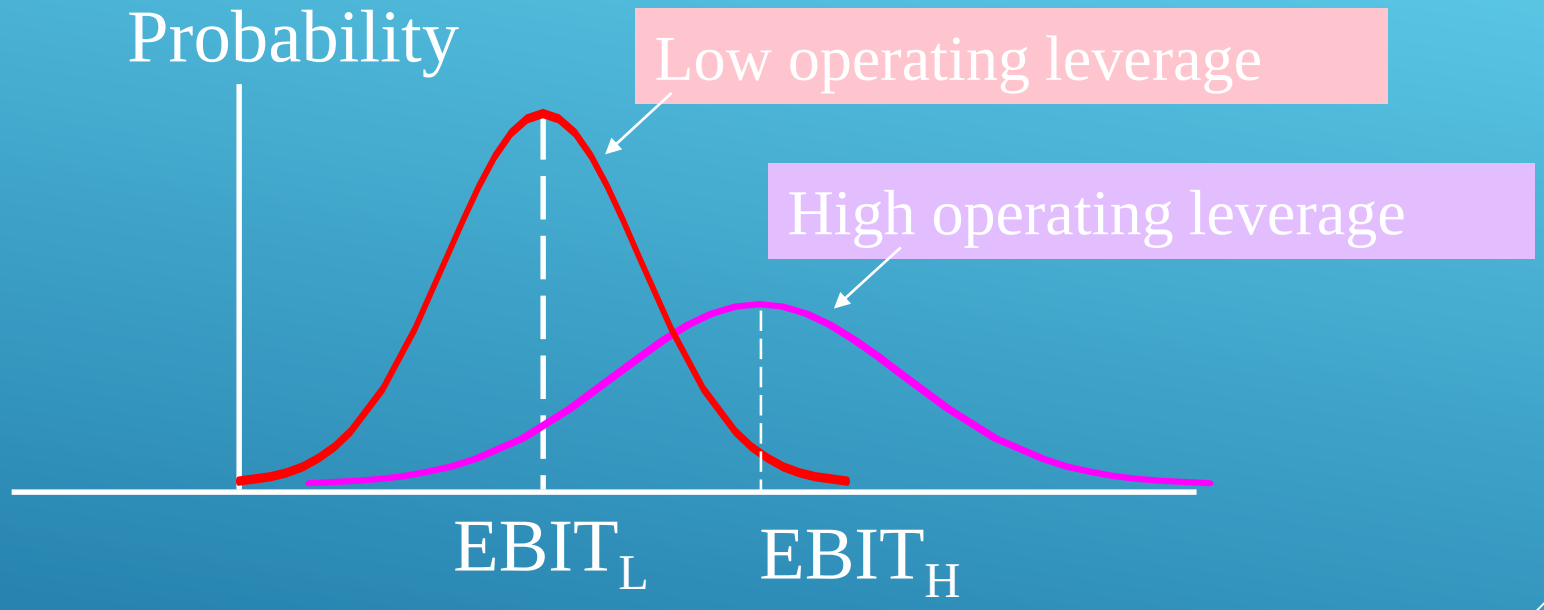
- Q is quantity sold, F is fixed cost, V is variable cost, TC is total cost, and P is price per unit.
- Operating breakeven = Q_{BE}

$$Q_{BE} = F / (P - V)$$

- Example: F=$200, P=$15, and V=$10:

$$Q_{BE} = \$200 / (\$15 - \$10) = 40.$$

(More...)



- In the typical situation, higher operating leverage leads to higher expected EBIT, but also increases risk.

BUSINESS RISK VERSUS FINANCIAL RISK

- Business risk:
  - Uncertainty in future EBIT.
  - Depends on business factors such as competition, operating leverage, etc.
- Financial risk:
  - Additional business risk concentrated on common stockholders when financial leverage is used.
  - Depends on the amount of debt and preferred stock financing.

Consider Two Hypothetical Firms

Firm U	Firm L
No debt	$10,000 of 12% debt
$20,000 in assets	$20,000 in assets
40% tax rate	40% tax rate

Both firms have same operating leverage, business risk, and EBIT of $3,000. They differ only with respect to use of debt.

Impact of Leverage on Returns

	Firm U	Firm L
EBIT	$3,000	$3,000
Interest	0	1,200
EBT	$3,000	$1,800
Taxes (40%)	1 ,200	720
NI	$1,800	$1,080
ROE	9.0%	10.8%

WHY DOES LEVERAGING INCREASE RETURN?

- More EBIT goes to investors in Firm L.
  - Total dollars paid to investors:
    - U: NI = $1,800.
    - L: NI + Int = $1,080 + $1,200 = $2,280.
  - Taxes paid:
    - U: $1,200; L: $720.
- Equity $ proportionally lower than NI.

Now consider the fact that EBIT is not known with certainty. What is the impact of uncertainty on stockholder profitability and risk for Firm U and Firm L?

Continued…

Firm U: Unleveraged

	Economy		
	Bad	Avg.	Good
Prob.	0.25	0.50	0.25
EBIT	$2,000	$3,000	$4,000
Interest	0	0	0
EBT	$2,000	$3,000	$4,000
Taxes (40%)	800	1,200	1,600
NI	$1,200	$1,800	$2,400

Firm L: Leveraged

	Economy		
	Bad	Avg.	Good
Prob.*	0.25	0.50	0.25
EBIT*	$2,000	$3,000	$4,000
Interest	1,200	1,200	1,200
EBT	$ 800	$1,800	$2,800
Taxes (40%)	320	720	1,120
NI	$ 480	$1,080	$1,680

*Same as for Firm U.

Firm U	Bad	Avg.	Good
BEP	10.0%	15.0%	20.0%
ROIC	6.0%	9.0%	12.0%
ROE	6.0%	9.0%	12.0%
TIE	n.a.	n.a.	n.a.

Firm L	Bad	Avg.	Good
BEP	10.0%	15.0%	20.0%
ROIC	6.0%	9.0%	12.0%
ROE	4.8%	10.8%	16.8%
TIE	1.7x	2.5x	3.3x

Profitability Measures:

	U	L
E(BEP)	15.0%	15.0%
E(ROIC)	9.0%	9.0%
E(ROE)	9.0%	10.8%

Risk Measures:

σ_{ROIC}	2.12%	2.12%
σ_{ROE}	2.12%	4.24%

CONCLUSIONS

- Basic earning power (EBIT/TA) and ROIC (NOPAT/Capital = EBIT(1-T)/TA) are unaffected by financial leverage.
- L has higher expected ROE: tax savings and smaller equity base.
- L has much wider ROE swings because of fixed interest charges. Higher expected return is accompanied by higher risk.

(More...)

- In a stand-alone risk sense, Firm L's stockholders see much more risk than Firm U's.
  - U and L: $\sigma_{ROIC} = 2.12\%$.
  - U: $\sigma_{ROE} = 2.12\%$.
  - L: $\sigma_{ROE} = 4.24\%$.
- L's financial risk is $\sigma_{ROE} - \sigma_{ROIC} = 4.24\% - 2.12\% = 2.12\%$. (U's is zero.)

(More...)

- For leverage to be positive (increase expected ROE), BEP must be > r_d.
- If r_d > BEP, the cost of leveraging will be higher than the inherent profitability of the assets, so the use of financial leverage will depress net income and ROE.
- In the example, E(BEP) = 15% while interest rate = 12%, so leveraging "works."

CAPITAL STRUCTURE THEORY

- MM theory
  - Zero taxes
  - Corporate taxes
  - Corporate and personal taxes
- Trade-off theory
- Signaling theory
- Debt financing as a managerial constraint

MM THEORY: ZERO TAXES

- MM prove, under a very restrictive set of assumptions, that a firm's value is unaffected by its financing mix:
  - $V_L = V_U$.
- Therefore, capital structure is irrelevant.
- Any increase in ROE resulting from financial leverage is exactly offset by the increase in risk (i.e., r_s), so WACC is constant.

- **References**

- Baker, S R, N Bloom, S J Davis, K Kost, M Sammon and T Viratyosin (2020), "The unprecedented stock market reaction to COVID-19", *Covid Economics* 1: 33-42
- Baur, D G and L T Hoang (2020), "A Crypto Safe Haven against Bitcoin", *Finance Research Letters*, 101431
- Baur, D G and T K McDermott (2010), "Is gold a safe haven? International evidence", *Journal of Banking & Finance* 34: 1886-1898
- Bofinger, P, S Dullien, G Felbermayr, C Fuest, M Hüther, J Südekum and B Weder di Mauro (2020), "Economic implications of the COVID-19 crisis for Germany and economic policy measures", in R Baldwin B Weder di Mauro (eds), *Mitigating the COVID Economic Crisis: Act Fast and Do Whatever it Takes*, VoxEU.org Book, CEPR Press.
- Cheema, M A, R W Faff and K Szulczuk (2020), "The 2008 Global Financial Crisis and COVID-19 Pandemic: How Safe are the Safe Haven Assets?", *Covid Economics* 34: 88-115
- Cheema, M A, K R Szulczyk and E Bouri (2020), "Cryptocurrency returns and economic policy uncertainty: A multicountry analysis using linear and quantile-based models", SSRN.
- Low, R K Y, Y Yao and R Faff (2016), "Diamonds vs. precious metals: What shines brightest in your investment portfolio?", *International Review of Financial Analysis* 43: 1-14
- Urquhart, A and H Zhang (2019), "Is Bitcoin a hedge or safe haven for currencies? An intraday analysis", *International Review of Financial Analysis* 63: 49-57
- Wyplosz, C (2020), "So far, so good: And now don't be afraid of moral hazard", in R Baldwin and B Weder di Mauro (eds), *Mitigating the COVID Economic Crisis: Act Fast and Do Whatever it Takes*, a VoxEU.org Book, CEPR Press.