# FN 201 : Lecture Note 9
# Capital Structure Decision

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# Topics in Lecture Note

- Overview and preview of capital structure effects
- Business versus financial risk and the impact of debt on returns
- Capital structure theory
- Example: Choosing the optimal structure

# Overview and preview of capital structure effects

# Goal of the Firm ?

- Maximize shareholder Wealth
- Maximize Profits
- Maximize ROIC
- Maximize Firm Value
- Minimize WACC

$$V = \sum_{t=1}^{\infty} \frac{FCF_t}{(1+WACC)^t}$$

The impact of capital structure on value depends upon the effect of debt on:

**=> WACC and FCF**

Basic notation:

- V = value of firm
- FCF = free cash flow
- WACC = weighted average cost of capital

# Goal of the Firm ?

- Maximize shareholder Wealth
- Maximize Profits
- Maximize ROIC
- Maximize Firm Value
- Minimize WACC

$$V = \sum_{t=1}^{\infty} \frac{FCF_t}{(1+WACC)^t}$$

- Lowering risk
- Increasing CFs
- Maximize Op. Profits
- Growth Business
- Reduce Taxes

# The Effect of Additional Debt on WACC

- Debt holders have **a prior claim on cash flows** relative to stockholders.

  = **Cost of stock, $R_E$, goes up**.

- Debt **increases risk of bankruptcy**

  = Causes **pre-tax cost of debt**, $R_D$, to increase

- Adding debt increase percent of firm financed with **low-cost debt** ($w_d$) and decreases percent financed with **high-cost equity** ($w_s$)

  = **Net effect on WACC is uncertain**

# The Effect of Additional Debt on FCF

- Debt Reduces the Taxes a Company Pays
- Additional debt **increases the probability of bankruptcy**:
  - **Direct costs** = Legal fees, “fire” sales, etc.
  - **Indirect costs** = Lost customers
- Additional debt can affect **the behavior of managers**:
  - **Reductions in agency costs**
  - **Increases in agency costs:** too risk-averse

# Business versus financial risk

# and the impact of debt on returns

# Business Risk: Uncertainty in EBIT, NOPAT, and ROIC

- 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**

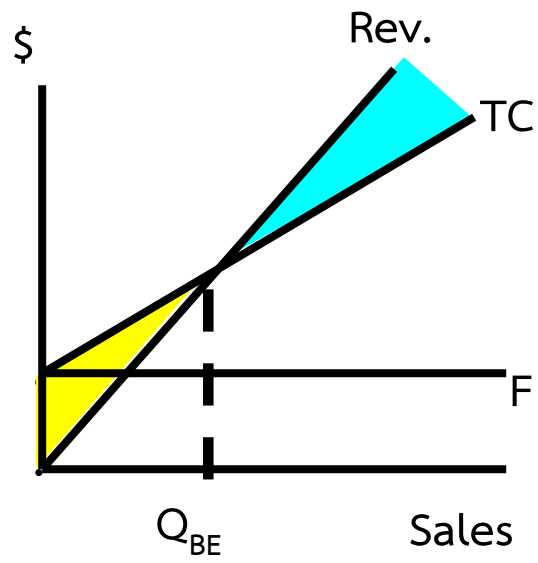
  = the change in EBIT caused by a change in quantity sold

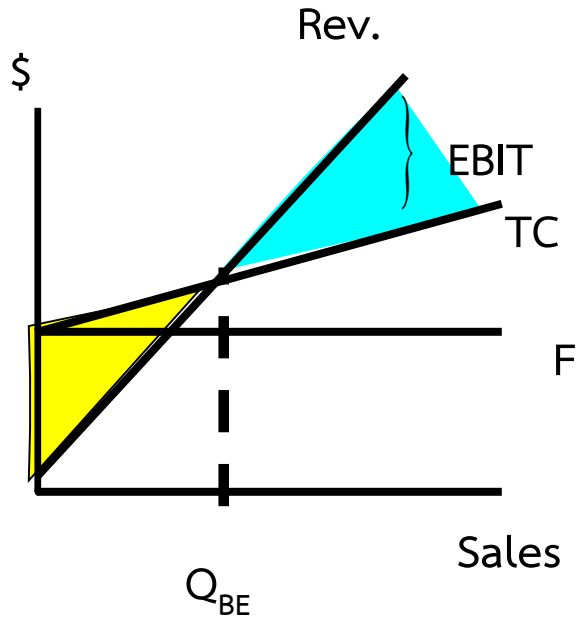
- The **higher the proportion of <u>fixed costs</u>** relative to **variable costs**,

  => the greater the operating leverage

Higher operating leverage leads to more business risk:

= small sales decline causes a larger EBIT decline.



# Operating Breakeven or Breakeven Quantity ($Q_{BE}$)

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

Q = quantity sold P = price per unit

F = fixed cost V = variable cost

TC = total cost, and

**Example**: Shapland Inc. has fixed operating costs of $500,000 and variable costs of $50 per unit. If it sells the product for $75 per unit, what is the break-even quantity?

# Business Risk versus Financial Risk

- **Business risk:**
  - Uncertainty in future **EBIT, NOPAT, and ROIC**.
  - 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 financing**.

**Recall that:**

1. NOPAD = EBIT ( 1 – T)
2. ROIC = NOPAD / Capital
3. ROE = NI / Equity

# Consider Two Hypothetical Firms Identical Except for Debt

| | Firm U | Firm L |
|---|---|---|
| Capital | $20,000 | $20,000 |
| Debt | $0 | $10,000 (12% rate) |
| Equity | $20,000 | $10,000 |
| Tax rate | 40% | 40% |
| EBIT | $3,000 | $3,000 |
| NOPAT | $1,800 | $1,800 |
| ROIC | 9% | 9% |

# 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 |
| ROIC = NOPAT/Capital | 9.0% | 9.0% |
| ROE = NI/Equity | 9.0% | 10.8% |

# Why does leveraging increase return?

- **More cash goes to investors** of 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.
- In Firm L, **fewer dollars are tied up in equity**.

# Impact of Leverage on Returns if EBIT Falls

## = Leverage magnifies risk and return!

| | Firm U | Firm L |
|---|---|---|
| EBIT | $2,000 | $2,000 |
| Interest | 0 | 1,200 |
| EBT | $2,000 | $800 |
| Taxes (40%) | 800 | 320 |
| NI | $1,200 | $480 |
| ROIC | 6.0% | 6.0% |
| ROE | 6.0% | 4.8% |

# Impact of Leverage on Returns if EBIT Increases

## = Leverage magnifies risk and return!

| | Firm U | Firm L |
|---|---|---|
| EBIT | $4,000 | $4,000 |
| Interest | 0 | 1,200 |
| EBT | $4,000 | $2,800 |
| Taxes (40%) | 1,600 | 1,120 |
| NI | $2,400 | $1,680 |
| ROIC | 12.0% | 12.0% |
| ROE | 12.0% | 16.8% |

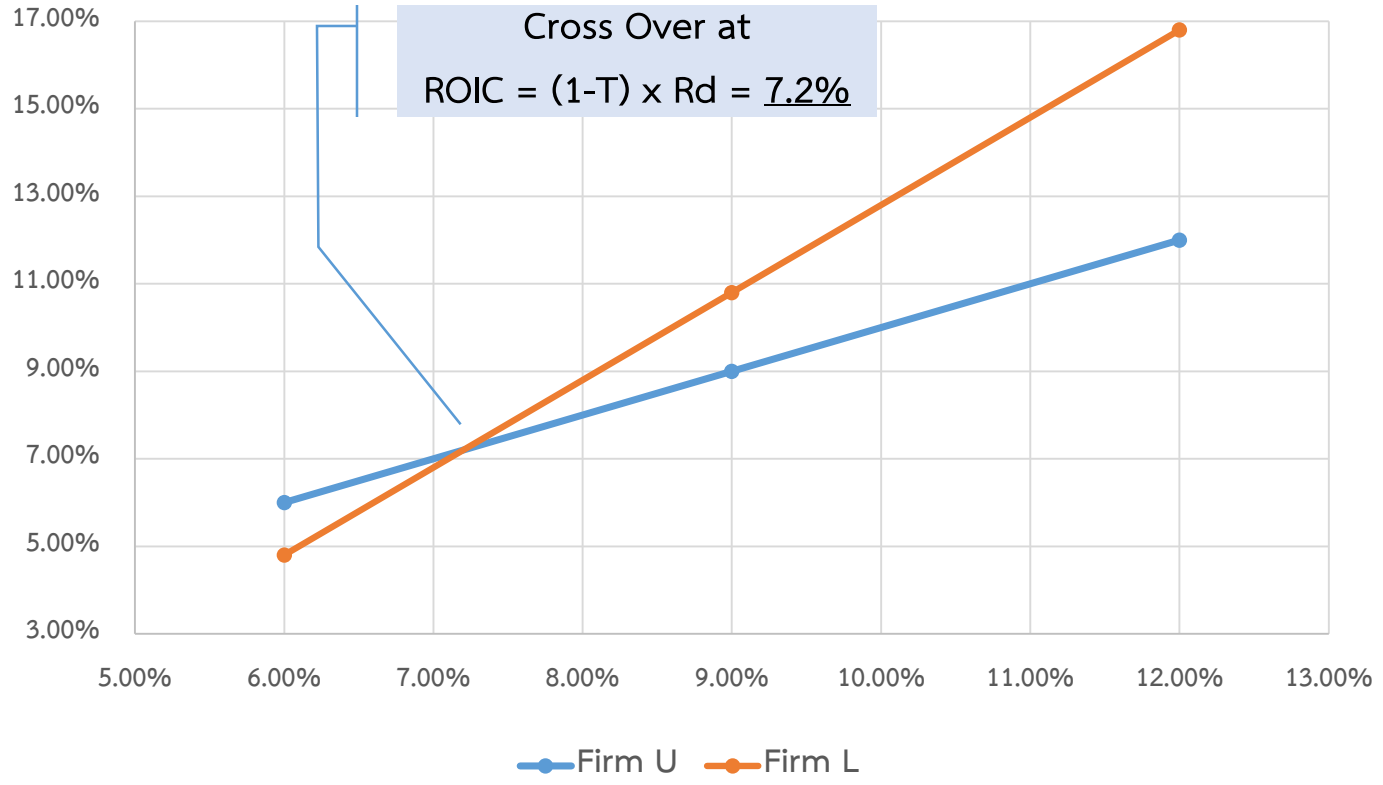
# Leverage magnifies risk and return!

- Financial risk is from an uncertainty in **EBIT and thus NOPAT**

1. NOPAD = EBIT ( 1 – T)
2. ROIC = NOPAD / Capital
3. ROE = NI / Equity

| Key Performance Measures | Worst | | Expected | | Best | |
|---|---|---|---|---|---|---|
| | U | L | U | L | U | L |
| EBIT | $2,000 | $2,000 | $3,000 | $3,000 | $4,000 | $4,000 |
| NOPAT (tax = 40%) | $1,200 | $1,200 | $1,800 | $1,800 | 1,600 | 1,600 |
| ROIC | 6.0% | 6.0% | 9.0% | 9.0% | 12.0% | 12.0% |
| **ROE** | **6.0%** | **4.8%** | **9.0%** | **10.8%** | **12.0%** | **16.8%** |

# Financial Leverage



# Capital structure theory

# Capital Structure Theory

- MM theory
  - Zero taxes
  - Corporate taxes
  - Corporate and personal taxes
- Trade-off theory
- Signaling theory
- Pecking order
- Debt financing as a managerial constraint
- Windows of opportunity

# Modigliani-Miller (MM) Theory: Zero Taxes

| | Firm U | Firm L |
|---|---|---|
| EBIT | $3,000 | $3,000 |
| Interest | 0 | 1,200 |
| NI | $3,000 | $1,800 |
| | | |
| CF to shareholder | $3,000 | $1,800 |
| CF to debtholder | 0 | $1,200 |
| Total CF | $3,000 | $3,000 |

*Notice that the total CF are identical for both firms.*

# MM Results: Zero Taxes

- **MM assume:**

  (1) No transactions costs;

  (2) No restrictions or costs to short sales;

  (3) Individuals can borrow at the same rate as corporations.

- MM prove that **if the total CF to investors of Firm U and Firm L are equal**, then arbitrage is possible unless the total values of Firm U and Firm L are equal:

$$V_L = V_U$$

- Because FCF and values of firms L and U are equal, **their WACCs are equal**.
- Therefore, capital structure is irrelevant.

# MM Theory: Corporate Taxes

- Corporate tax laws **allow interest to be deducted**, which reduces taxes paid by levered firms.
- Therefore, more **CF goes to investors and less to taxes** when leverage is used.
- In other words, **the debt "shields" some of the firm's CF from taxes.**

# MM Result: Corporate Taxes

- MM show that the total CF to Firm L's investors is equal to the total CF to Firm U's investor plus an additional amount due to interest deductibility:

$$CF_L = CF_U + r_d DT$$

- What is value of these cash flows?

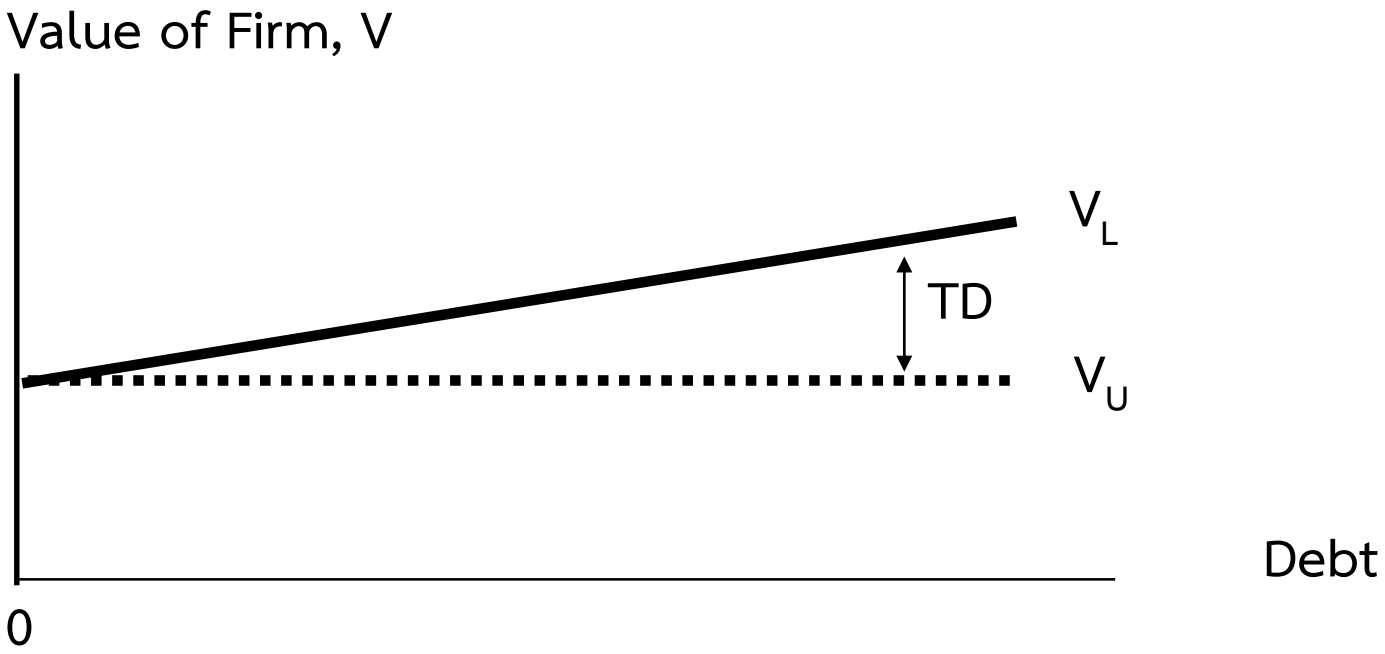
  Value of $CF_U = V_U$

  MM show that the value of $r_d DT = TD$

**Therefore, $V_L = V_U + TD$**

- If T=40%, then every dollar of debt adds 40 cents of extra value to firm.

# MM relationship between value and debt when corporate taxes are considered.




Under MM with corporate taxes, the firm's value increases continuously as more and more debt is used.

# Miller's Theory: Corporate and Personal Taxes

- **Personal taxes lessen the advantage of corporate debt:**
  - **Corporate taxes favor debt financing** since corporations can deduct interest expenses.
  - **Personal taxes favor equity financing**, since no gain is reported until stock is sold, and long-term gains are taxed at a lower rate.

# Miller's Model with Corporate and Personal Taxes

$$V_L = V_U + \left[1 - \frac{(1-T_c)(1-T_E)}{(1-T_D)}\right] D$$

$T_c$ = corporate tax rate.

$T_d$ = personal tax rate on debt income.

$T_E$ = personal tax rate on stock income.

$T_c = 40\%$, $T_d = 30\%$, and $T_s = 12\%$.

$$V_L = V_U + \left[ 1 - \frac{(1 - 0.40)(1 - 0.12)}{(1 - 0.30)} \right] D$$

$$= V_U + (1 - 0.75)D$$

$$= V_U + 0.25D.$$

**Value rises with debt; each $1 increase in debt raises L's value by $0.25.**

# Conclusions with Personal Taxes

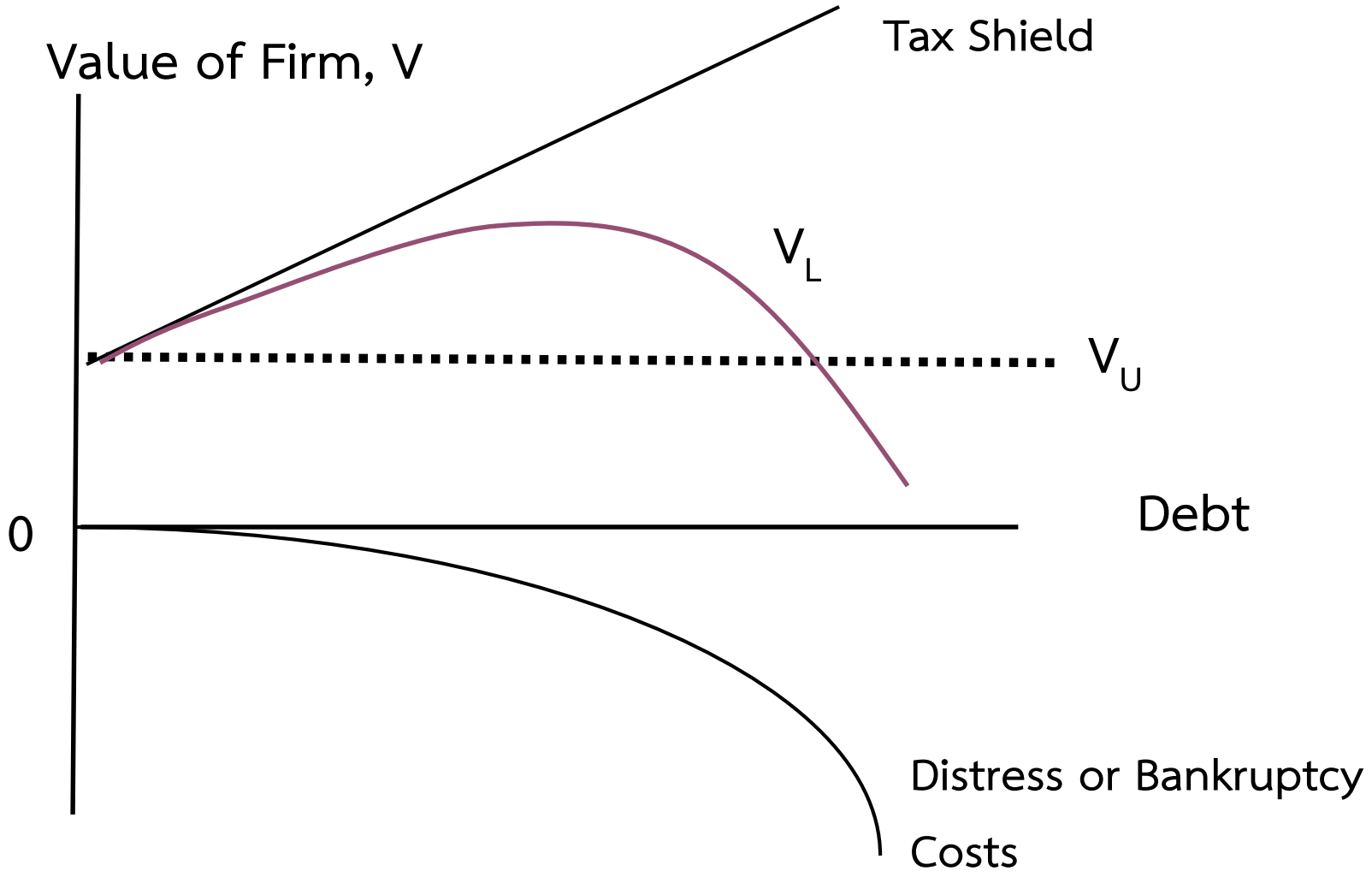
- Use of **debt financing remains advantageous, but benefits are less than under only corporate taxes.**
- **Firms should still use 100% debt.**

Note: However, Miller argued that in equilibrium, the tax rates of marginal investors **would adjust until there was no advantage to debt.**

# Trade-off Theory

- **MM theory ignores bankruptcy (financial distress) costs**, which increase as more leverage is used.
  - ✓ At low leverage levels, tax benefits outweigh bankruptcy costs.
  - ✓ At high levels, bankruptcy costs outweigh tax benefits.
- **An optimal capital structure exists that balances these costs and benefits.**

# Tax Shield vs. Cost of Financial Distress



# Signaling Theory - Information

- MM assumed that **investors and managers have the same information.**
- But, **managers often have better information**. Thus, they would:
  - ✓A firm with **very positive prospect** should **NOT sell stock** and instead to raise required new capital by other means
  - ✓A firm with **very negative prospect** should **sell stock**, brining new investor to share losses!
- Investors understand this, so view **new stock sales as a negative signal.**
- Implications for managers?

# Pecking Order Theory

- Firms **use internally generated funds first**, because there are no flotation costs or negative signals.
- If more funds are needed, **firms then issue debt because it has lower flotation costs than equity** and not negative signals.
- If more funds are needed, firms then issue **equity**.

# Implications for Managers

- **Take advantage of tax benefits** by issuing debt, especially if the firm has:
  - High tax rate, stable sales, and low operating leverage
- **Avoid financial distress costs** by maintaining excess borrowing capacity, especially if the firm has:
  - Volatile sales, high operating leverage, many potential investment opportunities
  - Special purpose assets (instead of general purpose assets that make good collateral)
- If manager has asymmetric information regarding firm's future prospects, then **avoid issuing equity** if actual prospects are better than the market perceives.

# Choosing the Optimal Capital Structure: Example

**Example:**

b = 1.0 $R_F$ = 6% $R_M$ = 6%

T = 40% Debt = 0

Expected FCF = $30 million (expects zero growth)

**Solution**

**Cost of equity using CAPM:**

$R_E = R_F + b\,(RP_M)$ = 12%

**Currently has no debt: $w_d$ = 0%.**

WACC = $R_E$ = 12%.

**Current Value of Operations**

$V_{op} = [FCF(1+g)]/(WACC - g)$

$= [\$30(1+0)]/(0.12 - 0)$

= $250 million.

# Other Data for Valuation Analysis

- Company has no ST investments.
- Company has no preferred stock.
- 10 mil shares outstanding

**Current Valuation Analysis**

| | |
|---|---|
| $V_{op}$ | $250 |
| + ST Inv. | 0 |
| $V_{Total}$ | $250 |
| – Debt | 0 |
| S | $250 |
| ÷ n | 10 |
| P | $25.00 |

# Investment bankers provided estimates of $R_D$ for different capital structures.

| $w_d$ | 0% | 20% | 30% | 40% | 50% |
|---|---|---|---|---|---|
| $r_d$ | 0.0% | 8.0% | 8.5% | 10.0% | 12.0% |

If company recapitalizes, it will use proceeds from debt issuance to repurchase stock.

## Hamada's Formula:

**The Cost of Equity at Different Levels of Debt**

= MM theory implies that **beta changes with leverage**.

$b_U$ is the beta of a firm when it has no debt (the unlevered beta)

$$b = b_U [1 + (1 - T)(w_d/w_s)]$$

# The Cost of Equity for $w_d$ = 20%

- Use Hamada's equation to find beta:

$b = b_U [1 + (1 - T)(w_d/w_s)]$

$= 1.0 [1 + (1-0.4) (20\% / 80\%) ]$

$= \underline{1.15}$

- Use CAPM to find the cost of equity:

$r_s = r_{RF} + b_L (RPM)$

$= 6\% + 1.15 (6\%) = \underline{12.9\%}$

- Calculate for new WACC:

$WACC = w_d (1-T) r_d + w_{ce} r_s$

$= 0.2 (1 – 0.4) (8\%) + 0.8 (12.9\%)$

$=\underline{11.28\%}$

# Beta, $r_s$, and WACC

| $w_d$ | 0% | 20% | 30% | 40% | 50% |
|---|---|---|---|---|---|
| $r_d$ | 0.0% | 8.0% | 8.5% | 10.0% | 12.0% |
| $w_s$ | 100% | 80% | 70% | 60% | 50% |
| b | 1.000 | 1.150 | 1.257 | 1.400 | 1.600 |
| $r_s$ | 12.00% | 12.90% | 13.54% | 14.40% | 15.60% |
| WACC | 12.00% | 11.28% | 11.01% | 11.04% | 11.40% |

The WACC is minimized for $w_d$ = 30%. This is the optimal capital structure.

# Corporate Value for $w_d$ = 20%

- $V_{op}$ = [FCF(1+g)]/(WACC – g)

  = [$30(1+0)]/(0.1128 – 0)

  = $265.96 million.

- Debt = $D_{New}$ = $w_d$ $V_{op}$

  = 0.20(265.96) = $53.19 million.

- Equity = S = $w_s$ $V_{op}$

  = 0.80(265.96) = $212.77 million.

# Value of Operations, Debt, and Equity

| $w_d$ | 0% | 20% | 30% | 40% | 50% |
|---|---|---|---|---|---|
| $r_d$ | 0.0% | 8.0% | 8.5% | 10.0% | 12.0% |
| $w_s$ | 100% | 80% | 70% | 60% | 50% |
| b | 1.000 | 1.150 | 1.257 | 1.400 | 1.600 |
| $r_s$ | 12.00% | 12.90% | 13.54% | 14.40% | 15.60% |
| WACC | 12.00% | 11.28% | 11.01% | 11.04% | 11.40% |
| $V_{op}$ | $250.00 | $265.96 | $272.48 | $271.74 | $263.16 |
| D | $0.00 | $53.19 | $81.74 | $108.70 | $131.58 |
| S | $250.00 | $212.77 | $190.74 | $163.04 | $131.58 |

Value of operations is maximized at $w_d$ = 30%.

Question?