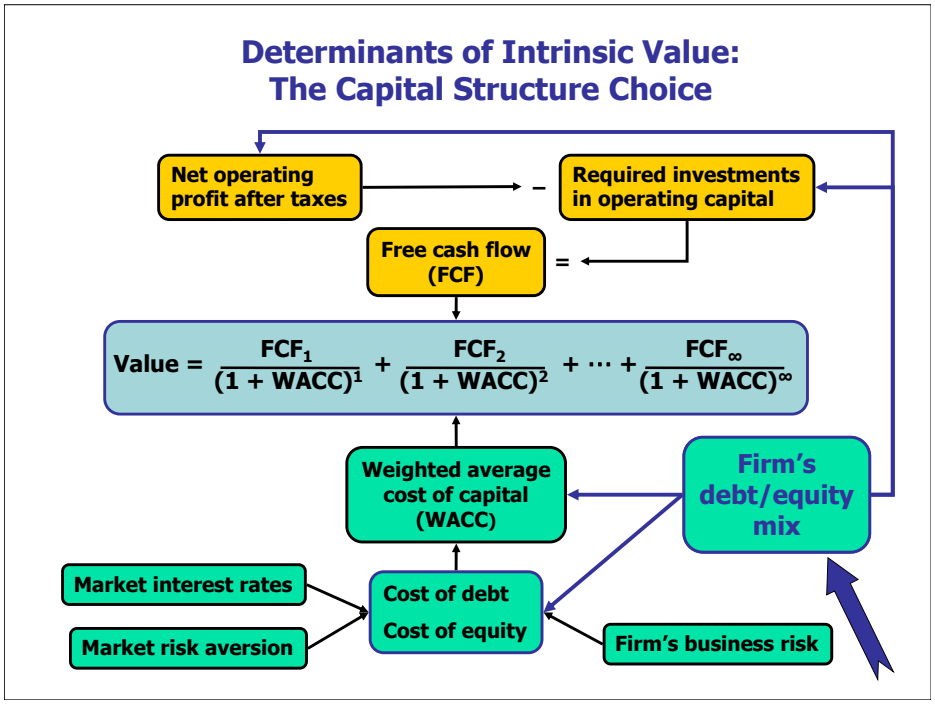
Chapter 15

Capital Structure Decisions

Topics in Chapter

- Overview and preview of capital structure effects
- Business versus financial risk
- The impact of debt on returns
- Capital structure theory, evidence, and implications for managers
- Example: Choosing the optimal structure



Basic Definitions

- V = value of firm
- FCF = free cash flow
- WACC = weighted average cost of capital
- r_s and r_d are costs of stock and debt
- w_s and w_d are percentages of the firm that are financed with stock and debt.

How can capital structure affect value?

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

$$WACC = w_d (1-T) r_d + w_s r_s$$

A Preview of Capital Structure Effects

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

(Continued…)

The Effect of Additional Debt on WACC

- Debtholders have a prior claim on cash flows relative to stockholders.
  - Debtholders' "fixed" claim increases risk of stockholders' "residual" claim.
  - Cost of stock, r_s, goes up.
- Firm's can deduct interest expenses.
  - Reduces the taxes paid
  - Frees up more cash for payments to investors
  - Reduces after-tax cost of debt

(Continued…)

The Effect on WACC (Continued)

- 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 = uncertain.

(Continued…)

The Effect of Additional Debt on FCF

- Additional debt increases the probability of bankruptcy.
  - Direct costs: Legal fees, "fire" sales, etc.
  - Indirect costs: Lost customers, reduction in productivity of managers and line workers, reduction in credit (i.e., accounts payable) offered by suppliers

(Continued…)

- 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 down 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.

Business Risk: Uncertainty in EBIT, NOPAT, and ROIC

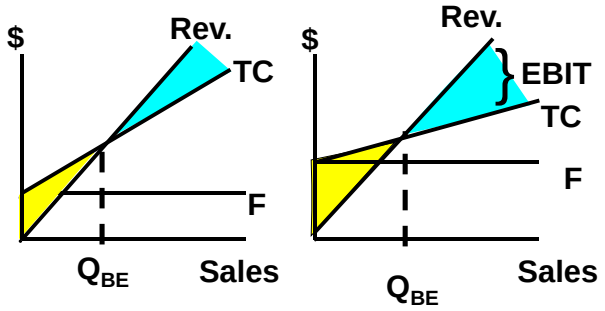
- Uncertainty about demand (unit sales).
- Uncertainty about output prices.
- Uncertainty about input costs.
- Product and other types of liability.
- Degree of operating leverage (DOL).

What is operating leverage, and how does it affect a firm's business risk?

- Operating leverage is the change in EBIT caused by a change in quantity sold.
- The higher the proportion of fixed costs relative to variable costs, the greater the operating leverage.

(More...)

Higher operating leverage leads to more business risk: small sales decline causes a larger 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...)

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 and preferred stock financing.

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	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

	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%

Leverage magnifies risk and return!

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

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; and (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.

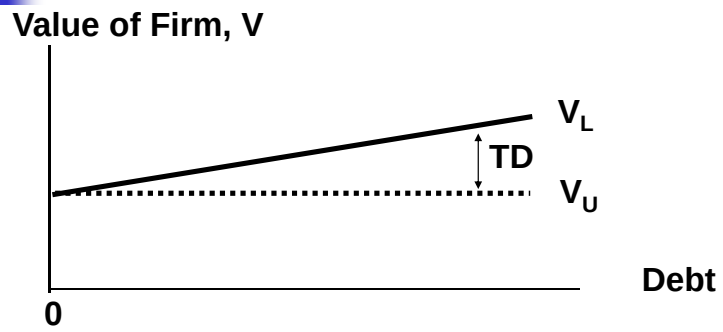
MM Theory: Corporate Taxes

- 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:
  - $CF_L = CF_U + r_dDT$.
- What is value of these cash flows?
  - Value of $CF_U = V_U$
  - MM show that the value of $r_dDT = TD$
  - 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

$$V_L = V_U + \left(1 - \frac{(1 - T_c)(1 - T_s)}{(1 - T_d)}\right) D$$

T_c = corporate tax rate.
T_d = personal tax rate on debt income.
T_s = 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.

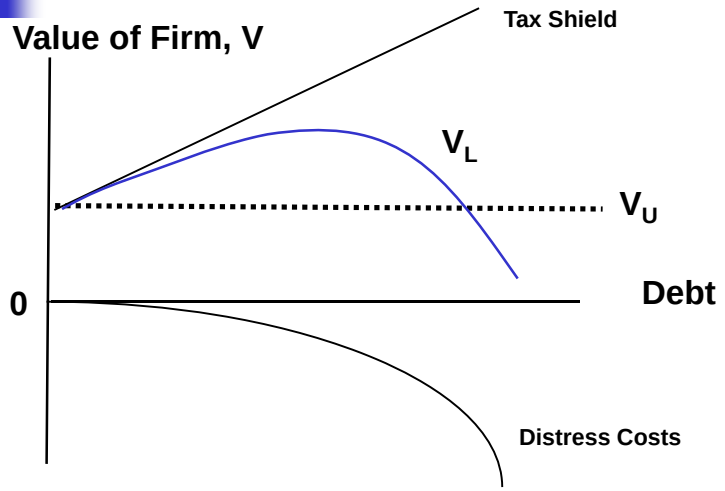
Conclusions with Personal Taxes

- 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

- MM assumed that investors and managers have the same information.
- But, managers often have better information. Thus, they would:
  - Sell stock if stock is overvalued.
  - Sell bonds if stock is undervalued.
- 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.

Debt Financing and Agency Costs

- One agency problem is that managers can use corporate funds for non-value maximizing purposes.
- The use of financial leverage:
  - Bonds "free cash flow."
  - Forces discipline on managers to avoid perks and non-value adding acquisitions.

(More...)

- A second agency problem is the potential for "underinvestment".
  - Debt increases risk of financial distress.
  - Therefore, managers may avoid risky projects even if they have positive NPVs.

Investment Opportunity Set and Reserve Borrowing Capacity

- Firms with many investment opportunities should maintain reserve borrowing capacity, especially if they have problems with asymmetric information (which would cause equity issues to be costly).

Windows of Opportunity

- Managers try to "time the market" when issuing securities.
- They issue equity when the market is "high" and after big stock price run ups.
- They issue debt when the stock market is "low" and when interest rates are "low."
- The issue short-term debt when the term structure is upward sloping and long-term debt when it is relatively flat.

Empirical Evidence

- Tax benefits are important– $1 debt adds about $0.10 to value.
- Bankruptcies are costly– costs can be up to 10% to 20% of firm value.
- Firms don't make quick corrections when stock price changes cause their debt ratios to change– doesn't support trade-off model.

Empirical Evidence (Continued)

- After big stock price run ups, debt ratio falls, but firms tend to issue equity instead of debt.
  - Inconsistent with trade-off model.
  - Inconsistent with pecking order.
  - Consistent with windows of opportunity.
- Many firms, especially those with growth options and asymmetric information problems, tend to maintain excess borrowing capacity.

Implications for Managers

- Take advantage of tax benefits by issuing debt, especially if the firm has:
  - High tax rate
  - Stable sales
  - Low operating leverage

Implications for Managers (Continued)

- 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)

Implications for Managers (Continued)

- If manager has asymmetric information regarding firm's future prospects, then avoid issuing equity if actual prospects are better than the market perceives.
- Always consider the impact of capital structure choices on lenders' and rating agencies' attitudes

Choosing the Optimal Capital Structure: Example

- b = 1.0; r_{RF} = 6%; RP_M = 6%.
- Cost of equity using CAPM:
  - $r_s = r_{RF} + b\,(RP_M) = 6\% + 1(6\%) = 12\%$
- Currently has no debt: w_d = 0%.
  - WACC = r_s = 12%.
- Tax rate is T = 40%.

Current Value of Operations

- Expected FCF = $30 million.
- Firm expects zero growth: g = 0.
- $V_{op} = [FCF(1+g)]/(WACC - g)$
  $= [\$30(1+0)]/(0.12 - 0)$
  $= \$250$ million.

Other Data for Valuation Analysis

- Company has no ST investments.
- Company has no preferred stock.
- 100,000 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.

The Cost of Equity at Different Levels of Debt: Hamada's Formula

- 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:

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

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

  $= 1.15$
- Use CAPM to find the cost of equity:

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

  $= 6\% + 1.15 (6\%) = 12.9\%$

The WACC for w_d = 20%

- $WACC = w_d (1-T) r_d + w_{ce} r_s$
- $WACC = 0.2 (1 – 0.4) (8\%) + 0.8 (12.9\%)$
- $WACC = 11.28\%$

- Repeat this for all capital structures under consideration.

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%.

Anatomy of a Recap: Before Issuing Debt

	Before Debt
V_{op}	\$250
+ ST Inv.	0
V_{Total}	\$250
– Debt	0
S	\$250
÷ n	10
P	\$25.00
Total shareholder wealth: S + Cash	\$250

Issue Debt (w_d = 20%), But Before Repurchase

- WACC decreases to 11.28%.
- V_{op} increases to $265.9574.
- Firm temporarily has short-term investments of $53.1915 (until it uses these funds to repurchase stock).
- Debt is now $53.1915.

Anatomy of a Recap: After Debt, but Before Repurchase

	Before Debt	After Debt, Before Rep.
V_{op}	$250	$265.96
+ ST Inv.	0	53.19
V_{Total}	$250	$319.15
– Debt	0	53.19
S	$250	$265.96
÷ n	10	10
P	$25.00	$26.60
Total shareholder wealth: S + Cash	$250	$265.96

After Issuing Debt, Before Repurchasing Stock

- Stock price increases from $25.00 to $26.60.
- Wealth of shareholders (due to ownership of equity) increases from $250 million to $265.96 million.

The Repurchase: No Effect on Stock Price

- The announcement of an intended repurchase might send a signal that affects stock price, and the previous change in capital structure affects stock price, but the repurchase itself has no impact on stock price.
  - If investors thought that the repurchase would increase the stock price, they would all purchase stock the day before, which would drive up its price.
  - If investors thought that the repurchase would decrease the stock price, they would all sell short the stock the day before, which would drive down the stock price.

Remaining Number of Shares After Repurchase

- D_{Old} is amount of debt the firm initially has, D_{New} is amount after issuing new debt.
- If all new debt is used to repurchase shares, then total dollars used equals
  - $(D_{New} - D_{Old}) = (\$53.19 - \$0) = \$53.19$.
- n_{Prior} is number of shares before repurchase, n_{Post} is number after. Total shares remaining:
  - $n_{Post} = n_{Prior} - (D_{New} - D_{Old})/P$
    $= 10 - (\$53.19/\$26.60)$
    $= 8$ million.

(Ignore rounding differences; see *Ch15 Mini Case.xls* for actual calculations).

Anatomy of a Recap: After Rupurchase

	Before Debt	After Debt, Before Rep.	After Rep.
V_{op}	\$250	\$265.96	\$265.96
+ ST Inv.	0	53.19	0
V_{Total}	\$250	\$319.15	\$265.96
– Debt	0	53.19	53.19
S	\$250	\$265.96	\$212.77
÷ n	10	10	8
P	\$25.00	\$26.60	\$26.60
Total shareholder wealth: S + Cash	\$250	\$265.96	\$265.96

Key Points

- ST investments fall because they are used to repurchase stock.
- Stock price is unchanged.
- Value of equity falls from \$265.96 to \$212.77 because firm no longer owns the ST investments.
- Wealth of shareholders remains at \$265.96 because shareholders now directly own the funds that were held by firm in ST investments.

Intrinsic Stock Price Maximized at Optimal Capital Structure

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
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D	\$0.00	\$53.19	\$81.74	\$108.70	\$131.58
S	\$250.00	\$212.77	\$190.74	\$163.04	\$131.58
n	10	8	7	6	5
P	\$25.00	\$26.60	**\$27.25**	\$27.17	\$26.32

Shortcuts

- The corporate valuation approach will always give the correct answer, but there are some shortcuts for finding S, P, and n.
- Shortcuts on next slides.

Calculating S, the Value of Equity after the Recap

- $S = (1 - w_d)\ V_{op}$
- At $w_d = 20\%$:
- $S = (1 - 0.20)\ \$265.96$
- $S = \$212.77$.

(Ignore rounding differences; see *Ch15 Mini Case.xls* for actual calculations).

Number of Shares after a Repurchase, n_{Post}

- At $w_d = 20\%$:
- $n_{Post} = n_{Prior}(V_{opNew} - D_{New})/(V_{opNew} - D_{Old})$
  $= 10(\$265.96 - \$53.19)/(\$265.96 - \$0)$
  $= 8$

Calculating PPost, the Stock Price after a Recap

- At $w_d = 20\%$:
- $P_{Post} = (V_{opNew} - D_{Old})/n_{Prior}$
  $= (\$265.96 - \$0)/10$
  $= \$26.60$

Optimal Capital Structure

- w_d = 30% gives:
  - Highest corporate value
  - Lowest WACC
  - Highest stock price per share
- But w_d = 40% is close. Optimal range is pretty flat.