Chapter 14: Capital Structure Decisions

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

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
- \( w_d \) and \( w_e \) are percentages of the firm that are financed with stock and debt.

How can capital structure affect value?

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

\[
WACC = w_d (1-T) r_d + w_e r_s
\]

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

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 (\( w_e \))
- Net effect on WACC = uncertain.

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
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).

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.

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).

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).

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
- No debt
- $20,000 in assets
- 40% tax rate

Firm L
- $10,000 of 12% debt
- $20,000 in assets
- 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

<table>
<thead>
<tr>
<th></th>
<th>Firm U</th>
<th>Firm L</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>$3,000</td>
<td>$3,000</td>
</tr>
<tr>
<td>Interest</td>
<td>0</td>
<td>1,200</td>
</tr>
<tr>
<td>EBT</td>
<td>$3,000</td>
<td>$1,800</td>
</tr>
<tr>
<td>Taxes (40%)</td>
<td>1,200</td>
<td>720</td>
</tr>
<tr>
<td>NI</td>
<td>$1,800</td>
<td>$1,080</td>
</tr>
<tr>
<td>ROE</td>
<td>9.0%</td>
<td>10.8%</td>
</tr>
</tbody>
</table>

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?
Firm L: Leveraged

<table>
<thead>
<tr>
<th>Economy</th>
<th>Bad</th>
<th>Avg.</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prob.*</td>
<td>0.25</td>
<td>0.50</td>
<td>0.25</td>
</tr>
<tr>
<td>EBIT*</td>
<td>$2,000</td>
<td>$3,000</td>
<td>$4,000</td>
</tr>
<tr>
<td>Interest</td>
<td>1,200</td>
<td>1,200</td>
<td>1,200</td>
</tr>
<tr>
<td>EBT</td>
<td>$800</td>
<td>$1,800</td>
<td>$2,800</td>
</tr>
<tr>
<td>Taxes (40%)</td>
<td>320</td>
<td>720</td>
<td>1,120</td>
</tr>
<tr>
<td>NI</td>
<td>$480</td>
<td>$1,080</td>
<td>$1,680</td>
</tr>
</tbody>
</table>

*Same as for Firm U.

Economy

<table>
<thead>
<tr>
<th>Firm U</th>
<th>Bad</th>
<th>Avg.</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEP</td>
<td>10.0%</td>
<td>15.0%</td>
<td>20.0%</td>
</tr>
<tr>
<td>ROIC</td>
<td>6.0%</td>
<td>9.0%</td>
<td>12.0%</td>
</tr>
<tr>
<td>ROE</td>
<td>6.0%</td>
<td>9.0%</td>
<td>12.0%</td>
</tr>
<tr>
<td>TIE</td>
<td>n.a.</td>
<td>n.a.</td>
<td>n.a.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Firm L</th>
<th>Bad</th>
<th>Avg.</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEP</td>
<td>10.0%</td>
<td>15.0%</td>
<td>20.0%</td>
</tr>
<tr>
<td>ROIC</td>
<td>6.0%</td>
<td>9.0%</td>
<td>12.0%</td>
</tr>
<tr>
<td>ROE</td>
<td>4.8%</td>
<td>10.8%</td>
<td>16.8%</td>
</tr>
<tr>
<td>TIE</td>
<td>1.7x</td>
<td>2.5x</td>
<td>3.3x</td>
</tr>
</tbody>
</table>

Profitability Measures:

- **U**
  - E(BEP): 15.0%
  - E(ROIC): 9.0%
  - E(ROE): 9.0%

- **L**
  - E(BEP): 15.0%
  - E(ROIC): 9.0%
  - E(ROE): 10.8%

Risk Measures:

- $\sigma_{\text{ROIC}}$: 2.12%
- $\sigma_{\text{ROE}}$: 2.12%

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.

In a stand-alone risk sense, Firm L’s stockholders see much more risk than Firm U’s.

- U and L: $\sigma_{\text{ROIC}} = 2.12\%$.
- U: $\sigma_{\text{ROE}} = 2.12\%$.
- L: $\sigma_{\text{ROE}} = 4.24\%$.

L’s financial risk is $\sigma_{\text{ROE}} - \sigma_{\text{ROIC}} = 4.24\% - 2.12\% = 2.12\%$. (U’s is zero.)

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.

MM Theory: Corporate Taxes

- Corporate tax laws favor debt financing over equity financing.
- With corporate taxes, the benefits of financial leverage exceed the risks: More EBIT goes to investors and less to taxes when leverage is used.
- MM show that: \( V_L = V_U + TD \).
- 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.

MM relationship between capital costs and leverage when corporate taxes are considered.

- Cost of Capital (%)
- WACC
- \( r_s(1-T) \)
- Debt/Value Ratio (%)

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**

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

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

**Example Calculation:**

\[ T_c = 40\%, \ T_d = 30\%, \text{ and } T_s = 12\%. \]

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

\[ = V_U + (1 - 0.75)D \]

\[ = V_U + 0.25D. \]

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.

**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?

**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.
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.

**Choosing the Optimal Capital Structure: Example**

Currently is all-equity financed.

Expected EBIT = $500,000.

Firm expects zero growth.

100,000 shares outstanding; \( r_s = 12\% \);

\[ P_0 = $25; T = 40\%; b = 1.0; r_{RF} = 6\%; \]

\[ R_{PM} = 6\%. \]

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### Estimates of Cost of Debt

<table>
<thead>
<tr>
<th>Percent financed with debt, ( w_d )</th>
<th>( r_d )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>8.0%</td>
</tr>
<tr>
<td>20%</td>
<td>8.5%</td>
</tr>
<tr>
<td>30%</td>
<td>10.0%</td>
</tr>
<tr>
<td>40%</td>
<td>12.0%</td>
</tr>
</tbody>
</table>

If company recapitalizes, debt would be issued to repurchase stock.

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### The Cost of Equity at Different Levels of Debt: Hamada’s Equation

- MM theory implies that beta changes with leverage.
- \( b_u \) is the beta of a firm when it has no debt (the unlevered beta).
- \( b_L = b_u [1 + (1 - T)(D/S)] \)

**The Cost of Equity for \( w_d = 20\% \)**

- Use Hamada’s equation to find beta:
  \[ b_L = b_u [1 + (1 - T)(D/S)] \]
  \[ = 1.0 [1 + (1-0.4) (20\% / 80\%)] \]
  \[ = 1.15 \]

- Use CAPM to find the cost of equity:
  \[ r_s = r_{RF} + b_L (R_{PM}) \]
  \[ = 6\% + 1.15 (6\%) = 12.9\% \]

---

### Cost of Equity vs. Leverage

<table>
<thead>
<tr>
<th>( w_d )</th>
<th>D/S</th>
<th>( b_L )</th>
<th>( r_s )</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0.00</td>
<td>1.000</td>
<td>12.00%</td>
</tr>
<tr>
<td>20%</td>
<td>0.25</td>
<td>1.150</td>
<td>12.90%</td>
</tr>
<tr>
<td>30%</td>
<td>0.43</td>
<td>1.257</td>
<td>13.54%</td>
</tr>
<tr>
<td>40%</td>
<td>0.67</td>
<td>1.400</td>
<td>14.40%</td>
</tr>
<tr>
<td>50%</td>
<td>1.00</td>
<td>1.600</td>
<td>15.60%</td>
</tr>
</tbody>
</table>
The WACC for \( w_d = 20\% \)

- WACC = \( w_d (1 - T) r_d + w_e r_s \)
- WACC = 0.2 (1 - 0.4) (8\%) + 0.8 (12.9\%) = 11.28\%

Repeat this for all capital structures under consideration.

WACC vs. Leverage

\[
\begin{array}{cccc}
\text{w}_d & \text{r}_d & \text{r}_s & \text{WACC} \\
0\% & 0.0\% & 12.00\% & 12.00\% \\
20\% & 8.0\% & 12.90\% & 11.28\% \\
30\% & 8.5\% & 13.54\% & 11.01\% \\
40\% & 10.0\% & 14.40\% & 11.04\% \\
50\% & 12.0\% & 15.60\% & 11.40\% \\
\end{array}
\]

Corporate Value for \( w_d = 20\% \)

- \( V = \frac{\text{FCF}}{(\text{WACC} - g)} \)
- \( g = 0 \), so investment in capital is zero; so FCF = NOPAT = EBIT (1-T).
- NOPAT = \((\$500,000)(1-0.40)\) = \$300,000.
- \( V = \frac{\$300,000}{0.1128} = \$2,659,574. \)

Corporate Value vs. Leverage

\[
\begin{array}{ccc}
\text{w}_d & \text{WACC} & \text{Corp. Value} \\
0\% & 12.00\% & \$2,500,000 \\
20\% & 11.28\% & \$2,659,574 \\
30\% & 11.01\% & \$2,724,796 \\
40\% & 11.04\% & \$2,717,391 \\
50\% & 11.40\% & \$2,631,579 \\
\end{array}
\]

Debt and Equity for \( w_d = 20\% \)

- The dollar value of debt is:
  - \( D = w_d V = 0.2 (\$2,659,574) = \$531,915. \)
- \( S = V - D \)
  - \( S = \$2,659,574 - \$531,915 = \$2,127,659. \)

Debt and Stock Value vs. Leverage

\[
\begin{array}{ccc}
\text{w}_d & \text{Debt, D} & \text{Stock Value, S} \\
0\% & \$0 & \$2,500,000 \\
20\% & \$531,915 & \$2,127,660 \\
30\% & \$817,439 & \$1,907,357 \\
40\% & \$1,086,957 & \$1,630,435 \\
50\% & \$1,315,789 & \$1,315,789 \\
\end{array}
\]

Note: these are rounded; see Ch 13 Mini Case.xls for full calculations.
Wealth of Shareholders

- Value of the equity declines as more debt is issued, because debt is used to repurchase stock.
- But total wealth of shareholders is value of stock after the recap plus the cash received in repurchase, and this total goes up (It is equal to Corporate Value on earlier slide).

Stock Price for \( w_d = 20\% \)

- The firm issues debt, which changes its WACC, which changes value.
- The firm then uses debt proceeds to repurchase stock.
- Stock price changes after debt is issued, but does not change during actual repurchase (or arbitrage is possible).

Stock Price for \( w_d = 20\% \) (Continued)

- The stock price after debt is issued but before stock is repurchased reflects shareholder wealth:
  - \( S \), value of stock
  - Cash paid in repurchase.

Stock Price for \( w_d = 20\% \) (Continued)

- \( D_0 \) and \( n_0 \) are debt and outstanding shares before recap.
- \( D - D_0 \) is equal to cash that will be used to repurchase stock.
- \( S + (D - D_0) \) is wealth of shareholders’ after the debt is issued but immediately before the repurchase.

Stock Price for \( w_d = 20\% \) (Continued)

\[
P = S + \frac{(D - D_0)}{P}\]

\[
0 = \frac{P = \$2,127,660 + ($531,915 - 0)}{100,000}
\]

\[
P = $26.596 \text{ per share.}
\]

Number of Shares Repurchased

\[
\# \text{ Repurchased} = \frac{(D - D_0)}{P}
\]

\[
\# \text{ Rep.} = \frac{($531,915 - 0)}{26.596} = 20,000.
\]

\[
\# \text{ Remaining} = n = \frac{n}{P}
\]

\[
n = \frac{2,127,660}{26.596} = 80,000.
\]
### Price per Share vs. Leverage

<table>
<thead>
<tr>
<th>( w_d )</th>
<th>( P )</th>
<th>Repurch.</th>
<th>Remaining</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>$25.00</td>
<td>0</td>
<td>100,000</td>
</tr>
<tr>
<td>20%</td>
<td>$26.60</td>
<td>20,000</td>
<td>80,000</td>
</tr>
<tr>
<td>30%</td>
<td>$27.25</td>
<td>30,000</td>
<td>70,000</td>
</tr>
<tr>
<td>40%</td>
<td>$27.17</td>
<td>40,000</td>
<td>60,000</td>
</tr>
<tr>
<td>50%</td>
<td>$26.32</td>
<td>50,000</td>
<td>50,000</td>
</tr>
</tbody>
</table>

### 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.