Appendix J: Methods for Optimal Capital Structure

1. The EBIT-EPS Approach

1. EBIT-EPS Approach to Capital Structure Decisions
- EBIT - EPS analysis is a practical tool that enables financial managers to evaluate alternative financing plans to determine how to achieve the optimal capital structure.


- EBIT = earnings before interest and taxes
  \[ EBIT = (p - v)x - FC \]
  
  where:
  - \( p \) = selling price per unit
  - \( v \) = unit variable cost
  - \( x \) = sales volume in units
  - \( FC \) = fixed operating costs

- EPS = earnings per share

• The primary objective is to determine the EBIT break even, or indifference, points at which the EPS will be the same regardless of the financing plan chosen by the financial manager.


• The indifference point has the following implications for capital structure decisions:
  – At EBIT amounts in excess of EBIT indifference level, more heavily leveraged financing plan will generate higher EPS.


– At EBIT amounts below the EBIT indifference level, financing plan involving the least leverage will generate a higher EPS.


• The indifference points between any two methods of financing can be determined by solving for EBIT in the following equation:
\[
\frac{(EBIT - I)(1-t) - PD}{S_1} = \frac{(EBIT - I)(1-t) - PD}{S_2}
\]
\(t = \text{tax rate}
\PD = \text{preferred stock dividends}
\) and 
\(S_1, S_2 = \text{number of shares of common stock outstanding after financing for plan 1 and plan 2, respectively}
\)
\(I = \text{fixed finance charges}
\)

- Example: Assume a media firm, with long term capitalization consisting entirely of $5 million in stock, wants to raise $2 million to acquire new equipment

- The company can finance this by:
  1. Selling 40,000 shares of common stock at $50 each
  2. Selling bonds at 10% interest
  3. Issuing preferred stock with 8% dividend

- The present EBIT of the company is $800,000
- The income tax rate is 50%
- 100,000 shares of common stock are outstanding
• When the company finances this project, the projected EBIT level will become $1 million

<table>
<thead>
<tr>
<th>Financing Method</th>
<th>All Common</th>
<th>All Debt</th>
<th>All Preferred</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>1,000,000</td>
<td>1,000,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Interest</td>
<td>-</td>
<td>200,000</td>
<td>-</td>
</tr>
<tr>
<td>Earnings Before Taxes (EBT)</td>
<td>1,000,000</td>
<td>800,000</td>
<td>1,000,000</td>
</tr>
<tr>
<td>Taxes</td>
<td>500,000</td>
<td>400,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Earnings after taxes</td>
<td>500,000</td>
<td>400,000</td>
<td>500,000</td>
</tr>
<tr>
<td>Preferred Stock Dividend</td>
<td></td>
<td>160,000</td>
<td></td>
</tr>
<tr>
<td>Earnings available to common stock holders</td>
<td>500,000</td>
<td>400,000</td>
<td>340,000</td>
</tr>
<tr>
<td>Number of shares</td>
<td>140,000</td>
<td>100,000</td>
<td>100,000</td>
</tr>
<tr>
<td>EPS</td>
<td>$3.57</td>
<td>$4.00</td>
<td>$3.40</td>
</tr>
</tbody>
</table>


• To solve for the indifference point between all common and all debt:

$$\frac{(EBIT - I)(1-t) - PD}{S_1} = \frac{(EBIT - I)(1-t) - PD}{S_2}$$

$$\frac{(EBIT - 0)(1-0.5) - 0}{140,000} = \frac{(EBIT - 0)(1-0.5) - 0}{100,000}$$

$$EBIT = $700,000$$


• The indifference point between all common and all preferred:

$$\frac{(EBIT - I)(1-t) - PD}{S_1} = \frac{(EBIT - I)(1-t) - PD}{S_2}$$

$$\frac{(EBIT - 0)(1-0.5) - 0}{140,000} = \frac{(EBIT - 0)(1-0.5) - 160,000}{100,000}$$

$$EBIT = $1,120,000$$

• The following conclusions can be drawn from this info:
  —At any level of EBIT, debt is better than preferred stock, since it gives a higher EPS

—At a level of EBIT above $700,000 debt is better than common stock. If EBIT is below $700,000 the reverse is true
—At a level of EBIT above $1,120,000 preferred stock is better than common

• Conclusion: the EBIT-EPS approach helps financial managers examine the impact of financial leverage as a financing method
Methods for Optimal Capital Structure (cont.)

2. Goldman Sachs’ EPS Model
   • Relies on Earnings Per Share to determine Debt/Equity
   • EPS quantifies hidden costs: dilution & dividend costs

Example:
   • Convertible bonds: unsure whether the bond will be converted to equity and how many shares? Does not predict expected increase in shares & level of uncertainty.

EPS equals
   income to common stock holders / number of common shares outstanding

   • Adding debt lowers earnings (numerator)
   • Adding equity raises # shares (denominator)


Graph

- More debt & less equity causes EPS increase (anti-dilution)
- However, standard deviation of EPS increase because less shares, high leverage = more risk


P/E ratio & Capital structure

- Repurchasing shares is inefficient for growth companies with high P/E
- Would actually reduce EPS, due to paying for overvalued stock


Table 3: Relating Leverage to Credit Spreads

<table>
<thead>
<tr>
<th>S&amp;P¹</th>
<th>Credit Spreads²</th>
<th>Debt / Cap.</th>
<th>EBIT / Int.</th>
<th>Mean</th>
<th>Std Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA</td>
<td>20%</td>
<td>21.4</td>
<td>97</td>
<td>16</td>
<td></td>
</tr>
<tr>
<td>AA</td>
<td>25%</td>
<td>10.1</td>
<td>120</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>40%</td>
<td>6.1</td>
<td>156</td>
<td>28</td>
<td></td>
</tr>
<tr>
<td>BBB</td>
<td>50%</td>
<td>3.7</td>
<td>211</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>BB</td>
<td>60%</td>
<td>2.1</td>
<td>NA</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

Higher debt = Lower bond rating

Methods of Evaluating Hybrids (convertibles)

• 1) Assign hybrids as 100% equity credit
  – Limited to a proportion of total equity
  – S&P method


• 2) Assign hybrids fractional equity credit depending on how similar it is to either debt/equity
  – Moody’s method
• 3) or any alternative ratios to determine if it’s more like debt or equity


Hybrids & EPS

• Convertibles change earning & shares outstanding
• Generates tax-deductible interest until converted into shares


Dual Nature of Hybrids

• Debt part of life – reduces earnings (interest payments)
• Equity part of life – increases shares, but higher earnings
• Overall effects on EPS uncertain

**Solution**

- To reconcile dual nature, calculate according to *Diluted EPS*
- Requires EPS to be calculated as worse of two alternatives


**Flaws of Diluted EPS**

- 1) Unclear if bond will be converted
- 2) If converted, # shares uncertain
- 3) If converted, doesn’t necessarily increase earnings


**Real Solution: Economic EPS**

- 4) Dividends not shared with future share holders.
  - Only retained earnings shared
  - If all or most earnings distributed as dividends, earnings per share would not be diluted

• 3) Economic EPS = Dividend Per Share + Retained EPS

- retained EPS = remaining income / existing & future shares


Example:

• 1) Issue 10 mil. New Shares

Or

• 2) $400 mil. convertible debt, 4% interest, must be converted after 3 years


<table>
<thead>
<tr>
<th>Year 1 Earnings</th>
<th>Current</th>
<th>Issue Equity</th>
<th>Issue Convert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings</td>
<td>$500MM</td>
<td>$500MM</td>
<td>$494MM</td>
</tr>
<tr>
<td>Dividend</td>
<td>$100MM</td>
<td>$110MM</td>
<td>$100MM</td>
</tr>
<tr>
<td>Retained</td>
<td>$400MM</td>
<td>$390MM</td>
<td>$384MM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shares</th>
<th>Existing Shares</th>
<th>Future Shares</th>
<th>Uncertainty</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings</td>
<td>100MM</td>
<td>110MM</td>
<td>100MM</td>
</tr>
<tr>
<td>Future Shares</td>
<td>0MM</td>
<td>0MM</td>
<td>1MM</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 1 EPS</th>
<th>Dividends Per Share</th>
<th>Issue Equity</th>
<th>Issue Convert</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings</td>
<td>$4.00</td>
<td>$3.55</td>
<td>$3.53</td>
</tr>
<tr>
<td>Retained EPS</td>
<td>$5.00</td>
<td>$4.55</td>
<td>$4.53</td>
</tr>
<tr>
<td>EPS Risk</td>
<td>$0.00</td>
<td>$0.00</td>
<td>$0.03</td>
</tr>
</tbody>
</table>


• In this case, EPS in year 1 maximized by issuing equity

• Even though extra shares dilute earnings, extra income from not paying interest results in slightly higher EPS

However,
• This only applies for year 1
• Convertibles might dilute shares less after conversion…
• If $400 mil. only translate into 8 mil. Shares (depends on future share price) – higher EPS


Table
• Debt replacement
  –Lower EPS, Lower Standard Deviation (Risk)
• Share repurchase
  –Higher EPS, Higher SD & risk

Bolton and Freixas Approach
• Supply-side determines how entrepreneur is financed
• Debt is preferred by entrepreneur, but…
• Usually turned down by banks, high-risk (turn to VCs)

Hellmann and Stiglitz model
• High-risk entrepreneurs choose debt financing in equilibrium
• Safer entrepreneurs prefer equity

The Rationale
• Debt-financed high-risk, high-reward entrepreneur owns entire firm and all surplus
• Equity-financed entrepreneur share cash flow along with risk with investors

Conclusion
• Thus, there exists a risk-return threshold where entrepreneur is indifferent between debt and equity financing. Choice based upon probability of success and returns around the threshold.

Financing Risk Variables
• 1) Age
  – For young firms, no track record
  – Any prediction of future is unreliable
  – Highest degree of asymmetric information
2) Size
   - Represents degree of insurance against default
   - total equity / total assets
   - fixed assets + current assets = collateral


3rd Method: Minimizing Cost of Capital

Firms use capital structure and firm value maximization computer programs to determine optimal debt & equity levels

Lowest WACC

WACC = D/V * Rd * (1-T) + E/V * Re


Optimization Models

Palisade’s RiskOptimizer software

Example: XYZ Corp.

XYZ Corp has 24% debt in its capital structure

Assumptions on Interest Rates

**XYZ Corp. ($ Million)**

<table>
<thead>
<tr>
<th>Debt ratio (%)</th>
<th>WACC (%)</th>
<th>Blended cost of debt (%)</th>
<th>Cost of equity (%)</th>
<th>Debt rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>12.00</td>
<td>5.5</td>
<td>12.0</td>
<td>AAA</td>
</tr>
<tr>
<td>10</td>
<td>11.49</td>
<td>5.5</td>
<td>12.3</td>
<td>AAA</td>
</tr>
<tr>
<td>20</td>
<td>10.77</td>
<td>5.5</td>
<td>12.4</td>
<td>A</td>
</tr>
<tr>
<td>30</td>
<td>10.94</td>
<td>5.5</td>
<td>12.4</td>
<td>A</td>
</tr>
<tr>
<td>40</td>
<td>10.28</td>
<td>7.0</td>
<td>14.1</td>
<td>BB</td>
</tr>
<tr>
<td>50</td>
<td>10.76</td>
<td>11.4</td>
<td>14.1</td>
<td>B</td>
</tr>
<tr>
<td>60</td>
<td>10.93</td>
<td>11.4</td>
<td>16.1</td>
<td>CCC</td>
</tr>
<tr>
<td>70</td>
<td>10.89</td>
<td>13.3</td>
<td>16.1</td>
<td>CCC</td>
</tr>
<tr>
<td>80</td>
<td>10.88</td>
<td>13.3</td>
<td>19.8</td>
<td>CCC</td>
</tr>
<tr>
<td>90</td>
<td>11.05</td>
<td>15.5</td>
<td>19.8</td>
<td>CCC</td>
</tr>
<tr>
<td>100</td>
<td>11.57</td>
<td>17.8</td>
<td>19.8</td>
<td>CCC</td>
</tr>
</tbody>
</table>


**Optimization**

The optimal financial leverage ratio is 39%. If the firm operated at this ratio it would be maximizing the total benefit from its current overall value.

![Diagram](image)

At a 24% leverage, the WACC is 10.44%. The value of the company is $3,212 million, if one discounts the expected cash flow for Net Present Value.

When we input XYZ Corp.'s 2003 figures into the program we notice that, at 24% debt, it is **not** leveraged correctly.

Software shows the best ratio is 39%.
Optimal Capital Structure: Debt/Equity?

- Case Study: British Telecom (BT)
  - 1998-2001 BT increases debt level from £4.8bn to £31bn. This caused drastic decrease in share price.
- What is correct proportion of debt to equity?


- Graph shows direct correlation between debt/equity and firm value for BT
- Displays that there is an optimal capital structure
  - Different for each company / industry


2005 BT Capital Structure:
- 8 billion in long term debt
- 3.5 billion in equity
- 27 billion in assets
- 29.6% levered

LexisNexis Financial Reports
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.

- EBIT is unaffected by a change in capital structure (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!
- Tells us to be careful when using P/E ratios, e.g. comparing P/E ratios of companies with different capital structures