Financing decisions (2)

Class 16
Financial Management, 15.414
Today

Capital structure

- M&M theorem
- Leverage, risk, and WACC

Reading

- Brealey and Myers, Chapter 17
Financing decisions

Key goal

➢ Ensure that funds are available for positive NPV projects, now and in the future

➢ Signaling, taxes, mispricing, issue costs, and corporate control also important

Observations

➢ Firms follow a pecking order

➢ Different industries seem to have different target debt ratios

➢ Stock issues are bad news, but debt issues are either neutral or good news
Financing decisions

Two models

➤ **Pecking-order theory**
   Firms are worried primarily about selling undervalued shares. They sell equity only when they have no other choice, and there isn’t a specific target debt ratio.

➤ **Trade-off theory**
   Firms care mostly about taxes and distress costs. The tax benefits of debt dominate at low leverage, while distress costs dominate at high leverage. This trade-off leads to an optimal capital structure.
Growth, leverage, and the pecking order

Cash deficits, $g > g^*$
More borrowing, higher leverage

Plowback
70%

Cash surpluses, $g < g^*$
Pay down debt, low leverage

Plowback
30%
Trade-off theory

Firm value

$V_U$ + tax shields of debt

$V_L$ with tax shields and distress

$V_L$ according to MM

Optimal capital structure

Leverage
Financing decisions

Modigliani-Miller Theorem

Assume

- Efficient markets and no asymmetric information
- No taxes
- No transaction or bankruptcy costs
- Investment decisions don’t change

Then

- The value of the firm is independent of its capital structure.
- Financing choices are irrelevant!

Value is created on the left-hand side of the balance sheet, not the right-hand side.
M&M Theorem

Why is MM useful?

- **It tells us what is important ...**
  - Does debt affect investment decisions?
  - Does debt affect taxes?
  - Can equity be issued at fair value?
  - Are transaction costs or bankruptcy costs important?

- **And what isn’t ...**
  - Impact of debt on ROE and risk
  - Cost of debt relative to the cost of equity ($r_D$ vs. $r_E$)
**MM Theorem, cont.**

**Message 1 (pie theory)**

\[
\text{Value} = \text{PV of assets}
\]

* Credit to Yogi Berra
Yogi Berra

Wisdom

➢ “Nobody goes there anymore; it's too crowded.”

➢ “You should always go to other people's funerals; otherwise, they won't come to yours.”

➢ “The future ain't what it used to be.”

➢ “Baseball is 90% mental -- the other half is physical.”
Message 2

In general, financial transactions don’t create or destroy value as long as securities are sold at fair value.

[Unless they affect taxes, investment decisions, etc.]

Example

Your firm needs to raise $100 million. Does it matter whether you decide to issue debt or equity?
Example

Current

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liab &amp; Eq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Assets</td>
<td>Long-Term Debt</td>
</tr>
<tr>
<td>$1 billion</td>
<td>$200 million</td>
</tr>
<tr>
<td>Equity</td>
<td>Equity</td>
</tr>
<tr>
<td>$800 million</td>
<td>$800 million</td>
</tr>
</tbody>
</table>

Issue new debt

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liab &amp; Eq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Assets</td>
<td>Old debt $200 mill</td>
</tr>
<tr>
<td>$1.1 billion</td>
<td>New debt $100 mill</td>
</tr>
<tr>
<td>Equity</td>
<td>Equity</td>
</tr>
<tr>
<td>$800 million</td>
<td>$800 million</td>
</tr>
</tbody>
</table>

Issue new equity

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liab &amp; Eq</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Assets</td>
<td>Long-Term Debt</td>
</tr>
<tr>
<td>$1.1 billion</td>
<td>$200 million</td>
</tr>
<tr>
<td>Equity</td>
<td>Old Eq</td>
</tr>
<tr>
<td>$800 million</td>
<td>$800 million</td>
</tr>
<tr>
<td>New Eq</td>
<td>$100 mill</td>
</tr>
</tbody>
</table>
MM Theorem, cont.

Message 3

Leverage increases ROE and the expected returns to stockholders, but it also increases risk.

According to M&M, the two effects offset each other exactly.

\[
\text{ROE} = \frac{\text{NI}}{\text{Equity}} = \frac{\text{NI}}{\text{Assets}} \times \frac{\text{Assets}}{\text{Equity}} = \frac{\text{E} + \text{D}}{\text{E}}
\]

\[
\text{ROE} = \text{ROA} \times \left[1 + \frac{\text{Debt}}{\text{Equity}}\right]
\]
MM Theorem, cont.

Leverage and risk

Asset = Debt + Equity

If D / E = 0%, then $1 of equity supports $1 of assets
If D / E = 100%, then $1 of equity supports $2 of assets
If D / E = 900%, then $1 of equity supports $10 of assets

Leverage magnifies equity risk

$1 change in A → $1 change in E  [E is residual claim]
1% change in A → 1% × (A / E) change in E

Multiplier = \[
\frac{\text{Asset}}{\text{Equity}} = \left[ 1 + \frac{\text{Debt}}{\text{Equity}} \right]
\]  [Same multiplier for ROE]
Example

Your firm is all equity financed and has $1 million of assets and 10,000 shares of stock (stock price = $100). Earnings before interest and taxes next year will be either $50,000, $125,000, or $200,000 depending on economic conditions.

The firm is thinking about a leverage recapitalization, selling $300,000 of debt and using the proceeds to repurchase stock. The interest rate is 10%.

How would this transaction affect the firm’s EPS and cashflows to stockholders? Ignore taxes.

**Current:** A = $1 million; E = $1 million (10,000 shares); D = $0

**Recap:** A = $1 million; E = $700,000 (7,000 shares); D = $300,000
### Example, cont.

#### All equity

<table>
<thead>
<tr>
<th></th>
<th>Bad</th>
<th>Expected</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td># of shares</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Debt</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>EBIT</td>
<td>$50,000</td>
<td>$125,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Interest</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Net income</td>
<td>$50,000</td>
<td>$125,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>EPS</td>
<td>$5</td>
<td>$12.5</td>
<td>$20</td>
</tr>
</tbody>
</table>

#### Recapitalization

<table>
<thead>
<tr>
<th></th>
<th>Bad</th>
<th>Expected</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td># of shares</td>
<td>7,000</td>
<td>7,000</td>
<td>7,000</td>
</tr>
<tr>
<td>Debt (r=10%)</td>
<td>$300,000</td>
<td>$300,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>EBIT</td>
<td>$50,000</td>
<td>$125,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Interest</td>
<td>30,000</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$20,000</td>
<td>$95,000</td>
<td>$170,000</td>
</tr>
<tr>
<td>EPS</td>
<td>$2.86</td>
<td>$13.57</td>
<td>$24.29</td>
</tr>
</tbody>
</table>
Leverage, EPS, and ROE

Leverage increase risk and expected payoff
MM Theorem, cont.

Leverage and risk

Asset = Debt + Equity

Returns: \[ r_A = \frac{D}{A} r_D + \frac{E}{A} r_E \] \[ \rightarrow \] \[ r_E = r_A + \frac{D}{E} (r_A - r_D) \]

Betas: \[ \beta_A = \frac{D}{A} \beta_D + \frac{E}{A} \beta_E \] \[ \rightarrow \] \[ \beta_E = \beta_A + \frac{D}{E} (\beta_A - \beta_D) \]

The required return and beta of equity goes up when leverage increases.
\( \beta_A, \beta_E, \beta_D \text{ and leverage} \)
$r_A$, $r_E$, $r_D$ and leverage

![Graph showing the relationship between required return, debt-to-equity ratio, and $r_A$, $r_E$, $r_D$.]
M&M Theorem, cont.

Message 4

Leverage shifts the firm towards ‘low cost’ debt financing, but it also raises the cost of equity.

According to M&M, the two effects offset each other exactly.

Ignoring tax effects, changing capital structure doesn’t affect the WACC.

Without taxes:

\[
\text{WACC} = r_A = \frac{D}{A} r_D + \frac{E}{A} r_E
\]

Combined effect is a wash
WACC is determined only by asset risk
$r_A, r_E, r_D$ and leverage
Example

Your firm is all equity financed and has $1 million of assets and 10,000 shares of stock (stock price = $100). Earnings before interest and taxes next year will be either $50,000, $125,000, or $200,000. These earnings are expected to continue indefinitely. The payout ratio is 100%.

The firm is thinking about a leverage recapitalization, selling $300,000 of debt and using the proceeds to repurchase stock. The interest rate is 10%.

How would this transaction affect the firm’s EPS and stock price? Ignore taxes.
### Example, cont.

#### All equity

<table>
<thead>
<tr>
<th></th>
<th>Bad</th>
<th>Expected</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td># of shares</td>
<td>10,000</td>
<td>10,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Debt</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>EBIT</td>
<td>$50,000</td>
<td>$125,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Interest</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Net income</td>
<td>$50,000</td>
<td>$125,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>EPS</td>
<td>$5</td>
<td>$12.5</td>
<td>$20</td>
</tr>
</tbody>
</table>

Expected EPS = $12.5

Stock price = EPS / r_E → r_E = EPS / price = 12.5%

r_A = r_E
Example, cont.

Recapitalization

<table>
<thead>
<tr>
<th></th>
<th>Bad</th>
<th>Expected</th>
<th>Good</th>
</tr>
</thead>
<tbody>
<tr>
<td># of shares</td>
<td>7,000</td>
<td>7,000</td>
<td>7,000</td>
</tr>
<tr>
<td>Debt (r=10%)</td>
<td>$300,000</td>
<td>$300,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>EBIT</td>
<td>$50,000</td>
<td>$125,000</td>
<td>$200,000</td>
</tr>
<tr>
<td>Interest</td>
<td>30,000</td>
<td>30,000</td>
<td>30,000</td>
</tr>
<tr>
<td>Net income</td>
<td>$20,000</td>
<td>$95,000</td>
<td>$170,000</td>
</tr>
<tr>
<td>EPS</td>
<td>$2.86</td>
<td>$13.57</td>
<td>$24.29</td>
</tr>
</tbody>
</table>

Expected EPS = $13.57

\[
r_E = r_A + \frac{D}{E} (r_A - r_D) = 0.125 + \frac{0.3}{0.7} (0.125 - 0.10) = 0.1357
\]

Stock price = EPS / r_E = $100