Valuing Companies

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Finance Theory II
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Valuing companies

- Familiar valuation methods
  - Discounted Cash Flow Analysis
  - Comparables
  - Real Options

- Some new issues
  - Do we value assets or equity?
  - Terminal values (liquidation, going concern)
  - Minority interests, controlling interests
DCF Analysis

- **WACC method:**
  - Forecast expected FCF
  - Estimate WACC
  - Compute PV

- **APV method:**
  - Forecast expected FCF
  - Estimate $k_A$
  - Compute PV
  - Add PV(Tax Shield)
Value Assets or Equity?

- DCF methods give you the value of the whole firm (D + E) or *Enterprise Value*.
  - E.g., you are founding a new firm: you will receive D from creditors and E from shareholders.

- Often, you need to value the *Equity Value* in an existing firm
  - E.g., M&A, IPOs
  - You need to subtract the value of its existing debt D

- Also, need to add the value of control when valuing a controlling equity position (more on this later).
Terminal Values

- In valuing long-lived projects or ongoing businesses, we don’t typically forecast every year of cash flow forever.

- Forecast FCF until it is reasonable (or best guess) to think that the project or company is in “steady state.”

- Typically, assume:
  - either the company is liquidated;
  - or FCF is a growing, flat, or declining, perpetuity;

- Note: The forecast horizon will depend on firm and industry.
Terminal Value in Liquidation

1) Salvage value (SV):
   - CF that the firm receives from liquidating its assets

   \[ SV = \text{Liquidation price} - \text{Liquidation costs} \]

   - The firm is taxed on (SV – PPE) so that overall it gets

   \[ SV^*(1- t) + t*PPE \]

2) Net Working Capital
   - Recouped NWC at project end (i.e., last \( \Delta \text{NWC} = \text{last WC} \)
Remarks

- In principle, you would like NWC’s actual value, not book value.

- These might differ for instance:
  - cannot recoup full A/R,
  - Inventory sells over or below book value
  - etc.

- Liquidation value tends to underestimate TV unless liquidation is likely. Useful as a lower bound.
Terminal Value as Perpetuity

- No-growth perpetuity
  
  \[ TV = \frac{FCF_{T+1}}{k} \]

- For a no-growth firm, we can assume (for simplicity)

  \[ FCF = EBIT(1-t) + \text{Depreciation} - \text{CAPX} - \Delta\text{NWC} \]

\[ TV = \frac{EBIT(1-t)_{T+1}}{k} \]
Terminal Value as Growing Perpetuity

- PV in year t of a perpetuity growing at a rate g

\[
TV = \frac{FCF_{T+1}}{(k - g)}
\]

- For a growing perpetuity, we can assume (for simplicity)

\[
FCF = EBIT(1-t) + \text{Depreciation} - \text{CAPX} - \Delta NWC
\]

\[
(1+g)EBIT(1-t)_T
\]

\[
-\Delta NA = -g*NA_{\text{prior year}}
\]

\[
TV = \frac{[EBIT(1- t)_{T+1} - g*NA_T]}{(k - g)}
\]
Terminal Value as Perpetuity (Summary)

\[ T \]

\[ TV \]
\[ \downarrow \]
\[ \frac{FCF_{T+1}}{k} \]
\[ \frac{FCF_{T+1}}{(k - g)} \]

\[ T+1 \]

\[ FCF \]
\[ \downarrow \]
\[ \frac{EBIT(t-1)}{} \]
\[ \frac{EBIT(t-1) - \Delta NA}{g \cdot NA_T} \]

\[ \ldots \]

No growth

Growth @ \( g \)
Remarks

- Growing perpetuity - assumptions
  - Net assets grow at the same rate as profits
  - \( \Delta NA \) is a good measure of replacement costs

- Don’t forget to discount TV further to get PVT

- In WACC method, \( k = WACC \)

- In APV method, \( k = k_A \) for FCF and appropriate rate for TS
Example

- You are considering the acquisition of XYZ Enterprises. XYZ’s balance sheet looks like this as of today (year 0).

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current assets</td>
<td>Current liabilities</td>
</tr>
<tr>
<td>Plant</td>
<td>Debt</td>
</tr>
<tr>
<td></td>
<td>Net worth</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>Total</strong></td>
</tr>
</tbody>
</table>

- Projections:

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>200</td>
<td>217</td>
<td>239</td>
<td>270</td>
</tr>
<tr>
<td>EBIT</td>
<td>20</td>
<td>22</td>
<td>25</td>
<td>26</td>
</tr>
<tr>
<td>NWC</td>
<td>33</td>
<td>37</td>
<td>41</td>
<td>44</td>
</tr>
<tr>
<td>Depreciation</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>CAPX</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>6</td>
</tr>
</tbody>
</table>
Example (cont.)

What is the value of XYZ’s stock under the following assumptions:

1) XYZ is liquidated after year 5 (assuming zero salvage value).

2) Sales growth and EBIT/Sales ratios are (past year 5):

<table>
<thead>
<tr>
<th>Sales growth</th>
<th>EBIT/Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>5%</td>
<td>10%</td>
</tr>
<tr>
<td>0%</td>
<td>10%</td>
</tr>
<tr>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>0%</td>
<td>5%</td>
</tr>
</tbody>
</table>

Tax rate = 34%, and WACC = 13%.
Example (cont.)

Start by estimating FCF over 5 years:
- NWC(year 0) = Current assets - current liabilities = 50-20=30

FCF = EBIT(1 - t) + Dep - CAPX - ΔNWC

<table>
<thead>
<tr>
<th></th>
<th>Year 0</th>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
<th>Year 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td></td>
<td>20</td>
<td>22</td>
<td>25</td>
<td>26</td>
<td>30</td>
</tr>
<tr>
<td>EBIT(1-t)</td>
<td></td>
<td>13.2</td>
<td>14.52</td>
<td>16.5</td>
<td>17.16</td>
<td>19.8</td>
</tr>
<tr>
<td>NWC</td>
<td>30</td>
<td>33</td>
<td>37</td>
<td>41</td>
<td>44</td>
<td>48</td>
</tr>
<tr>
<td>ΔNWC</td>
<td>3</td>
<td>4</td>
<td>4</td>
<td>3</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Depreciation</td>
<td>5</td>
<td>5</td>
<td>6</td>
<td>7</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>CAPX</td>
<td>10</td>
<td>10</td>
<td>15</td>
<td>6</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>FCF</td>
<td>5.2</td>
<td>5.52</td>
<td>3.5</td>
<td>15.16</td>
<td>3.8</td>
<td></td>
</tr>
<tr>
<td>PV @ 13%</td>
<td>22.7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Example – Liquidation Value (LV)

1) Liquidation value (LV)
   \[ t \times \text{PPE(year 5)} + \text{NWC(year 5)} \]

\[ \text{PPE(year 5)} = \text{PPE(year 0)} + \text{all CAPX} - \text{all Dep from year 0 to 5} \]

\[ \text{PPE} = 80 \]
\[ \text{PPE} \times t = 80 \times 34\% = 27.2 \]

\[ \text{LV} = 27.2 + 48 = 75.2 \quad \Rightarrow \quad \text{PVLV} = 75.2/(1.13)^5 = 40.8 \]

\[ \text{Firm value} = 22.7 + 40.8 = 63.5 \]
\[ \text{Equity value} = \text{Firm value} - \text{MV of Debt} = 63.5 - 30 = 33.5 \]
For 2) to 5), we need EBIT (year 6) and NA (year 5) to apply

\[ TV = \frac{[EBIT(\text{year 6})(1 - t) - g*NA(\text{year 5})]}{[k - g]} \]

**EBIT(year 6)**
= fraction \( \alpha \) of Sales(year 6)
= \( \alpha * (1 + g) * \text{Sales(year 5)} = \alpha * (1 + g) * 293 \)

**NA(year 5)**
= NA(year 0) + all CAPX - all Dep + all \( \Delta \text{NWC from 0 to 5} \)
= 128

**PVTV**
= \( TV / (1.13)^5 \)
### Example (cont.)

<table>
<thead>
<tr>
<th></th>
<th>( \alpha )</th>
<th>g</th>
<th>TV</th>
<th>PVTVP</th>
<th>Firm</th>
<th>Equity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2)</td>
<td>10%</td>
<td>5%</td>
<td>173.8</td>
<td>94.3</td>
<td>117.0</td>
<td>87.0</td>
</tr>
<tr>
<td>3)</td>
<td>10%</td>
<td>0%</td>
<td>148.8</td>
<td>80.7</td>
<td>103.4</td>
<td>73.4</td>
</tr>
<tr>
<td>4)</td>
<td>5%</td>
<td>5%</td>
<td>46.9</td>
<td>25.5</td>
<td>48.2</td>
<td>18.2</td>
</tr>
<tr>
<td>5)</td>
<td>5%</td>
<td>0%</td>
<td>74.4</td>
<td>40.4</td>
<td>63.1</td>
<td>33.1</td>
</tr>
</tbody>
</table>
When is Growth Valuable?

TV (with growth) > TV (w/o growth)

\[
\frac{(1+g) \cdot EBIT(1-t) - g \cdot NA}{k-g} > \frac{EBIT(1-t)}{k}
\]

\[
EBIT^*(1 - t) - k^*NA > 0
\]
Economic Value Added (EVA)

EVA = EBIT*(1 - t) - k*NA

**Intuition:** Growth is good when the cost of increasing NA is more than compensated by the capitalized increase in EBIT*(1 - t).
Remarks

- EVA is a particular incarnation of NPV (+ some assumptions)

- Appeal of EVA coherent measure for Capital budgeting, Performance evaluation and Managerial compensation.

- Assumes linear relationship between NA and EBIT*(1 - t)

- **EVA has nothing to do with sustainable growth:**
  - Sustainable growth rate answers “How fast can I grow without increasing my leverage ratio or issuing equity?”
  - It has nothing to say about whether growing is good or not.
EVA: Bottom Line

Use EVA as...
- a simple measure to determine whether the business is generating value and whether growth is enhancing value
- as a way of setting goals to enhance value

Beware of EVA for...
- young companies
- companies in rapidly changing business environments
- companies where book values are not accurate measures of replacement costs
DCF Analysis: Pros and Cons

Strengths
- CF comes from specific forecasts and assumptions
- Can see impact of changes in strategies
- Valuation tied to underlying fundamentals

Weaknesses
- CF only as good as your forecasts/assumptions
- Might “forget something”
- Need to forecast managerial behavior (unless you’re in control)
- Need to estimate the discount rate using a theory (e.g., CAPM) that may be incorrect or imprecise in this particular case
Multiples

- Assess the firm’s value based on that of publicly traded comps.

- **Cash-flow-based Value multiples:**
  - MV of firm/Earnings, MV of firm /EBITDA, MV of firm /FCF

- **Cash-flow-based Price multiples:**
  - Price/Earnings (P/E), Price/EBITDA, Price/FCF

- **Asset-based multiples:**
  - MV of firm/BV of assets, MV of equity/BV of equity
Procedure

- **Hope:** Firms in the same business should have similar multiples (e.g., P/E).

- **STEP 1:** Identify firms in same business as the firm you want to value.

- **STEP 2:** Calculate P/E ratio for comps and come up with an estimate of P/E for the firm you want to value (e.g. take the average of comps’ P/E).

- **STEP 3:** Multiply the estimated P/E by the actual Net Income of the firm you want to value.
Motivation for Multiples?

- **Assumption 1:** Comps’ actual FCF are a perpetuity

  \[ MV = \frac{FCF}{WACC - g} \implies MV = \frac{1}{FCF \frac{1}{WACC - g}} \]

- **Assumption 2:**
  - Comps have the same WACC (requires similar D/(D+E))
  - Comps are growing at a similar rate g
Motivation for Multiples?

**Assumption 1:**
- $E = CF$ to shareholders
- $E$ is a perpetuity

$$P = \frac{E}{k_E - g} \Rightarrow \frac{P}{E} = \frac{1}{k_E - g}$$

**Assumption 2:**
- Comps have the same $k_E$ ⇒ *This requires similar leverage!*
- Comps are growing at a similar rate $g$
Remarks

- For firms with no earnings or limited asset base (e.g., hi-tech),
  - price-to-patents multiples,
  - price-to-subscribers multiples,
  - or even price-to-Ph.D. multiples!

- Since these are rough approximations (at best)
  - One may want to check different multiples
  - See if some multiples are quite constant across firms
# Example: Valuing ADI

<table>
<thead>
<tr>
<th>ADI (Dec. 1995)</th>
<th>EBIT</th>
<th>tax rate</th>
<th>Net income</th>
<th>BV equity</th>
<th>BV liabs</th>
<th># shares</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>163.6</td>
<td>25%</td>
<td>119.3</td>
<td>656.0</td>
<td>345.7</td>
<td>114.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>ADI</th>
<th>Burr-Brown</th>
<th>Linear Techno.</th>
<th>Maxim Integrated Products</th>
<th>Siliconix</th>
<th>Motorola</th>
<th>Mean w/o ADI</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROE</td>
<td>18.2%</td>
<td>16.3%</td>
<td>25.5%</td>
<td>23.4%</td>
<td>26.8%</td>
<td>16.1%</td>
<td>21.6%</td>
</tr>
<tr>
<td>Liabs/Assets</td>
<td>34.5%</td>
<td>29.0%</td>
<td>16.9%</td>
<td>22.1%</td>
<td>56.6%</td>
<td>51.5%</td>
<td>35.2%</td>
</tr>
<tr>
<td>5-year growth in sales</td>
<td>14.3%</td>
<td>9.9%</td>
<td>32.2%</td>
<td>43.1%</td>
<td>14.0%</td>
<td>20.3%</td>
<td>23.9%</td>
</tr>
<tr>
<td>P/E</td>
<td>14.2</td>
<td>25.8</td>
<td>30.3</td>
<td>15.2</td>
<td>18.9</td>
<td></td>
<td>20.9</td>
</tr>
<tr>
<td>(D+E)/EBIT(1-t)</td>
<td>16.3</td>
<td>26.6</td>
<td>30.3</td>
<td>18.3</td>
<td>24.2</td>
<td></td>
<td>23.1</td>
</tr>
<tr>
<td>Market-to-Book equity</td>
<td>2.3</td>
<td>6.6</td>
<td>7.1</td>
<td>4.1</td>
<td>3.0</td>
<td></td>
<td>4.6</td>
</tr>
<tr>
<td>Market-to-Book firm</td>
<td>1.9</td>
<td>5.6</td>
<td>5.7</td>
<td>2.3</td>
<td>2.0</td>
<td></td>
<td>3.5</td>
</tr>
</tbody>
</table>
Example (cont.)

- There is no exact science to come up with appropriate multiples. The following is only an example. Need experience and guts.

- ADI’s 5-year sales growth is less than average
  - Shade down estimate of P/E and (D+E)/EBIT*(1 - t) w.r.t. mean
    - P/E = 20.9*(1 - 15%) = 17.8
    - (D+E)/EBIT*(1 - t) = 23.1*(1 - 15%) = 19.6

- ADI’s ROE is less than average
  - Shade down estimate of M/B equity and M/B firm w.r.t. mean
    - M/B equity = 4.6*(1 - 15%) = 3.9
    - M/B firm = 3.5*(1 - 15%) = 3.0
## Example (cont.)

<table>
<thead>
<tr>
<th></th>
<th>Comps ratio (X / Y)</th>
<th>P/E</th>
<th>(D+E) / EBIT(1-t)</th>
<th>M/B Equity</th>
<th>M/B Firm</th>
</tr>
</thead>
<tbody>
<tr>
<td>1)</td>
<td></td>
<td>17.8</td>
<td>19.6</td>
<td>3.9</td>
<td>3.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Actual (Y)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2)</td>
<td></td>
<td>119.3</td>
<td>122.7</td>
<td>656</td>
<td>1001.7</td>
</tr>
</tbody>
</table>

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3)</td>
<td>MV Firm (Ratio * Y)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4)</td>
<td>MV Equity (Ratio * Y or MV Firm - Debt)</td>
<td>2119.4</td>
<td>2063.5</td>
<td>2565.0</td>
<td>2634.4</td>
</tr>
</tbody>
</table>

| 5) | **Price** (MV Equity / #shares) | 18.5 | 18.0 | 22.4 | 23.0 |
Comparables: Pros and Cons

Pros:
- Simple + lots of information
- Market consensus about discount rate and growth rate.
- Free-ride on market’s information.

Cons:
- Assumes that companies are alike in growth, costs of capital, business composition, leverage
- Hard to find true comps
- Hard to incorporate firm specific information
- Accounting differences
- If everyone uses comps, who actually does fundamental analysis?
Comps & the Conglomerate Discount

- Is the value of a conglomerate equal to the sum of its parts?
  - Calculate Firm Value / Assets for the conglomerate
  - For each of its business segments (in annual report), calculate median Firm Value / Assets for single segment firms in that industry
  - Add up these comps, weighting by the share of the conglomerate’s assets in that industry

- Result: On average, conglomerates are worth 12% less than the sum of their parts.
Possible Interpretations

- Conglomerates are an inefficient form of organization
- The stock market doesn’t get it
- The comparables method doesn’t work
Distribution of Price / Sales ratios for Internet stocks (March 2000)
Distribution of Price / Sales ratios for all stocks (March 2000)
## Internet stocks and selected high-tech stocks
(March 2000, in $billions)

<table>
<thead>
<tr>
<th></th>
<th>Internet</th>
<th>Cisco</th>
<th>Intel</th>
<th>IBM</th>
<th>Microsoft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity MV</td>
<td>651.6</td>
<td>445.5</td>
<td>408</td>
<td>194.1</td>
<td>505.7</td>
</tr>
<tr>
<td>Equity BV</td>
<td>34.7</td>
<td>11.7</td>
<td>35.8</td>
<td>21.6</td>
<td>27.5</td>
</tr>
<tr>
<td>Sales</td>
<td>12.1</td>
<td>12.2</td>
<td>29.4</td>
<td>87.5</td>
<td>19.7</td>
</tr>
<tr>
<td>Gross Profits</td>
<td>4.8</td>
<td>8.4</td>
<td>20.3</td>
<td>38.1</td>
<td>17.4</td>
</tr>
<tr>
<td>NI</td>
<td>-7.2</td>
<td>2.1</td>
<td>7.3</td>
<td>7.7</td>
<td>7.8</td>
</tr>
<tr>
<td>M/B Equity</td>
<td>18.8</td>
<td>38.1</td>
<td>11.4</td>
<td>9.0</td>
<td>18.4</td>
</tr>
<tr>
<td>MV Equity / Sales</td>
<td>53.9</td>
<td>36.5</td>
<td>13.9</td>
<td>2.2</td>
<td>25.7</td>
</tr>
<tr>
<td>MV Equity / Profits</td>
<td>135.8</td>
<td>53.0</td>
<td>20.1</td>
<td>5.1</td>
<td>29.1</td>
</tr>
</tbody>
</table>
What growth and margin assumptions would have justified Internet valuation in March 2000?

<table>
<thead>
<tr>
<th>Short-run growth rate</th>
<th>Years of high growth</th>
<th>Value ($billions)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Profit margin = 5%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>10</td>
<td>7.7</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>30.4</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>58.6</td>
</tr>
<tr>
<td>30%</td>
<td>10</td>
<td>50.0</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>150.2</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>368.0</td>
</tr>
<tr>
<td><strong>Panel B: Profit margin = 10%</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20%</td>
<td>10</td>
<td>37.4</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>74.6</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>125.7</td>
</tr>
<tr>
<td>30%</td>
<td>10</td>
<td>122.0</td>
</tr>
<tr>
<td></td>
<td>20</td>
<td>314.1</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td><strong>744.5</strong></td>
</tr>
</tbody>
</table>

Assumptions: Discount rate = 10%, long-term growth = 6%