The Dark Side of Valuation:
A Jedi Guide to Valuing Difficult-to-value Companies

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Some Initial Thoughts

"One hundred thousand lemmings cannot be wrong"

Graffiti
Misconceptions about Valuation

- Myth 1: A valuation is an objective search for “true” value
  - Truth 1.1: All valuations are biased. The only questions are how much and in which direction.
  - Truth 1.2: The direction and magnitude of the bias in your valuation is directly proportional to who pays you and how much you are paid.

- Myth 2.: A good valuation provides a precise estimate of value
  - Truth 2.1: There are no precise valuations
  - Truth 2.2: The payoff to valuation is greatest when valuation is least precise.

- Myth 3: The more quantitative a model, the better the valuation
  - Truth 3.1: One’s understanding of a valuation model is inversely proportional to the number of inputs required for the model.
  - Truth 3.2: Simpler valuation models do much better than complex ones.
The essence of intrinsic value

- In intrinsic valuation, you value an asset based upon its intrinsic characteristics.
- For cash flow generating assets, the intrinsic value will be a function of the magnitude of the expected cash flows on the asset over its lifetime and the uncertainty about receiving those cash flows.
- Discounted cash flow valuation is a tool for estimating intrinsic value, where the expected value of an asset is written as the present value of the expected cash flows on the asset, with either the cash flows or the discount rate adjusted to reflect the risk.
Risk Adjusted Value: Three Basic Propositions

The value of an asset is the present value of the expected cash flows on that asset, over its expected life:

$$\text{Value of asset} = \frac{E(CF_1)}{(1 + r)} + \frac{E(CF_2)}{(1 + r)^2} + \frac{E(CF_3)}{(1 + r)^3} + \cdots + \frac{E(CF_n)}{(1 + r)^n}$$

**Proposition 1:** If “it” does not affect the cash flows or alter risk (thus changing discount rates), “it” cannot affect value.

**Proposition 2:** For an asset to have value, the expected cash flows have to be positive some time over the life of the asset.

**Proposition 3:** Assets that generate cash flows early in their life will be worth more than assets that generate cash flows later; the latter may however have greater growth and higher cash flows to compensate.
### DCF Choices: Equity Valuation versus Firm Valuation

**Firm Valuation:** Value the entire business

<table>
<thead>
<tr>
<th>Assets</th>
<th>Liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Existing Investments</td>
<td>Debt</td>
</tr>
<tr>
<td>Generate cashflows today</td>
<td>Fixed Claim on cash flows</td>
</tr>
<tr>
<td>Includes long lived</td>
<td>Little or No role in management</td>
</tr>
<tr>
<td>(fixed) and short-lived</td>
<td>Fixed Maturity</td>
</tr>
<tr>
<td>(working capital) assets</td>
<td>Tax Deductible</td>
</tr>
<tr>
<td>Expected Value that will be</td>
<td>Equity</td>
</tr>
<tr>
<td>created by future investments</td>
<td>Residual Claim on cash flows</td>
</tr>
<tr>
<td></td>
<td>Significant Role in management</td>
</tr>
<tr>
<td></td>
<td>Perpetual Lives</td>
</tr>
</tbody>
</table>

**Equity valuation:** Value just the equity claim in the business
The fundamental determinants of value…

What are the cashflows from existing assets?
- Equity: Cashflows after debt payments
- Firm: Cashflows before debt payments

What is the value added by growth assets?
Equity: Growth in equity earnings/cashflows
Firm: Growth in operating earnings/cashflows

How risky are the cash flows from both existing assets and growth assets?
Equity: Risk in equity in the company
Firm: Risk in the firm’s operations

When will the firm become a mature firm, and what are the potential roadblocks?
DISCOUNTED CASHFLOW VALUATION

Cashflow to Firm
EBIT (1-t)
- (Cap Ex - Depr)
- Change in WC
= FCFF

Expected Growth
Reinvestment Rate
* Return on Capital

Firm is in stable growth:
Grows at constant rate forever

Terminal Value = FCFF_{n+1}/(r-g_n)

Discount at WACC = Cost of Equity (Equity/(Debt + Equity)) + Cost of Debt (Debt/(Debt + Equity))

Value of Operating Assets + Cash & Non-op Assets
= Value of Firm
- Value of Debt
= Value of Equity

Cost of Equity

Cost of Debt
(Riskfree Rate + Default Spread) (1-t)

Weights
Based on Market Value

Riskfree Rate:
- No default risk
- No reinvestment risk
- In same currency and in same terms (real or nominal as cash flows)

Beta
- Measures market risk

Risk Premium
- Premium for average risk investment

Type of Business
Operating Leverage
Financial Leverage
Base Equity Premium
Country Risk Premium
The Dark Side of Valuation…

- Valuing stable, money making companies with consistent and clear accounting statements, a long and stable history and lots of comparable firms is easy to do.

- The true test of your valuation skills is when you have to value “difficult” companies. In particular, the challenges are greatest when valuing:
  - Young companies, early in the life cycle, in young businesses
  - Companies that don’t fit the accounting mold
  - Companies that face substantial truncation risk (default or nationalization risk)
Difficult to value companies…

- Across the life cycle:
  - **Young, growth firms**: Limited history, small revenues in conjunction with big operating losses and a propensity for failure make these companies tough to value.
  - **Mature companies in transition**: When mature companies change or are forced to change, history may have to be abandoned and parameters have to be reestimated.
  - **Declining and Distressed firms**: A long but irrelevant history, declining markets, high debt loads and the likelihood of distress make them troublesome.

- Across sectors
  - **Financial service firms**: Opacity of financial statements and difficulties in estimating basic inputs leave us trusting managers to tell us what’s going on.
  - **Commodity and cyclical firms**: Dependence of the underlying commodity prices or overall economic growth make these valuations susceptible to macro factors.
  - **Firms with intangible assets**: Accounting principles are left to the wayside on these firms.

- Across the globe
  - **Emerging “risky” economies**: An economy in transition can create risks for even solid firms.
  - **Nationalization or expropriation risk**: A truncation risk that shows up when you are doing well.

- Across the ownership cycle
  - **Privately owned businesses**: Exposure to firm specific risk and illiquidity bedevil valuations.
  - **VC and private equity**: Different equity investors, with different perceptions of risk.
  - **Closely held public firms**: Part private and part public, sharing the troubles of both.
I. The challenge with young companies…

Making judgments on revenues/profits difficult because you cannot draw on history. If you have no product/service, it is difficult to gauge market potential or profitability. The company’s entire value lies in future growth but you have little to base your estimate on.

Cash flows from existing assets non-existent or negative.

What are the cashflows from existing assets?

Different claims on cash flows can affect value of equity at each stage.

What is the value of equity in the firm?

What is the value added by growth assets?

Limited historical data on earnings, and no market prices for securities makes it difficult to assess risk.

How risky are the cash flows from both existing assets and growth assets?

When will the firm become a mature firm, and what are the potential roadblocks?

Will the firm make it through the gauntlet of market demand and competition. Even if it does, assessing when it will become mature is difficult because there is so little to go on.
Upping the ante.. Young companies in young businesses…

- When valuing a business, we generally draw on three sources of information
  - The firm’s current financial statement
    - How much did the firm sell?
    - How much did it earn?
  - The firm’s financial history, usually summarized in its financial statements.
    - How fast have the firm’s revenues and earnings grown over time?
    - What can we learn about cost structure and profitability from these trends?
    - Susceptibility to macro-economic factors (recessions and cyclical firms)
  - The industry and comparable firm data
    - What happens to firms as they mature? (Margins.. Revenue growth… Reinvestment needs… Risk)

- It is when valuing these companies that you find yourself tempted by the dark side, where
  - “Paradigm shifts” happen…
  - New metrics are invented …
  - The story dominates and the numbers lag…
9a. Amazon in January 2000

Sales to capital ratio and expected margin are retail industry average numbers

Cost of Equity: 12.90%
Cost of Debt: 6.5% + 1.5% = 8.0%
Tax rate = 0% -> 10.00%

Sales Turnover Ratio: 3.00
Revenue Growth: 42%
Expected Margin: -> 10.00%

Used average interest coverage ratio over next 5 years to get BBB rating.

Dot.com retailers for first 5 years
Conventional retailers after year 5

Riskfree Rate: T. Bond rate = 6.5%
Beta: 1.60 -> 1.00
Risk Premium: 4%

Internet/Retail
Operating Leverage
Current D/E: 1.21%
Base Equity Premium
Country Risk Premium

All existing options valued as options, using current stock price of $84.

Value of Op Assets $14,910
+ Cash $26
= Value of Firm $14,936
- Value of Debt $349
= Value of Equity $14,587
- Equity Options $2,892
Value per share $34.32

Amazon was trading at $84 in January 2000.

Pushed debt ratio to retail industry average of 15%.

Forever

Terminal Value $1881/(0.0961-0.06) = 52,148

Cost of Equity
12.90%

Cost of Debt
8.00%

AT cost of debt
8.00%

Cost of Capital
12.84%

Used average interest coverage ratio over next 5 years to get BBB rating.

Dot.com retailers for first 5 years
Conventional retailers after year 5

Cost of Debt
6.5% + 1.5% = 8.0%
Tax rate = 0% -> 35%

Weights
Debt = 1.2% -> 15%

Terminal Year
$41,346
10.00%
35.00%
$2,688
$807
$1,881

Amazon was trading at $84 in January 2000.

Pushed debt ratio to retail industry average of 15%.
Lesson 1: Don’t trust regression betas…. 
Lesson 2: The cost of capital will change over time…

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>-$373</td>
<td>-$94</td>
<td>$407</td>
<td>$1,038</td>
<td>$1,628</td>
</tr>
<tr>
<td>Taxes</td>
<td>$0</td>
<td>$0</td>
<td>$0</td>
<td>$167</td>
<td>$570</td>
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<tr>
<td>EBIT(1-t)</td>
<td>-$373</td>
<td>-$94</td>
<td>$407</td>
<td>$871</td>
<td>$1,058</td>
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<tr>
<td>Tax rate</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>16.13%</td>
<td>35%</td>
</tr>
<tr>
<td>NOL</td>
<td>$500</td>
<td>$873</td>
<td>$967</td>
<td>$560</td>
<td>$0</td>
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</table>

<table>
<thead>
<tr>
<th></th>
<th>Yrs 1-3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Terminal year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tax Rate</td>
<td>0.00%</td>
<td>16.13%</td>
<td>35.00%</td>
<td>35.00%</td>
<td>35.00%</td>
<td>35.00%</td>
<td>35.00%</td>
<td>35.00%</td>
<td></td>
</tr>
<tr>
<td>Debt Ratio</td>
<td>1.20%</td>
<td>1.20%</td>
<td>1.20%</td>
<td>3.96%</td>
<td>4.65%</td>
<td>5.80%</td>
<td>8.10%</td>
<td>15.00%</td>
<td>15.00%</td>
</tr>
<tr>
<td>Beta</td>
<td>1.60</td>
<td>1.60</td>
<td>1.60</td>
<td>1.48</td>
<td>1.36</td>
<td>1.24</td>
<td>1.12</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Cost of Equity</td>
<td>12.90%</td>
<td>12.90%</td>
<td>12.90%</td>
<td>12.42%</td>
<td>11.94%</td>
<td>11.46%</td>
<td>10.98%</td>
<td>10.50%</td>
<td>10.50%</td>
</tr>
<tr>
<td>Cost of Debt</td>
<td>8.00%</td>
<td>8.00%</td>
<td>8.00%</td>
<td>7.80%</td>
<td>7.75%</td>
<td>7.67%</td>
<td>7.50%</td>
<td>7.00%</td>
<td>7.00%</td>
</tr>
<tr>
<td>After-tax cost of debt</td>
<td>8.00%</td>
<td>6.71%</td>
<td>5.20%</td>
<td>5.07%</td>
<td>5.04%</td>
<td>4.98%</td>
<td>4.88%</td>
<td>4.55%</td>
<td>4.55%</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>12.84%</td>
<td>12.83%</td>
<td>12.81%</td>
<td>12.13%</td>
<td>11.62%</td>
<td>11.08%</td>
<td>10.49%</td>
<td>9.61%</td>
<td>9.61%</td>
</tr>
</tbody>
</table>
Lesson 3: Use updated numbers and the free cash flows will often be negative (even if the company is making money)

- When valuing Amazon in early 2000, the last annual report that was available was the 1998 annual report. For a young company, that is ancient data, since so much can change over the course of a short time period. To value Amazon the trailing 12-month numbers were used.

  - **Trailing 12-month inputs**
    - Amazon’s EBIT (Trailing 1999) = -$410 million
    - Tax rate used = 0%
    - Capital spending (Trailing 1999) = $243 million (includes acquisitions)
    - Depreciation (Trailing 1999) = $31 million
    - Non-cash Working capital Change (1999) = - 80 million

  - **Estimating FCFF (1999)**
    
    \[
    \text{Current EBIT} \times (1 - \text{tax rate}) = -410 \times (1-0) = -410 \text{ million} \\
    - (\text{Capital Spending} - \text{Depreciation}) = -212 \text{ million} \\
    - \text{Change in Working Capital} = -80 \text{ million} \\
    \text{Current FCFF} \text{ } = -542 \text{ million}
    \]
Lesson 4: Many of the operating expenses may be capital expenses….

- Since young companies are focused on generating future growth, it is possible that some or a significant portion of what accountants categorize as operating expenses represent expenditures designed to generate future growth (and thus are capital expenditures).

- In the late 1990s, many dot-com companies argued that SG&A expenses were really focused on getting new customers and should be treated as capital expenditures. Amazon, for instance, would have reported a profit if the SG&A expenses from 1999 were treated as capital expenditures, rather than operating expenses.

- If we adopt this rationale, it will also mean that they are reinvesting far more than we think they are. It will, however, make not their cash flows less negative.

- Should Amazon.com’s selling expenses be treated as cap ex?
Lesson 5: Work backwards

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues</th>
<th>Operating Margin</th>
<th>EBIT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr12m</td>
<td>$1,117</td>
<td>-36.71%</td>
<td>-$410</td>
</tr>
<tr>
<td>1</td>
<td>$2,793</td>
<td>-13.35%</td>
<td>-$373</td>
</tr>
<tr>
<td>2</td>
<td>$5,585</td>
<td>-1.68%</td>
<td>-$94</td>
</tr>
<tr>
<td>3</td>
<td>$9,774</td>
<td>4.16%</td>
<td>$407</td>
</tr>
<tr>
<td>4</td>
<td>$14,661</td>
<td>7.08%</td>
<td>$1,038</td>
</tr>
<tr>
<td>5</td>
<td>$19,059</td>
<td>8.54%</td>
<td>$1,628</td>
</tr>
<tr>
<td>6</td>
<td>$23,862</td>
<td>9.27%</td>
<td>$2,212</td>
</tr>
<tr>
<td>7</td>
<td>$28,729</td>
<td>9.64%</td>
<td>$2,768</td>
</tr>
<tr>
<td>8</td>
<td>$33,211</td>
<td>9.82%</td>
<td>$3,261</td>
</tr>
<tr>
<td>9</td>
<td>$36,798</td>
<td>9.91%</td>
<td>$3,646</td>
</tr>
<tr>
<td>10</td>
<td>$39,006</td>
<td>9.95%</td>
<td>$3,883</td>
</tr>
</tbody>
</table>
| TY(11)| $41,346  | 10.00%           | $4,135 Industry Average
Lesson 6: Scaling up is hard to do…

Typically, the revenue growth rate of a newly public company outpaces its industry average for only about five years.

Post-I.P.O. growth
Median of new issues from 1965 to 2005

Margin by which revenue growth rate exceeds industry average

Number of years after coming to market

Source: Andrew Metrick
The New York Times
Lesson 7: Don’t forget to pay for growth...

<table>
<thead>
<tr>
<th>Yr</th>
<th>Rev Growth</th>
<th>Rev</th>
<th>Reinv</th>
<th>Sales/Capital</th>
<th>ROC</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>150.00%</td>
<td>$1,676</td>
<td>$559</td>
<td>3.00</td>
<td>-76.62%</td>
</tr>
<tr>
<td>2</td>
<td>100.00%</td>
<td>$2,793</td>
<td>$931</td>
<td>3.00</td>
<td>-8.96%</td>
</tr>
<tr>
<td>3</td>
<td>75.00%</td>
<td>$4,189</td>
<td>$1,396</td>
<td>3.00</td>
<td>20.59%</td>
</tr>
<tr>
<td>4</td>
<td>50.00%</td>
<td>$4,887</td>
<td>$1,629</td>
<td>3.00</td>
<td>25.82%</td>
</tr>
<tr>
<td>5</td>
<td>30.00%</td>
<td>$4,398</td>
<td>$1,466</td>
<td>3.00</td>
<td>21.16%</td>
</tr>
<tr>
<td>6</td>
<td>25.20%</td>
<td>$4,803</td>
<td>$1,601</td>
<td>3.00</td>
<td>22.23%</td>
</tr>
<tr>
<td>7</td>
<td>20.40%</td>
<td>$4,868</td>
<td>$1,623</td>
<td>3.00</td>
<td>22.30%</td>
</tr>
<tr>
<td>8</td>
<td>15.60%</td>
<td>$4,482</td>
<td>$1,494</td>
<td>3.00</td>
<td>21.87%</td>
</tr>
<tr>
<td>9</td>
<td>10.80%</td>
<td>$3,587</td>
<td>$1,196</td>
<td>3.00</td>
<td>21.19%</td>
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<tr>
<td>10</td>
<td>6.00%</td>
<td>$2,208</td>
<td>$736</td>
<td>3.00</td>
<td>20.39%</td>
</tr>
</tbody>
</table>
Lesson 8: There are always scenarios where the market price can be justified…

<table>
<thead>
<tr>
<th></th>
<th>6%</th>
<th>8%</th>
<th>10%</th>
<th>12%</th>
<th>14%</th>
</tr>
</thead>
<tbody>
<tr>
<td>30%</td>
<td>$(1.94)$</td>
<td>$2.95$</td>
<td>$7.84$</td>
<td>$12.71$</td>
<td>$17.57$</td>
</tr>
<tr>
<td>35%</td>
<td>$1.41$</td>
<td>$8.37$</td>
<td>$15.33$</td>
<td>$22.27$</td>
<td>$29.21$</td>
</tr>
<tr>
<td>40%</td>
<td>$6.10$</td>
<td>$15.93$</td>
<td>$25.74$</td>
<td>$35.54$</td>
<td>$45.34$</td>
</tr>
<tr>
<td>45%</td>
<td>$12.59$</td>
<td>$26.34$</td>
<td>$40.05$</td>
<td>$53.77$</td>
<td>$67.48$</td>
</tr>
<tr>
<td>50%</td>
<td>$21.47$</td>
<td>$40.50$</td>
<td>$59.52$</td>
<td>$78.53$</td>
<td>$97.54$</td>
</tr>
<tr>
<td>55%</td>
<td>$33.47$</td>
<td>$59.60$</td>
<td>$85.72$</td>
<td>$111.84$</td>
<td>$137.95$</td>
</tr>
<tr>
<td>60%</td>
<td>$49.53$</td>
<td>$85.10$</td>
<td>$120.66$</td>
<td>$156.22$</td>
<td>$191.77$</td>
</tr>
</tbody>
</table>
Lesson 9: You will be wrong 100% of the time… and it really is not (always) your fault…

- No matter how careful you are in getting your inputs and how well structured your model is, your estimate of value will change both as new information comes out about the company, the business and the economy.

- As information comes out, you will have to adjust and adapt your model to reflect the information. Rather than be defensive about the resulting changes in value, recognize that this is the essence of risk.

- **A test:** If your valuations are unbiased, you should find yourself increasing estimated values as often as you are decreasing values. In other words, there should be equal doses of good and bad news affecting valuations (at least over time).
9b. Amazon in January 2001

Current Revenue: $2,465
Current Margin: -34.60%

EBIT: -$545
Revenue Growth: 25.41%
Sales Turnover Ratio: 3.02

Reinvest: Cap ex includes acquisitions
Working capital is 3% of revenues

Expected Margin: -> 9.32%

Value of Op Assets: $8,789
+ Cash & Non-op: $1,263
= Value of Firm: $10,052
- Value of Debt: $1,879
= Value of Equity: $8,173
- Equity Options: $845
= Value per share: $20.83

Value of Debt: $1,879
Value of Equity: $8,173
- Equity Options: $845
= Value per share: $20.83

NOL: 1,289 m

Cost of Equity: 13.81%
Cost of Debt: 6.5% + 3.5% = 10.0%

Cost of Capital: 12.77%
Reinvestment:
Cap ex includes acquisitions
Working capital is 3% of revenues

β = 2.18
Risk Premium: 4%

Comprehensive Income:

Amazon.com
January 2001
Stock price = $14
Lesson 10: Here is your consolation prize… the market makes even bigger mistakes…

Amazon: Value and Price

- Value per share
- Price per share

<table>
<thead>
<tr>
<th>Time of analysis</th>
<th>2000</th>
<th>2001</th>
<th>2002</th>
<th>2003</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value per share</td>
<td>$80.00</td>
<td>$40.00</td>
<td>$30.00</td>
<td>$40.00</td>
</tr>
<tr>
<td>Price per share</td>
<td>$90.00</td>
<td>$20.00</td>
<td>$20.00</td>
<td>$50.00</td>
</tr>
</tbody>
</table>
Lesson 11: Pricing ≠ Valuation

- Faced with uncertainty, most investors price young, growth companies, rather than value them. You price an asset by looking at what others will pay rather than what an asset is worth.
- Pricing usually manifests itself in the form of multiples (sometimes creative) and comparisons across firms and transactions.
- Those who price assets argue that they are doing so, because they do not want to make the assumptions that underlie full-fledged valuation but those assumptions are made implicitly rather than explicitly.
Valuing Facebook Pre-IPO: May 17, 2012

**Stable Growth**
- $g = 2\%$; $\beta = 1.00$;
- $\text{Cost of capital} = 8\%$
- $\text{ROC} = 20\%$
- $\text{Reinvestment Rate} = 2\%/20\% = 10\%$

**Starting numbers**

<table>
<thead>
<tr>
<th></th>
<th>This year</th>
<th>Last year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$3,711.00</td>
<td>$1,974.00</td>
</tr>
<tr>
<td>Operating income or EBIT</td>
<td>$1,695.00</td>
<td>$1,032.00</td>
</tr>
<tr>
<td>Invested Capital</td>
<td>$4,216.11</td>
<td>$694.00</td>
</tr>
<tr>
<td>Tax rate</td>
<td>40.00%</td>
<td></td>
</tr>
<tr>
<td>Operating margin</td>
<td>45.68%</td>
<td></td>
</tr>
<tr>
<td>Return on capital</td>
<td>146.54%</td>
<td></td>
</tr>
<tr>
<td>Sales/Capital</td>
<td>0.88</td>
<td></td>
</tr>
<tr>
<td>Revenue growth rate</td>
<td>87.99%</td>
<td></td>
</tr>
</tbody>
</table>

**Revenue growth of 40% a year for 5 years, tapering down to 2% in year 10**

**Pre-tax operating margin declines to 35% in year 10**

**Sales to capital ratio of 1.50 for incremental sales**

**Terminal Value**

\[ 8,330/(0.08 - 0.02) = 138,830 \]

**Cost of capital decreases to 8% from years 6-10**

**At 4.00 pm, May 17, the offering was priced at $38/share**

---

### Yearly Revenues

<table>
<thead>
<tr>
<th>Year</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Revenues</td>
<td>$5,195</td>
<td>$7,274</td>
<td>$10,183</td>
<td>$14,256</td>
<td>$26,425</td>
<td>$32,979</td>
<td>$38,651</td>
<td>$42,362</td>
<td>$43,209</td>
<td></td>
</tr>
<tr>
<td>EBIT</td>
<td>$2,318</td>
<td>$3,167</td>
<td>$4,325</td>
<td>$5,903</td>
<td>$8,051</td>
<td>$10,377</td>
<td>$12,599</td>
<td>$14,353</td>
<td>$15,279</td>
<td>$15,123</td>
</tr>
<tr>
<td>EBIT (1-t)</td>
<td>$1,391</td>
<td>$1,900</td>
<td>$2,595</td>
<td>$3,542</td>
<td>$4,830</td>
<td>$6,226</td>
<td>$7,559</td>
<td>$8,612</td>
<td>$9,167</td>
<td>$9,074</td>
</tr>
<tr>
<td>- Reinvestment</td>
<td>$900</td>
<td>$1,385</td>
<td>$1,940</td>
<td>$2,715</td>
<td>$3,802</td>
<td>$4,311</td>
<td>$4,369</td>
<td>$3,782</td>
<td>$2,474</td>
<td>$565</td>
</tr>
<tr>
<td>FCFF</td>
<td>$401</td>
<td>$515</td>
<td>$655</td>
<td>$826</td>
<td>$1,029</td>
<td>$1,915</td>
<td>$3,190</td>
<td>$4,830</td>
<td>$6,694</td>
<td>$8,509</td>
</tr>
</tbody>
</table>

**Value of equity**

- 66,264
- - Options 3,088
- Value in stock 63,175
- Value/share $27.07

---

**Cost of capital = 11.19% (.988) + 1.59% (.012) = 11.07%**

**Term yr**

- EBIT (1-t) 9255
- Reinv 926
- FCFF 8330

---

**Riskfree Rate:**
- Riskfree rate = 2% + Beta = 1.53 x Risk Premium = 6% = Unlevered Beta for Sectors: 1.52 D/E=1.21%

---

**Weights**

- E = 98.8% D = 1.2%
Lesson 11: Uncertainty is not a bug, but a feature with young companies
An “option premium” for some young companies: The option to expand into a new product/market
An Example of an Expansion Option

- You have completed a DCF valuation of a small anti-virus software company, Secure Mail, and estimated a value of $115 million.
- Assume that there is the possibility that the company could use the customer base that it develops for the anti-virus software and the technology on which the software is based to create a database software program sometime in the next 5 years.
  - It will cost Secure Mail about $500 million to develop a new database program, if they decide to do it today.
  - Based upon the information you have now on the potential for a database program, the company can expect to generate about $40 million a year in after-tax cashflows for ten years. The cost of capital for private companies that provide database software is 12%.
  - The annualized standard deviation in firm value at publicly traded database companies is 50%.
  - The five-year treasury bond rate is 3%.
Valuing the Expansion Option

\[ S = \text{Value of entering the database software market} \]
\[ = \text{PV of $40 million for 10 years } @ 12\% = $226 \text{ million} \]
\[ K = \text{Exercise price} \]
\[ = \text{Cost of entering the database software market} = $500 \text{ million} \]
\[ t = \text{Period over which you have the right to enter the market} \]
\[ = 5 \text{ years} \]
\[ s = \text{Standard deviation of stock prices of database firms} = 50\% \]
\[ r = \text{Riskless rate} = 3\% \]

\textbf{Call Value} = $56 \text{ Million}

\begin{align*}
\text{DCF valuation of the firm} &= $115 \text{ million} \\
\text{Value of Option to Expand to Database market} &= $56 \text{ million} \\
\text{Value of the company with option to expand} &= $171 \text{ million}
\end{align*}
A note of caution: Opportunities are not options...

Is the first investment necessary for the second investment?

Not necessary

A Zero competitive advantage on Second Investment

Pre-Requisit

An Exclusive Right to Second Investment

No option value

Option has no value

100% of option value

Option has high value

Second Investment has zero excess returns

Second investment has large sustainable excess return

First-Mover  Technological  Brand  Telecom  Pharmaceutical
Mover  Edge  Name  Licenses  patents

Increasing competitive advantage/ barriers to entry
II. Mature Companies in transition..

- Mature companies are generally the easiest group to value. They have long, established histories that can be mined for inputs. They have investment policies that are set and capital structures that are stable, thus making valuation more grounded in past data.

- However, this stability in the numbers can mask real problems at the company. The company may be set in a process, where it invests more or less than it should and does not have the right financing mix. In effect, the policies are consistent, stable and bad.

- If you expect these companies to change or as is more often the case to have change thrust upon them,
The perils of valuing mature companies…

**Figure 7.1: Estimation Issues - Mature Companies**

- **What are the cashflows from existing assets?**
  - Equity claims can vary in voting rights and dividends.
- **What is the value added by growth assets?**
- **How risky are the cash flows from both existing assets and growth assets?**
  - Operating risk should be stable, but the firm can change its financial leverage. This can affect both the cost of equity and capital.
- **When will the firm become a mature firm, and what are the potential roadblocks?**
  - Maintaining excess returns or high growth for any length of time is difficult to do for a mature firm.

Lots of historical data on earnings and cashflows. Key questions remain if these numbers are volatile over time or if the existing assets are not being efficiently utilized.

Growth is usually not very high, but firms may still be generating healthy returns on investments, relative to cost of funding. Questions include how long they can generate these excess returns and with what growth rate in operations. Restructuring can change both inputs dramatically and some firms maintain high growth through acquisitions.

What is the value of equity in the firm?

Equity claims can vary in voting rights and dividends.
Hormel Foods: The Value of Control Changing

Hormel Foods sells packaged meat and other food products and has been in existence as a publicly traded company for almost 80 years. In 2008, the firm reported after-tax operating income of $315 million, reflecting a compounded growth of 5% over the previous 5 years.

The Status Quo

Run by existing management, with conservative reinvestment policies (reinvestment rate = 14.34% and debt ratio = 10.4%).

Anemic growth rate and short growth period, due to reinvestment policy

Low debt ratio affects cost of capital

<table>
<thead>
<tr>
<th>Year</th>
<th>Operating income after taxes</th>
<th>Expected growth rate</th>
<th>ROC</th>
<th>Reinvestment Rate</th>
<th>Reinvestment</th>
<th>FCFF</th>
<th>Cost of capital</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailing 12 months</td>
<td>$315</td>
<td></td>
<td>2.75%</td>
<td>14.34%</td>
<td>19.14%</td>
<td>$62</td>
<td>$262</td>
<td>6.79%</td>
</tr>
<tr>
<td>1</td>
<td>$324</td>
<td>2.75%</td>
<td>14.34%</td>
<td>19.14%</td>
<td>$64</td>
<td>$269</td>
<td>6.79%</td>
<td>$236</td>
</tr>
<tr>
<td>2</td>
<td>$333</td>
<td>2.75%</td>
<td>14.34%</td>
<td>19.14%</td>
<td>$65</td>
<td>$276</td>
<td>6.79%</td>
<td>$227</td>
</tr>
<tr>
<td>3</td>
<td>$342</td>
<td>2.75%</td>
<td>14.34%</td>
<td>19.14%</td>
<td>$114</td>
<td>$4,840</td>
<td>7.23%</td>
<td>$3,974</td>
</tr>
<tr>
<td>Beyond</td>
<td>$350</td>
<td>2.35%</td>
<td>7.23%</td>
<td>32.52%</td>
<td>$114</td>
<td>$4,840</td>
<td>7.23%</td>
<td>$3,974</td>
</tr>
</tbody>
</table>

Value of operating assets | $4,682
(Add) Cash | $155
(Debt) | $491
(Debt) Management Options | $53
Value of equity in common stock | $4,293
Value per share | $31.91

| Expected growth rate = ROC * Reinvestment Rate |
| 14.34% * 19.14% = 2.75% |
| 14.00% * 40% = 5.60% |
| ROC drops, reinvestment rises and growth goes up. |

New and better management

More aggressive reinvestment which increases the reinvestment rate (to 40%) and length of growth (to 5 years), and higher debt ratio (20%).

Operating Restructuring

<table>
<thead>
<tr>
<th>Year</th>
<th>Operating income after taxes</th>
<th>Expected growth rate</th>
<th>ROC</th>
<th>Reinvestment Rate</th>
<th>Reinvestment</th>
<th>FCFF</th>
<th>Cost of capital</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trailing 12 months</td>
<td>$315</td>
<td>5.60%</td>
<td>14.00%</td>
<td>40.00%</td>
<td>$133</td>
<td>$200</td>
<td>6.63%</td>
<td>$187</td>
</tr>
<tr>
<td>1</td>
<td>$333</td>
<td>5.60%</td>
<td>14.00%</td>
<td>40.00%</td>
<td>$141</td>
<td>$211</td>
<td>6.63%</td>
<td>$185</td>
</tr>
<tr>
<td>2</td>
<td>$351</td>
<td>5.60%</td>
<td>14.00%</td>
<td>40.00%</td>
<td>$148</td>
<td>$223</td>
<td>6.63%</td>
<td>$184</td>
</tr>
<tr>
<td>3</td>
<td>$371</td>
<td>5.60%</td>
<td>14.00%</td>
<td>40.00%</td>
<td>$260</td>
<td>$235</td>
<td>6.63%</td>
<td>$182</td>
</tr>
<tr>
<td>4</td>
<td>$392</td>
<td>5.60%</td>
<td>14.00%</td>
<td>40.00%</td>
<td>$223</td>
<td>$248</td>
<td>6.63%</td>
<td>$180</td>
</tr>
<tr>
<td>Beyond</td>
<td>$414</td>
<td>2.35%</td>
<td>6.74%</td>
<td>34.87%</td>
<td>$148</td>
<td>$6,282</td>
<td>6.74%</td>
<td>$4,557</td>
</tr>
</tbody>
</table>

Value of operating assets | $5,475
(Add) Cash | $155
(Debt) | $491
(Debt) Management Options | $53
Value of equity in common stock | $5,085
Value per share | $37.80

Financial restructuring

Cost of capital = Cost of equity (1-Debt ratio) + Cost of debt (Debt ratio)

Status quo = 7.33% (1-.104) + 3.60% (1-.40) (.104) = 6.79%

Optimal = 7.75% (1-.20) + 3.60% (1-.40) (.20) = 6.63%

Cost of equity rises but cost of capital drops.
Lesson 1: Cost cutting and increased efficiency are easier accomplished on paper than in practice…

![Cost-synergy estimation chart]

**Cost-synergy estimation is better, but there are patterns emerging in the errors**

<table>
<thead>
<tr>
<th>Mergers achieving stated percentage of expected cost savings, percent</th>
<th>3</th>
<th>5</th>
<th>1</th>
<th>4</th>
<th>12</th>
<th>13</th>
<th>25</th>
<th>36</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-30%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30-50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>51-60%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>61-70%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>71-80%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>81-90%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>91-100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Typical sources of estimation error**

- Underestimating one-time costs
- Using benchmarks from noncomparable situations
- Not sanity-checking management estimates against precedent transactions
- Failing to ground estimates in bottom-up analysis (e.g., location-by-location review of overlaps)

Lesson 2: Increasing growth is not always an option (or at least not a good option)

Modes of organic growth vary in value creation intensity—consumer goods industry

<table>
<thead>
<tr>
<th>Category of growth</th>
<th>Shareholder value created for incremental $1 million of growth/target acquisition size</th>
<th>Revenue growth/acquisition size necessary to double typical company's share price</th>
</tr>
</thead>
<tbody>
<tr>
<td>New-product market development</td>
<td>1.75–2.00</td>
<td>5–6</td>
</tr>
<tr>
<td>Expanding an existing market</td>
<td>0.30–0.75</td>
<td>13–33</td>
</tr>
<tr>
<td>Maintaining/growing share in a growing market</td>
<td>0.10–0.50</td>
<td>20–100</td>
</tr>
<tr>
<td>Competing for share in a stable market</td>
<td>-0.25–0.40</td>
<td>n/m–25</td>
</tr>
<tr>
<td>Acquisition (25th to 75th percentile result)</td>
<td>-0.5–0.20</td>
<td>n/m–50</td>
</tr>
</tbody>
</table>
Lesson 3: Financial leverage is a double-edged sword.


<table>
<thead>
<tr>
<th>Debt Ratio</th>
<th>Beta</th>
<th>Cost of Equity</th>
<th>Bond Rating</th>
<th>Interest rate on debt</th>
<th>Tax Rate</th>
<th>Cost of Debt (after-tax)</th>
<th>WACC</th>
<th>Firm Value (G)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0.78</td>
<td>7.00%</td>
<td>AAA</td>
<td>3.60%</td>
<td>40.00%</td>
<td>2.16%</td>
<td>7.00%</td>
<td>$4,523</td>
</tr>
<tr>
<td>10%</td>
<td>0.83</td>
<td>7.31%</td>
<td>AAA</td>
<td>3.60%</td>
<td>40.00%</td>
<td>2.16%</td>
<td>6.80%</td>
<td>$4,665</td>
</tr>
<tr>
<td>10.39%</td>
<td>0.83</td>
<td>7.33%</td>
<td>AAA</td>
<td>3.60%</td>
<td>40.00%</td>
<td>2.16%</td>
<td>6.79%</td>
<td>$4,680</td>
</tr>
<tr>
<td>20%</td>
<td>0.89</td>
<td>7.70%</td>
<td>AAA</td>
<td>3.60%</td>
<td>40.00%</td>
<td>2.16%</td>
<td>6.59%</td>
<td>$4,815</td>
</tr>
<tr>
<td>30%</td>
<td>0.97</td>
<td>8.20%</td>
<td>A+</td>
<td>4.60%</td>
<td>40.00%</td>
<td>2.76%</td>
<td>6.57%</td>
<td>$4,834</td>
</tr>
<tr>
<td>40%</td>
<td>1.09</td>
<td>8.86%</td>
<td>A-</td>
<td>5.35%</td>
<td>40.00%</td>
<td>3.21%</td>
<td>6.60%</td>
<td>$4,808</td>
</tr>
<tr>
<td>50%</td>
<td>1.24</td>
<td>9.79%</td>
<td>B+</td>
<td>8.35%</td>
<td>40.00%</td>
<td>5.01%</td>
<td>7.40%</td>
<td>$4,271</td>
</tr>
<tr>
<td>60%</td>
<td>1.47</td>
<td>11.19%</td>
<td>B-</td>
<td>10.85%</td>
<td>40.00%</td>
<td>6.51%</td>
<td>8.38%</td>
<td>$3,757</td>
</tr>
<tr>
<td>70%</td>
<td>1.86</td>
<td>13.52%</td>
<td>CCC</td>
<td>12.35%</td>
<td>40.00%</td>
<td>7.41%</td>
<td>9.24%</td>
<td>$3,398</td>
</tr>
<tr>
<td>80%</td>
<td>2.70</td>
<td>18.53%</td>
<td>CC</td>
<td>14.35%</td>
<td>38.07%</td>
<td>8.89%</td>
<td>10.81%</td>
<td>$2,992</td>
</tr>
<tr>
<td>90%</td>
<td>5.39</td>
<td>34.70%</td>
<td>CC</td>
<td>14.35%</td>
<td>33.84%</td>
<td>9.49%</td>
<td>12.01%</td>
<td>$2,597</td>
</tr>
</tbody>
</table>

- **As debt ratio increases, equity becomes riskier (higher beta) and cost of equity goes up.**
- **As firm borrows more money, its ratings drop and cost of debt rises.**
- **Debt ratio is percent of overall market value of firm that comes from debt financing.**
- **At debt ratios > 80%, firm does not have enough operating income to cover interest expenses. Tax rate goes down to reflect lost tax benefits.**
- **As cost of capital drops, firm value rises (as operating cash flows remain unchanged).**

Optimal: Cost of capital lowest between 20 and 30%.
III. Dealing with decline and distress...

Historical data often reflects flat or declining revenues and falling margins. Investments often earn less than the cost of capital.

**What are the cashflows from existing assets?**

Underfunded pension obligations and litigation claims can lower value of equity. Liquidation preferences can affect value of equity.

**What is the value of equity in the firm?**

Growth can be negative, as firm sheds assets and shrinks. As less profitable assets are shed, the firm’s remaining assets may improve in quality.

**What is the value added by growth assets?**

Depending upon the risk of the assets being divested and the use of the proceeds from the divestiture (to pay dividends or retire debt), the risk in both the firm and its equity can change.

**How risky are the cash flows from both existing assets and growth assets?**

When will the firm become a mature firm, and what are the potential roadblocks?

There is a real chance, especially with high financial leverage, that the firm will not make it. If it is expected to survive as a going concern, it will be as a much smaller entity.
a. Dealing with Decline

- In decline, firms often see declining revenues and lower margins, translating in negative expected growth over time.

- If these firms are run by good managers, they will not fight decline. Instead, they will adapt to it and shut down or sell investments that do not generate the cost of capital. This can translate into negative net capital expenditures (depreciation exceeds cap ex), declining working capital and an overall negative reinvestment rate. The best case scenario is that the firm can shed its bad assets, make itself a much smaller and healthier firm and then settle into long-term stable growth.

- As an investor, your worst case scenario is that these firms are run by managers in denial who continue to expand the firm by making bad investments (that generate lower returns than the cost of capital). These firms may be able to grow revenues and operating income but will destroy value along the way.
11. Sears Holdings: Status Quo

**Current Cashflow to Firm**
- EBIT(1-t) : 1,183
- Net CapX : -18
- Chg WC : -67
= FCFF : 1,268
Reinvestment Rate = 75/1183 = -7.19%

Return on capital = 4.99%

**Expected Growth in EBIT (1-t)**
- .30*-.05 = -.015
-1.5%

**Stable Growth**
g = 2%; Beta = 1.00;
Country Premium = 0%
Cost of capital = 7.13%
ROC = 7.13%; Tax rate = 38%
Reinvestment Rate = 28.05%

**Terminal Value**
4 = 868/(.0713-.02) = 16,921

**Discount at Cost of Capital (WACC)**
9.58% (.566) + 4.80% (0.434) = 7.50%

**On July 23, 2008, Sears was trading at $76.25 a share.**
b. Dealing with the “downside” of Distress

- A DCF valuation values a firm as a going concern. If there is a significant likelihood of the firm failing before it reaches stable growth and if the assets will then be sold for a value less than the present value of the expected cashflows (a distress sale value), DCF valuations will understate the value of the firm.

- Value of Equity = DCF value of equity \( (1 - \text{Probability of distress}) \) + Distress sale value of equity \( \times \text{Probability of distress} \)

- There are three ways in which we can estimate the probability of distress:
  - Use the bond rating to estimate the cumulative probability of distress over 10 years
  - Estimate the probability of distress with a probit
  - Estimate the probability of distress by looking at market value of bonds.

- The distress sale value of equity is usually best estimated as a percent of book value (and this value will be lower if the economy is doing badly and there are other firms in the same business also in distress).
Reinvestment:
Capital expenditures include cost of new casinos and working capital

Extended reinvestment break, due to investment in past

Industry average

Expected Margin: -> 17%

Stable Growth
Stable Revenue Growth: 3%
Stable Operating Margin: 17%
Stable ROC=10%
Reinvest 30% of EBIT(1-t)

Terminal Value = 758(.0743-.03) = $17,129

Cost of Equity
21.82%

Cost of Debt
3% + 6% = 9%
9% (1-.38) = 5.58%

Weights
Debt = 73.5% -> 50%

Revenues
$4,434 $4,523 $5,427 $6,513 $7,815 $8,206 $8,616 $9,047 $9,499 $9,974

Oper margin
5.81% 6.86% 7.90% 8.95% 10% 11.40% 12.80% 14.20% 15.60% 17%

EBIT
$258 $310 $429 $583 $782 $935 $1,103 $1,285 $1,482 $1,696

Tax rate
26.0% 26.0% 26.0% 26.0% 26.0% 28.4% 30.8% 33.2% 35.6% 38.00%

EBIT * (1 - t)
$191 $229 $317 $431 $578 $670 $763 $858 $954 $1,051

- Reinvestment
-$19 -$11 $0 $22 $58 $67 $153 $215 $286 $350

FCFF
$210 $241 $317 $410 $520 $603 $611 $644 $668 $701

Beta
3.14 3.14 3.14 3.14 3.14 2.75 2.36 1.97 1.59 1.20

Cost of equity
21.82% 21.82% 21.82% 21.82% 21.82% 19.50% 17.17% 14.85% 12.52% 10.20%

Debt ratio
73.50% 73.50% 73.50% 73.50% 73.50% 68.80% 64.10% 59.40% 54.70% 50.00%

Beta
3.14 -> 1.20

Risk Premium
6%

Beta
3.14

Country Risk Premium
Casino
1.15

Current D/E: 277%
Base Equity Premium

Value of Op Assets
$9,793

+ Cash & Non-op
$3,040

= Value of Firm
$12,833

- Value of Debt
$7,565

= Value of Equity
$5,268

Value per share
$8.12

Riskfree Rate:
T. Bond rate = 3%

Value of Op Assets
$9,793

= Value of Firm
$12,833

- Value of Equity
$5,268

Value per share
$8.12

Cost of Equity
21.82%

Cost of Debt
3% + 6% = 9%
9% (1-.38) = 5.58%

Weights
Debt = 73.5% -> 50%

Risk Premium
6%

Beta
3.14

Country Risk Premium
Casino
1.15

Current D/E: 277%
Base Equity Premium

Las Vegas Sands
February 2009
Trading @ $4.25
Adjusting the value of LVS for distress...

- In February 2009, LVS was rated B+ by S&P. Historically, 28.25% of B+ rated bonds default within 10 years. LVS has a 6.375% bond, maturing in February 2015 (7 years), trading at $529. If we discount the expected cash flows on the bond at the risk-free rate, we can back out the probability of distress from the bond price:

\[
529 = \sum_{t=1}^{7} \frac{63.75(1-\Pi_{\text{Distress}})^t}{(1.03)^t} + \frac{1000(1-\Pi_{\text{Distress}})^7}{(1.03)^7}
\]

- Solving for the probability of bankruptcy, we get:

\[
\Pi_{\text{Distress}} = \text{Annual probability of default} = 13.54\%
\]

  - Cumulative probability of surviving 10 years = \((1 - .1354)^{10} = 23.34\%\)
  - Cumulative probability of distress over 10 years = \(1 - .2334 = .7666 \text{ or } 76.66\%\)

- If LVS is becomes distressed:
  - Expected distress sale proceeds = $2,769 million < Face value of debt
  - Expected equity value/share = $0.00

- Expected value per share = $8.12 \((1 - .7666) + $0.00 \cdot (.7666) = $1.92\)
The “sunny” side of distress: Equity as a call option to liquidate the firm

Value of firm

Net Payoff on Equity

Face Value of Debt
Application to valuation: A simple example

- Assume that you have a firm whose assets are currently valued at $100 million and that the standard deviation in this asset value is 40%.
- Further, assume that the face value of debt is $80 million (It is zero coupon debt with 10 years left to maturity).
- If the ten-year treasury bond rate is 10%,
  - how much is the equity worth?
  - What should the interest rate on debt be?
The inputs

- Value of the underlying asset = $S = $100 million
- Exercise price = $K = $80 million
- Life of the option = $t = 10 years
- Variance in the value of the underlying asset = $\sigma^2 = 0.16$
- Riskless rate = $r = 10\%$

The output

- The Black-Scholes model provides the following value for the call:
  - $d_1 = 1.5994$, $N(d_1) = 0.9451$
  - $d_2 = 0.3345$, $N(d_2) = 0.6310$
- Value of the call = $100 \times 0.9451 - 80 \exp^{-0.10 \times 10} \times 0.6310 = $75.94 million
- Value of the outstanding debt = $100 - $75.94 = $24.06 million
- Interest rate on debt = $(80 / 24.06)^{1/10} - 1 = 12.77\%$
Assume now that a catastrophe wipes out half the value of this firm (the value drops to $50 million), while the face value of the debt remains at $80 million.

The inputs
- Value of the underlying asset = \( S = \) Value of the firm = $50 million
- All the other inputs remain unchanged

The output
- Based upon these inputs, the Black-Scholes model provides the following value for the call:
  - \( d_1 = 1.0515 \)  \( \text{N}(d_1) = 0.8534 \)
  - \( d_2 = -0.2135 \)  \( \text{N}(d_2) = 0.4155 \)
- Value of the call = 50 \( (0.8534) - 80 \exp^{(-0.10)(10)} (0.4155) = $30.44 \) million
- Value of the bond = $50 - $30.44 = $19.56 million
Equity value persists as firm value declines.
Real World Approaches to Valuing Equity in Troubled Firms: Getting Inputs

<table>
<thead>
<tr>
<th>Input</th>
<th>Estimation Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of the Firm</td>
<td>• Cumulate market values of equity and debt (or)</td>
</tr>
<tr>
<td></td>
<td>• Value the assets in place using FCFF and WACC (or)</td>
</tr>
<tr>
<td></td>
<td>• Use cumulated market value of assets, if traded.</td>
</tr>
<tr>
<td>Variance in Firm Value</td>
<td>• If stocks and bonds are traded, ( \sigma^2_{\text{firm}} = w_e \sigma^2_e + w_d \sigma^2_d + 2 w_e w_d \rho_{ed} \sigma_e \sigma_d )</td>
</tr>
<tr>
<td></td>
<td>where ( \sigma^2_e ) = variance in the stock price</td>
</tr>
<tr>
<td></td>
<td>( w_e = \text{MV weight of Equity} )</td>
</tr>
<tr>
<td></td>
<td>( \sigma^2_d ) = the variance in the bond price</td>
</tr>
<tr>
<td></td>
<td>( w_d = \text{MV weight of debt} )</td>
</tr>
<tr>
<td></td>
<td>• If not traded, use variances of similarly rated bonds.</td>
</tr>
<tr>
<td></td>
<td>• Use average firm value variance from the industry in which company operates.</td>
</tr>
<tr>
<td>Value of the Debt</td>
<td>• If the debt is short term, you can use only the face or book value of the debt.</td>
</tr>
<tr>
<td></td>
<td>• If the debt is long term and coupon bearing, add the cumulated nominal value of these coupons to the face value of the debt.</td>
</tr>
<tr>
<td>Maturity of the Debt</td>
<td>• Face value weighted duration of bonds outstanding (or)</td>
</tr>
<tr>
<td></td>
<td>• If not available, use weighted maturity.</td>
</tr>
</tbody>
</table>
Valuing Equity as an option - Eurotunnel in early 1998

- Eurotunnel has been a financial disaster since its opening
  - In 1997, Eurotunnel had earnings before interest and taxes of -£56 million and net income of -£685 million
  - At the end of 1997, its book value of equity was -£117 million
- It had £8,865 million in face value of debt outstanding
  - The weighted average duration of this debt was 10.93 years

<table>
<thead>
<tr>
<th>Debt Type</th>
<th>Face Value</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short term</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 year</td>
<td>2435</td>
<td>6.7</td>
</tr>
<tr>
<td>20 year</td>
<td>3555</td>
<td>12.6</td>
</tr>
<tr>
<td>Longer</td>
<td>1940</td>
<td>18.2</td>
</tr>
<tr>
<td>Total</td>
<td>£8,865 mil</td>
<td>10.93 years</td>
</tr>
</tbody>
</table>
The Basic DCF Valuation

- The value of the firm estimated using projected cashflows to the firm, discounted at the weighted average cost of capital was £2,312 million.

- This was based upon the following assumptions –
  - Revenues will grow 5% a year in perpetuity.
  - The COGS which is currently 85% of revenues will drop to 65% of revenues in yr 5 and stay at that level.
  - Capital spending and depreciation will grow 5% a year in perpetuity.
  - There are no working capital requirements.
  - The debt ratio, which is currently 95.35%, will drop to 70% after year 5. The cost of debt is 10% in high growth period and 8% after that.
  - The beta for the stock will be 1.10 for the next five years, and drop to 0.8 after the next 5 years.
  - The long term bond rate is 6%.
Other Inputs

- The stock has been traded on the London Exchange, and the annualized std deviation based upon ln (prices) is 41%.
- There are Eurotunnel bonds, that have been traded; the annualized std deviation in ln(price) for the bonds is 17%.
  - The correlation between stock price and bond price changes has been 0.5. The proportion of debt in the capital structure during the period (1992-1996) was 85%.
  - Annualized variance in firm value
    \[= (0.15)^2 (0.41)^2 + (0.85)^2 (0.17)^2 + 2 (0.15) (0.85)(0.5)(0.41)(0.17)= 0.0335\]
- The 15-year bond rate is 6%. (I used a bond with a duration of roughly 11 years to match the life of my option)
Valuing Eurotunnel Equity and Debt

- **Inputs to Model**
  - Value of the underlying asset = $S$ = Value of the firm = £2,312 million
  - Exercise price = $K$ = Face Value of outstanding debt = £8,865 million
  - Life of the option = $t$ = Weighted average duration of debt = 10.93 years
  - Variance in the value of the underlying asset = $\sigma^2$ = Variance in firm value = 0.0335
  - Riskless rate = $r$ = Treasury bond rate corresponding to option life = 6%

- Based upon these inputs, the Black-Scholes model provides the following value for the call:
  
  \[
  d1 = -0.8337 \quad N(d1) = 0.2023
  \]
  
  \[
  d2 = -1.4392 \quad N(d2) = 0.0751
  \]

- Value of the call = 2312 \* (0.2023) - 8,865 \* exp\((-0.06)(10.93)(0.0751)\) = £122 million

- Appropriate interest rate on debt = \((8865/2190)^{(1/10.93)}-1\) = 13.65%
IV. Valuing Financial Service Companies

Existing assets are usually financial assets or loans, often marked to market. Earnings do not provide much information on underlying risk. Preferred stock is a significant source of capital.

What are the cashflows from existing assets?

Defining capital expenditures and working capital is a challenge. Growth can be strongly influenced by regulatory limits and constraints. Both the amount of new investments and the returns on these investments can change with regulatory changes.

What is the value added by growth assets?

How risky are the cash flows from both existing assets and growth assets?

For financial service firms, debt is raw material rather than a source of capital. It is not only tough to define but if defined broadly can result in high financial leverage, magnifying the impact of small operating risk changes on equity risk.

In addition to all the normal constraints, financial service firms also have to worry about maintaining capital ratios that are acceptable to regulators. If they do not, they can be taken over and shut down.

When will the firm become a mature firm, and what are the potential roadblocks?

What is the value of equity in the firm?

Preferred stock is a significant source of capital.
2b. Goldman Sachs: August 2008

Rationale for model
Why dividends? Because FCFE cannot be estimated
Why 3-stage? Because the firm is behaving (reinvesting, growing) like a firm with potential.

Dividends
EPS = $16.77 * Payout Ratio 8.35% 
DPS = $1.40
(Updated numbers for 2008 financial year ending 11/08)

Retention Ratio = 91.65%

Expected Growth in first 5 years =
91.65% * 13.19% = 12.09%

g = 4%: ROE = 10% (> Cost of equity)
Beta = 1.20
Payout = (1 - 4/10) = .60 or 60%

Terminal Value = EPS * Payout/(r-g)
= (42.03 * 1.04 * .6)/(.095 - .04) = 476.86

Cost of Equity
4.10% + 1.40 * 4.5% = 10.4%

Riskfree Rate:
Treasury bond rate 4.10%

Beta
1.40

Risk Premium
4.5%
Implied Equity Risk premium in 8/08

Average beta for investment banks = 1.40

Between years 6-10, as growth drops to 4%, payout ratio increases and cost of equity decreases.

In August 2008, Goldman was trading at $169/share.

Value of Equity per share = PV of Dividends & Terminal value = $222.49

Discount at Cost of Equity

Return on equity at 2008 levels, well below 16% in 2007 and 20% in 2004-2006.
Lesson 1: Financial service companies are opaque…

- With financial service firms, we enter into a Faustian bargain. They tell us very little about the quality of their assets (loans, for a bank, for instance are not broken down by default risk status) but we accept that in return for assets being marked to market (by accountants who presumably have access to the information that we don’t have).
- In addition, estimating cash flows for a financial service firm is difficult to do. So, we trust financial service firms to pay out their cash flows as dividends. Hence, the use of the dividend discount model.
Lesson 2: For financial service companies, book value matters…

- The book value of assets and equity is mostly irrelevant when valuing non-financial service companies. After all, the book value of equity is a historical figure and can be nonsensical. (The book value of equity can be negative and is so for more than a 1000 publicly traded US companies)

- With financial service firms, book value of equity is relevant for two reasons:
  - Since financial service firms mark to market, the book value is more likely to reflect what the firms own right now (rather than a historical value)
  - The regulatory capital ratios are based on book equity. Thus, a bank with negative or even low book equity will be shut down by the regulators.

- From a valuation perspective, it therefore makes sense to pay heed to book value. In fact, you can argue that reinvestment for a bank is the amount that it needs to add to book equity to sustain its growth ambitions and safety requirements:
  - \[\text{FCFE} = \text{Net Income} - \text{Reinvestment in regulatory capital (book equity)}\]
2d. Deutsche Bank: March 2009

Last 2 years

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Income</th>
<th>Dividends</th>
<th>Risk adjusted assets</th>
<th>Book Equity</th>
<th>Regulatory Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>3,954 m</td>
<td>2,146 m</td>
<td>312,882 m</td>
<td>31,914 m</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>-3,855 m</td>
<td>285 m</td>
<td>312,882 m</td>
<td>31,914 m</td>
<td></td>
</tr>
</tbody>
</table>

Normalized Net Income for base year 3,000 m

Normalized ROE = 9.4%

Expected growth in asset base 4%

Target capital ratio 10%

Target ROE 10.2%

Stable Growth

\[ g = 3\% \quad \text{Beta} = 1.00 \quad \text{Cost of equity} = 10.20\% \]

\[ \text{Return on equity} = 10.20\%; \quad \text{Reinvestment Rate} = g/\text{ROE} = 3/10.20\% = 29.41\% \]

Cashflows

<table>
<thead>
<tr>
<th>Year</th>
<th>Asset Base</th>
<th>Capital ratio</th>
<th>Regulatory Capital</th>
<th>ROE</th>
<th>Change in capital</th>
<th>Net Income</th>
<th>Reinvestment</th>
<th>FCFE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>325,398 €</td>
<td>10.16%</td>
<td>33,060 €</td>
<td>9.56%</td>
<td>1,146 €</td>
<td>3,161 €</td>
<td>1,146 €</td>
<td>2,014 €</td>
</tr>
<tr>
<td>2</td>
<td>338,414 €</td>
<td>10.12%</td>
<td>34,247 €</td>
<td>9.72%</td>
<td>1,187 €</td>
<td>3,329 €</td>
<td>1,187 €</td>
<td>2,142 €</td>
</tr>
<tr>
<td>3</td>
<td>351,950 €</td>
<td>10.08%</td>
<td>35,477 €</td>
<td>9.88%</td>
<td>1,229 €</td>
<td>3,505 €</td>
<td>1,229 €</td>
<td>2,278 €</td>
</tr>
<tr>
<td>4</td>
<td>366,028 €</td>
<td>10.04%</td>
<td>36,749 €</td>
<td>10.04%</td>
<td>1,273 €</td>
<td>3,690 €</td>
<td>1,273 €</td>
<td>2,417 €</td>
</tr>
<tr>
<td>5</td>
<td>380,669 €</td>
<td>10.00%</td>
<td>38,067 €</td>
<td>10.20%</td>
<td>1,318 €</td>
<td>3,883 €</td>
<td>1,318 €</td>
<td>2,565 €</td>
</tr>
</tbody>
</table>

Terminal Value = \( \frac{2,823}{(1.02 - 0.03)} = 39,209 \text{ m} \)

PV of CF = 31,383 m

\#/ shares = 581.85

Value/Share = 53.94 €

Discount at Cost of equity = 3.60% + 1.162 * 6% + -0.60% = 11.172%

In March 2009

Deutsche Bank price = 48 Euros/share (down from 89 Euros in early 2008)

Riskfree Rate:

Euro Riskfree Rate = 3.6%

Beta = 1.162

Mature market premium = 6%
V. Valuing Companies with “intangible” assets

If capital expenditures are misclassified as operating expenses, it becomes very difficult to assess how much a firm is reinvesting for future growth and how well its investments are doing.

What is the value added by growth assets?

What are the cashflows from existing assets?

How risky are the cash flows from both existing assets and growth assets?

When will the firm become a mature firm, and what are the potential roadblocks?

The capital expenditures associated with acquiring intangible assets (technology, human capital) are mis-classified as operating expenses, leading to incorrect accounting earnings and measures of capital invested.

It can be more difficult to borrow against intangible assets than it is against tangible assets. The risk in operations can change depending upon how stable the intangible asset is.

Intangible assets such as brand name and customer loyalty can last for very long periods or dissipate overnight.
Lesson 1: Accounting rules are cluttered with inconsistencies…

- If we start with accounting first principles, capital expenditures are expenditures designed to create benefits over many periods. They should not be used to reduce operating income in the period that they are made, but should be depreciated/amortized over their life. They should show up as assets on the balance sheet.

- Accounting is consistent in its treatment of cap ex with manufacturing firms, but is inconsistent with firms that do not fit the mold.
  - With pharmaceutical and technology firms, R&D is the ultimate cap ex but is treated as an operating expense.
  - With consulting firms and other firms dependent on human capital, recruiting and training expenses are your long term investments that are treated as operating expenses.
  - With brand name consumer product companies, a portion of the advertising expense is to build up brand name and is the real capital expenditure. It is treated as an operating expense.
**Exhibit 11.1: Converting R&D expenses to R&D assets - Amgen**

**Step 1: Determining an amortizable life for R & D expenses.**
How long will it take, on an expected basis, for research to pay off at Amgen? Given the length of the approval process for new drugs by the Food and Drugs Administration, we will assume that this amortizable life is 10 years.

**Step 2: Capitalize historical R&D expense**

<table>
<thead>
<tr>
<th>Year</th>
<th>R&amp;D Expense</th>
<th>Unamortized portion</th>
<th>Amortization this year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current</td>
<td>3030.00</td>
<td>1.00</td>
<td>3030.00</td>
</tr>
<tr>
<td>-1</td>
<td>3266.00</td>
<td>0.90</td>
<td>2939.40</td>
</tr>
<tr>
<td>-2</td>
<td>3366.00</td>
<td>0.80</td>
<td>2692.80</td>
</tr>
<tr>
<td>-3</td>
<td>2314.00</td>
<td>0.70</td>
<td>1619.80</td>
</tr>
<tr>
<td>-4</td>
<td>2028.00</td>
<td>0.60</td>
<td>1216.80</td>
</tr>
<tr>
<td>-5</td>
<td>1655.00</td>
<td>0.50</td>
<td>827.50</td>
</tr>
<tr>
<td>-6</td>
<td>1117.00</td>
<td>0.40</td>
<td>446.80</td>
</tr>
<tr>
<td>-7</td>
<td>864.00</td>
<td>0.30</td>
<td>259.20</td>
</tr>
<tr>
<td>-8</td>
<td>845.00</td>
<td>0.20</td>
<td>169.00</td>
</tr>
<tr>
<td>-9</td>
<td>823.00</td>
<td>0.10</td>
<td>82.30</td>
</tr>
<tr>
<td>-10</td>
<td>663.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total</td>
<td>$13283.60</td>
<td>$1694.10</td>
<td></td>
</tr>
</tbody>
</table>

Current year’s R&D expense = Cap ex = $3,030 million
R&D amortization = Depreciation = $1,694 million
Unamortized R&D = Capital invested (R&D) = $13,284 million

**Step 3: Restate earnings, book value and return numbers**

<table>
<thead>
<tr>
<th></th>
<th>Unadjusted</th>
<th>Adjusted for R&amp;D</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net Income</td>
<td>$4,196</td>
<td>$4,196 + 3030 – 1694 = $5,532</td>
<td>Add current year’s R&amp;D and subtract R&amp;D amortization</td>
</tr>
<tr>
<td>Book value of equity</td>
<td>$17,869</td>
<td>$17,869 + 13,284 = $31,153</td>
<td>Add unamortized R&amp;D from prior years</td>
</tr>
<tr>
<td>Return on Equity</td>
<td>$4196/17869 = 23.48%</td>
<td>$5532/31153 = 17.75%</td>
<td>Return on equity drops when book equity is augmented by R&amp;D, even though net income rises.</td>
</tr>
<tr>
<td>Pre-tax Operating Income</td>
<td>$5,594</td>
<td>$5,594 + 3030 – 1694 = $6,930</td>
<td>Add current year’s R&amp;D and subtract R&amp;D amortization</td>
</tr>
<tr>
<td>Book value of invested capital</td>
<td>$21,985</td>
<td>$21,985 + 13,284 = $35,269</td>
<td>Add unamortized R&amp;D from prior years</td>
</tr>
<tr>
<td>Pre-tax Return on Capital</td>
<td>$594/21985 = 25.44%</td>
<td>$6930/35269 = 19.65%</td>
<td>Return on capital drops when capital is augmented by R&amp;D, even though operating income rises.</td>
</tr>
</tbody>
</table>
Current Cashflow to Firm

EBIT(1-t) = 7336(1-.28) = 6058
- Nt CpX= 6443
- Chg WC = 37
= FCFF = 423
Reinvestment Rate = 6480/6058 = 106.98%
Return on capital = 16.71%

Expected Growth in EBIT (1-t)

.60*.16=.096
9.6%

Stable Growth

g = 4%; Beta = 1.10;
Debt Ratio= 20%; Tax rate=35%
Cost of capital = 8.08%
ROC= 10.00%;
Reinvestment Rate=4/10=40%

Terminal Value

10 = 7300/(.0808-.04) = 179,099

Return on Capital

16%

Expected Growth in EBIT (1-t)

.60*.16=.096
9.6%

Stable Growth

g = 4%; Beta = 1.10;
Debt Ratio= 20%; Tax rate=35%
Cost of capital = 8.08%
ROC= 10.00%;
Reinvestment Rate=4/10=40%

Terminal Value

10 = 7300/(.0808-.04) = 179,099

Return on Capital

16%
Lesson 2: And fixing those inconsistencies can alter your view of a company and affect its value

<table>
<thead>
<tr>
<th></th>
<th>No R&amp;D adjustment</th>
<th>R&amp;D adjustment</th>
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</thead>
<tbody>
<tr>
<td>EBIT</td>
<td>$5,071</td>
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<tr>
<td>Invested Capital</td>
<td>$25,277</td>
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<tr>
<td>ROIC</td>
<td>14.58%</td>
<td>18.26%</td>
</tr>
<tr>
<td>Reinvestment Rate</td>
<td>115.68%</td>
<td>106.98%</td>
</tr>
<tr>
<td>Value of firm</td>
<td>$58,617</td>
<td>$95,497</td>
</tr>
<tr>
<td>Value of equity</td>
<td>$50,346</td>
<td>$87,226</td>
</tr>
<tr>
<td>Value/share</td>
<td>$42.73</td>
<td>$74.33</td>
</tr>
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</table>
VI. Valuing cyclical and commodity companies

Company growth often comes from movements in the economic cycle, for cyclical firms, or commodity prices, for commodity companies.

What are the cashflows from existing assets?

Historical revenue and earnings data are volatile, as the economic cycle and commodity prices change.

What is the value added by growth assets?

How risky are the cash flows from both existing assets and growth assets?

Primary risk is from the economy for cyclical firms and from commodity price movements for commodity companies. These risks can stay dormant for long periods of apparent prosperity.

When will the firm become a mature firm, and what are the potential roadblocks?

For commodity companies, the fact that there are only finite amounts of the commodity may put a limit on growth forever. For cyclical firms, there is the peril that the next recession may put an end to the firm.
Valuing a Cyclical Company - Toyota in Early 2009

As a cyclical company, Toyota's earnings have been volatile and 2009 earnings reflect the troubled global economy. We will assume that when economic growth returns, the operating margin for Toyota will revert back to the historical average.

Normalized Earnings

As a cyclical company, Toyota's earnings have been volatile and 2009 earnings reflect the troubled global economy. We will assume that when economic growth returns, the operating margin for Toyota will revert back to the historical average.

Normalized Operating Income = Revenues in 2009 * Average Operating Margin (98--09)

= 22661 * .0733 =1660.7 billion yen

Normalized Cost of capital

The cost of capital is computed using the average beta of automobile companies (1.10), and Toyota's cost of debt (3.25%) and debt ratio (52.9% debt ratio. We use the Japanese marginal tax rate of 40.7% for computing both the after-tax cost of debt and the after-tax operating income.

Cost of capital = 8.65% (.471) + 3.25% (1-.407) (.529) = 5.09%

Stable Growth

Once earnings are normalized, we assume that Toyota, as the largest market-share company, will be able to maintain only stable growth (1.5% in Yen terms)

Operating Assets 19,640 + Cash 2,288 + Non-operating assets 6,845 - Debt 11,862 - Minority Interests 583 Value of Equity / No of shares /3,448 Value per share ¥4735

In early 2009, Toyota Motors had the highest market share in the sector. However, the global economic recession in 2008-09 had pulled earnings down.

Normalized Return on capital and Reinvestment

Once earnings bounce back to normal, we assume that Toyota will be able to earn a return on capital equal to its cost of capital (5.09%). This is a sector, where earning excess returns has proved to be difficult even for the best of firms.

To sustain a 1.5% growth rate, the reinvestment rate has to be:

Reinvestment rate = 1.5%/5.09% = 29.46%
Valuing a commodity company - Exxon in Early 2009

Regressing Exxon’s operating income against the oil price per barrel from 1985-2008:

\[
\text{Operating Income} = -6,395 + 911.32 \times \text{Average Oil Price} \quad R^2 = 90.2\%
\]

Exxon Mobil's operating income increases about $9.11 billion for every $10 increase in the price per barrel of oil and 90% of the variation in Exxon's earnings over time comes from movements in oil prices.

**Estimate normalized income based on current oil price**

At the time of the valuation, the oil price was $45 a barrel. Exxon’s operating income based on this price is

\[
\text{Normalized Operating Income} = -6,395 + 911.32 \times 45 = $34,614
\]

**Estimate return on capital and reinvestment rate based on normalized income**

This operating income translates into a return on capital of approximately 21% and a reinvestment rate of 9.52%, based upon a 2% growth rate.

\[
\text{Reinvestment Rate} = \frac{g}{\text{ROC}} = \frac{2}{21\%} = 9.52\%
\]

**Exxon’s cost of capital**

Exxon has been a predominantly equity funded company, and is expected to remain so, with a debt ratio of only 2.85%. Its cost of equity is 8.35% (based on a beta of 0.90) and its pre-tax cost of debt is 3.75% (given AAA rating). The marginal tax rate is 38%.

\[
\text{Cost of capital} = 8.35\% \times .9715 + 3.75\% \times (1-.38) \times .0285 = 8.18\%.
\]

**Expected growth in operating income**

Since Exxon Mobile is the largest oil company in the world, we will assume an expected growth of only 2% in perpetuity.
Exxon Mobil Valuation: Simulation
The optionality in commodities: Undeveloped reserves as an option

Value of estimated reserve of natural resource

Net Payoff on Extraction

Cost of Developing Reserve

Aswath Damodaran
Gulf Oil was the target of a takeover in early 1984 at $70 per share (it had 165.30 million shares outstanding, and total debt of $9.9 billion).

- It had estimated reserves of 3038 million barrels of oil and the average cost of developing these reserves was estimated to be $10 a barrel in present value dollars (the development lag is approximately two years).
- The average relinquishment life of the reserves is 12 years.
- The price of oil was $22.38 per barrel, and the production cost, taxes and royalties were estimated at $7 per barrel.
- The bond rate at the time of the analysis was 9.00%.
- Gulf was expected to have net production revenues each year of approximately 5% of the value of the developed reserves. The variance in oil prices is 0.03.
Valuing Undeveloped Reserves

- Inputs for valuing undeveloped reserves
  - Value of underlying asset = Value of estimated reserves discounted back for period of development lag = \(3038 \times (\$22.38 - \$7) / 1.05^2 = \$42,380.44\)
  - Exercise price = Estimated development cost of reserves = \(3038 \times \$10 = \$30,380\) million
  - Time to expiration = Average length of relinquishment option = 12 years
  - Variance in value of asset = Variance in oil prices = 0.03
  - Riskless interest rate = 9%
  - Dividend yield = Net production revenue/ Value of developed reserves = 5%

- Based upon these inputs, the Black-Scholes model provides the following value for the call:
  \[d_1 = 1.6548 \quad N(d_1) = 0.9510\]
  \[d_2 = 1.0548 \quad N(d_2) = 0.8542\]

- Call Value= \(42,380.44 \exp^{-0.05(12)} (0.9510) - 30,380 \exp^{-0.09(12)} (0.8542)\)
  \[= \$13,306\) million\]
The composite value…

- In addition, Gulf Oil had free cashflows to the firm from its oil and gas production of $915 million from already developed reserves and these cashflows are likely to continue for ten years (the remaining lifetime of developed reserves).

- The present value of these developed reserves, discounted at the weighted average cost of capital of 12.5%, yields:
  - Value of already developed reserves = $915 \times \frac{1 - 1.125^{-10}}{0.125} = $5065.83

- Adding the value of the developed and undeveloped reserves
  - Value of undeveloped reserves = $13,306 million
  - Value of production in place = $5,066 million
  - Total value of firm = $18,372 million
  - Less Outstanding Debt = $9,900 million

- Value of Equity = $8,472 million
- Value per share = $8,472/165.3 = $51.25
VII. Valuing Emerging Market Companies

Big shifts in economic environment (inflation, interest rates) can affect operating earnings history. Poor corporate governance and weak accounting standards can lead to lack of transparency on earnings.

What are the cashflows from existing assets?

Cross holdings can affect value of equity

What is the value of equity in the firm?

How risky are the cash flows from both existing assets and growth assets?

Growth rates for a company will be affected heavily by growth rate and political developments in the country in which it operates.

What is the value added by growth assets?

When will the firm become a mature firm, and what are the potential roadblocks?

Even if the company’s risk is stable, there can be significant changes in country risk over time.

Economic crises can put many companies at risk. Government actions (nationalization) can affect long term value.
### Current Cashflow to Firm

<table>
<thead>
<tr>
<th>Component</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>EBIT (1-t)</td>
<td>Rs 20,116</td>
</tr>
<tr>
<td>Net CapX</td>
<td>Rs 31,590</td>
</tr>
<tr>
<td>Change in Working Capital</td>
<td>Rs 2,732</td>
</tr>
<tr>
<td><strong>FCFF</strong></td>
<td><strong>- Rs 14,205</strong></td>
</tr>
</tbody>
</table>

Reinvestment Rate = \((31590 + 2732) / 20116\) = 170.61%; Tax rate = 21.00%

Return on capital = 17.16%

#### Expected Growth from new inv.

\[ 0.70 \times 17.16\% = 0.1201 \]

#### Terminal Value

\[ 23493 / (0.1039 - 0.05) = Rs 435,686 \]

#### Discount at Cost of Capital (WACC)

\[ 14.00\% \times 0.747 + 8.09\% \times 0.253 = 12.50\% \]

#### Cost of Equity

14.00%

#### Cost of Debt

\[ 5\% + (4.25\% + 3\%) \times (1 - 0.3399) = 8.09\% \]

#### Weights

\[ E = 74.7\% \quad D = 25.3\% \]

#### Riskfree Rate

5%

#### Beta

1.20

#### Mature market premium

4.5%

#### Lambda

0.80

#### Country Equity Risk Premium

4.50%

#### Firm's D/E Ratio

33%

#### Country Default Spread

3%

#### Heri Equity Mkt Vol

1.50

---

**Op. Assets** Rs 210,813

+ Cash: 11418

+ Other NO 140576

- Debt 109198

**Equity** 253,628

**Value/Share Rs 614**

---

**On April 1, 2010**

Tata Motors price = Rs 781

---

**Riskfree Rate**

Rs Riskfree Rate = 5%

---

**On April 1, 2010**

Tata Motors price = Rs 781
Lesson 1: Be currency consistent

- **Currency consistency**: If your cash flows are in a specific currency, your discount rate has to be in the same currency as well.
- **Currency Invariance**: You can value any company in any currency and if you do it correctly, your value should be invariant to the currency used.

Generally speaking, you can value a company in its domestic currency or in a foreign currency.

- The advantage of using a domestic currency is that the most complete financial statements for the firm are usually in that currency and a significant portion of the operations are in that currency. The disadvantage is that many of the inputs that you need to estimate discount rates (starting with the riskfree rate) may be difficult to get in that currency.
  - While estimating a discount rate for an emerging market may sometimes be easier to do in US dollars or Euros, the expected future cash flows will then have to be converted into US dollars or Euros, using expected exchange rates in the future.
Estimating a riskfree rate

- On a riskfree asset, the actual return is equal to the expected return. Therefore, there is no variance around the expected return.
- For an investment to be riskfree, then, it has to have
  - No default risk
  - No reinvestment risk

1. **Time horizon matters**: Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time.

2. **Not all government securities are riskfree**: Some governments face default risk and the rates on bonds issued by them will not be riskfree.

**For a rate to be riskfree in valuation, it has to be long term, default free and currency matched (to the cash flows)**
Estimating the Riskfree Rate in Rupees… and US dollars.. Or Euros

- The Indian government had 10-year Rupee bonds outstanding, with a yield to maturity of about 8% on April 1, 2010. In January 2010, the Indian government had a local currency sovereign rating of Ba2. The typical default spread (over a default free rate) for Ba2 rated country bonds in early 2010 was 3%.

- The riskfree rate in Indian Rupees is
  a) The yield to maturity on the 10-year bond (8%)
  b) The yield to maturity on the 10-year bond + Default spread (8%+3% =11%)
  c) The yield to maturity on the 10-year bond – Default spread (8%-3% = 5%)
  d) None of the above

- If you wanted to do you entire valuation in US dollars, what would you use as your riskfree rate?
Why do riskfree rates vary?
Lesson 2: Country Risk Matters…

- As companies expand into emerging markets, drawn by higher growth or lower costs or both, they benefit. There is a cost, though, which comes from the greater uncertainty/risk that you are exposed to in these countries.
- In the 1980s, there were some who argued that country risk is diversifiable (i.e., it will average out across the many countries you are exposed to) and should be ignored. But that view has fallen to the wayside, as correlation across countries has risen.
Measures of “additional” country risk

*Default spread on Country Bond:* In this approach, the country equity risk premium is set equal to the default spread for the country, which can be estimated in one of three ways:

- As a default spread on a $ or Euro bond issued by the country
- The CDS spread for the country
- The typical spread given the rating of the country

Example: In 2010, for instance, India’s rating as a country was Baa1 and the typical default spread for that rating was 3%.

Country risk premium for India = 3%
Total equity risk premium for India = Mature market premium (4.5%) + CRP (3%) = 7.5%

*Adjusted for equity risk:* The country equity risk premium is based upon the volatility of the equity market relative to the government bond rate.

Country risk premium = Default Spread * $\frac{\sigma_{\text{Country Equity}}}{\sigma_{\text{Country Bond}}}$

Example: The standard deviation in the Sensex in 2010 was 30%, whereas the standard deviation in the Indian government bond was 20%. The resulting country and total risk premiums are below:

Country risk premium for India = 3% (30/20) = 4.5%
Total equity risk premium for India = 4.5% + 4.5 = 9%
<table>
<thead>
<tr>
<th>Country</th>
<th>Red # : Country risk premium</th>
<th>Black # : Total ERP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>6.00% 0.00%</td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>6.00% 0.00%</td>
<td></td>
</tr>
<tr>
<td>NORTH AM</td>
<td>6.00% 0.00%</td>
<td></td>
</tr>
<tr>
<td>Argentina</td>
<td>15.00% 9.00%</td>
<td></td>
</tr>
<tr>
<td>Belize</td>
<td>9.00% 3.00%</td>
<td></td>
</tr>
<tr>
<td>Bolivia</td>
<td>10.88% 4.88%</td>
<td></td>
</tr>
<tr>
<td>Brazil</td>
<td>8.63% 2.63%</td>
<td></td>
</tr>
<tr>
<td>Chile</td>
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<td></td>
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<td>Colombia</td>
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<td>Costa Rica</td>
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<tr>
<td>Ecuador</td>
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<td>Guatemala</td>
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<td>Panama</td>
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<td>Greece</td>
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<td>Sweden</td>
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<td>Kazakhstan</td>
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<tr>
<td>Qatar</td>
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<tr>
<td>Saudi Arabia</td>
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<td>UAE</td>
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<tr>
<td>MIDDLE EAST</td>
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<td>Australia</td>
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<td></td>
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<tr>
<td>New Zealand</td>
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</tr>
<tr>
<td>AUS &amp; NZ</td>
<td>6.00% 0.00%</td>
<td></td>
</tr>
</tbody>
</table>
Lesson 3: And you don’t have to be an emerging market company to be exposed

- **Source of revenues**: Other things remaining equal, a company should be more exposed to risk in a country if it generates more of its revenues from that country. A Brazilian firm that generates the bulk of its revenues in Brazil should be more exposed to country risk than one that generates a smaller percent of its business within Brazil.

- **Manufacturing facilities**: Other things remaining equal, a firm that has all of its production facilities in Brazil should be more exposed to country risk than one which has production facilities spread over multiple countries. The problem will be accented for companies that cannot move their production facilities (mining and petroleum companies, for instance).

- **Use of risk management products**: Companies can use both options/futures markets and insurance to hedge some or a significant portion of country risk.
Measuring country risk exposure

- If we treat country risk as a separate risk factor and allow firms to have different exposures to country risk (perhaps based upon the proportion of their revenues come from non-domestic sales)
  
  $$E(\text{Return}) = \text{Riskfree Rate} + \beta \times (\text{US premium}) + \lambda \times (\text{Country ERP})$$

- The easiest and most accessible data is on revenues. Most companies break their revenues down by region. One simplistic solution would be to do the following:
  
  $$\lambda = \frac{\% \text{ of revenues domestically firm}}{\% \text{ of revenues domestically avg firm}}$$

  Consider two firms – Tata Motors and Tata Consulting Services. In 2008-09, Tata Motors got about 91.37% of its revenues in India and TCS got 7.62%. The average Indian firm gets about 80% of its revenues in India:
  
  $$\lambda_{\text{Tata Motors}} = \frac{91\%}{80\%} = 1.14$$
  $$\lambda_{\text{TCS}} = \frac{7.62\%}{80\%} = 0.09$$

- There are two implications
  
  - A company’s risk exposure is determined by where it does business and not by where it is located
  - Firms might be able to actively manage their country risk exposures
A simpler solution: Operation based CRP - Single versus Multiple Emerging Markets

Single emerging market: Embraer, in 2004, reported that it derived 3% of its revenues in Brazil and the balance from mature markets. The mature market ERP in 2004 was 5% and Brazil’s CRP was 7.89%.

<table>
<thead>
<tr>
<th></th>
<th>Revenues</th>
<th>Total ERP</th>
<th>CRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>US and other mature markets</td>
<td>97%</td>
<td>5.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Brazil</td>
<td>3%</td>
<td>12.89%</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Embraer</strong></td>
<td></td>
<td><strong>5.24%</strong></td>
<td><strong>0.24%</strong></td>
</tr>
</tbody>
</table>

Multiple emerging markets: Ambev, the Brazilian-based beverage company, reported revenues from the following countries during 2011.

<table>
<thead>
<tr>
<th></th>
<th>Revenues</th>
<th>%</th>
<th>Total ERP</th>
<th>CRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>19</td>
<td>9.31%</td>
<td>15.00%</td>
<td>9.00%</td>
</tr>
<tr>
<td>Bolivia</td>
<td>4</td>
<td>1.96%</td>
<td>10.88%</td>
<td>4.88%</td>
</tr>
<tr>
<td>Brazil</td>
<td>130</td>
<td>63.73%</td>
<td>8.63%</td>
<td>2.63%</td>
</tr>
<tr>
<td>Canada</td>
<td>23</td>
<td>11.27%</td>
<td>6.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Chile</td>
<td>7</td>
<td>3.43%</td>
<td>7.05%</td>
<td>1.05%</td>
</tr>
<tr>
<td>Ecuador</td>
<td>6</td>
<td>2.94%</td>
<td>12.75%</td>
<td>6.75%</td>
</tr>
<tr>
<td>Paraguay</td>
<td>3</td>
<td>1.47%</td>
<td>12.00%</td>
<td>6.00%</td>
</tr>
<tr>
<td>Peru</td>
<td>12</td>
<td>5.88%</td>
<td>9.00%</td>
<td>3.00%</td>
</tr>
<tr>
<td><strong>Ambev</strong></td>
<td><strong>204</strong></td>
<td></td>
<td><strong>9.11%</strong></td>
<td><strong>3.11%</strong></td>
</tr>
</tbody>
</table>
Extending to a multinational: Regional breakdown
Coca Cola’s revenue breakdown and ERP in 2012

<table>
<thead>
<tr>
<th>Region</th>
<th>Revenues</th>
<th>Total ERP</th>
<th>CRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Europe</td>
<td>19%</td>
<td>6.67%</td>
<td>0.67%</td>
</tr>
<tr>
<td>Eastern Europe &amp; Russia</td>
<td>5%</td>
<td>8.60%</td>
<td>2.60%</td>
</tr>
<tr>
<td>Asia</td>
<td>15%</td>
<td>7.63%</td>
<td>1.63%</td>
</tr>
<tr>
<td>Latin America</td>
<td>15%</td>
<td>9.42%</td>
<td>3.42%</td>
</tr>
<tr>
<td>Australia</td>
<td>4%</td>
<td>6.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Africa</td>
<td>4%</td>
<td>9.82%</td>
<td>3.82%</td>
</tr>
<tr>
<td>North America</td>
<td>40%</td>
<td>6.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Coca Cola</td>
<td>100%</td>
<td>7.14%</td>
<td>1.14%</td>
</tr>
</tbody>
</table>

Things to watch out for:
1. Aggregation across regions. For instance, the Pacific region often includes Australia & NZ with Asia.
2. Obscure aggregations including Eurasia and Oceania.
Lesson 4: Crossholdings are always a problem, but particularly so in emerging markets

- Holdings in other firms can be categorized into
  - Minority passive holdings, in which case only the dividend from the holdings is shown in the balance sheet
  - Minority active holdings, in which case the share of equity income is shown in the income statements
  - Majority active holdings, in which case the financial statements are consolidated.

- We tend to be sloppy in practice in dealing with cross holdings. After valuing the operating assets of a firm, using consolidated statements, it is common to add on the balance sheet value of minority holdings (which are in book value terms) and subtract out the minority interests (again in book value terms), representing the portion of the consolidated company that does not belong to the parent company.
How to value holdings in other firms. In a perfect world.

In a perfect world, we would strip the parent company from its subsidiaries and value each one separately. The value of the combined firm will be

- Value of parent company + Proportion of value of each subsidiary

To do this right, you will need to be provided detailed information on each subsidiary to estimated cash flows and discount rates.
Two compromise solutions…

- **The market value solution:** When the subsidiaries are publicly traded, you could use their traded market capitalizations to estimate the values of the cross holdings. You do risk carrying into your valuation any mistakes that the market may be making in valuation.

- **The relative value solution:** When there are too many cross holdings to value separately or when there is insufficient information provided on cross holdings, you can convert the book values of holdings that you have on the balance sheet (for both minority holdings and minority interests in majority holdings) by using the average price to book value ratio of the sector in which the subsidiaries operate.
Tata Motor’s Cross Holdings

Value of Cross holdings: Tata Motors

- Tata Steel
- Tata Chemicals
- Non-listed Tata companies
Lesson 5: Success can be sometimes peril for your survival…

- Assume that you are valuing Venex, a Venezuelan business and have estimated a value of US $10 billion for the business, which has a book value of $1 billion.

- Now assume that there is a 30% chance that your business may be nationalized and that you will receive fair market value, if it is. What is your estimate of value for Venex.

- How would your answer change if you were told that you receive book value, if you are nationalized?
VIII. Valuing Companies across the ownership cycle

Reported income and balance sheet are heavily affected by tax considerations rather than information disclosure requirements. The line between the personal and business expenses is a fine one.

What are the **cashflows from existing assets**?
- Equity: Cashflows after debt payments
- Firm: Cashflows before debt payments

What is the **value added** by growth assets?
Equity: Growth in equity earnings/cashflows
Firm: Growth in operating earnings/cashflows

How **risky are the cash flows** from both existing assets and growth assets?
Equity: Risk in equity in the company
Firm: Risk in the firm’s operations

Reversing investment mistakes is difficult to do. The need for and the cost of illiquidity has to be incorporated into current

When will the firm become a **mature firm**, and what are the potential roadblocks?

Different buyers can perceive risk differently in the same private business, largely because what they see as risk will be a function of how diversified they are. The fall back positions of using market prices to extract risk measures does not

Many private businesses are finite life enterprises, not expected to last into perpetuity
Current Cashflow to Firm

EBIT(1-t) : 300
- Nt CpX 100
- Chg WC 40
= FCFF 160
Reinvestment Rate = 46.67%

Expected Growth in EBIT (1-t)
.4667*.1364 = .0636
6.36%

Terminal Value
5 = 289/(.1254-.04) = 3,403

Discount at Cost of Capital (WACC) = 16.26% (.70) + 3.30% (.30) = 12.37%

Cost of Equity
16.26%

Riskfree Rate:
Riskfree rate = 4.50% (10-year T.Bond rate)

Total Beta
2.94

Risk Premium
4.00%

Country Risk Premium
0%

Unlevered Beta for Sectors: 0.78
Firm’s D/E Ratio: 30/70
Lesson 1: In private businesses, risk in the eyes of the “beholder” (buyer)

<table>
<thead>
<tr>
<th>Private business owner with entire wealth invested in the business</th>
<th>Venture capitalist, with multiple holdings in the sector.</th>
<th>Public company investor with diversified portfolio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposed to all risk in the company. Total beta measures exposure to total risk. Total Beta = Market Beta / Correlation of firm with market</td>
<td>Partially diversified. Diversify away some firm specific risk but not all. Beta will fall between total and market beta.</td>
<td>Firm-specific risk is diversified away. Market or macro risk exposure captured in a market beta or betas.</td>
</tr>
</tbody>
</table>
Three assessment tools when the buyer falls in the middle…

- **Build up**: Start with cost of equity for a “diversified” investor and add premiums (based upon historical data) for other variables that capture the additional risk borne by “typical” buyer of a private business.
  - **Strength**: Numbers seem strong because they are backed up by data
  - **Weakness**: (1) Premiums are all from public markets (2) Double counting

- **Total Beta plus**: Look at potential buyer (what else the buyer has in his or her portfolio), assess the correlation of that portfolio with the market and estimate a “customized” total beta.
  - **Strength**: Ties the cost of equity to the buyer, as it should.
  - **Weaknesses**: (1) Buyers are under no obligation to give you this information (2) Treats private markets as extensions of public ones

- **Survey**: Find out what buyers of private businesses are demanding as a rate of return when they value private businesses.
  - **Strength**: Agnostic on risk and return models
  - **Weakness**: (1) Wide differences in what “required” means across survey respondents (2) Circular logic (3) Works if private capital markets are separate and unconnected to public markets.
Lesson 2: With financials, trust but verify..

- **Different Accounting Standards**: The accounting statements for private firms are often based upon different accounting standards than public firms, which operate under much tighter constraints on what to report and when to report.

- **Intermingling of personal and business expenses**: In the case of private firms, some personal expenses may be reported as business expenses.

- **Separating “Salaries” from “Dividends”**: It is difficult to tell where salaries end and dividends begin in a private firm, since they both end up with the owner.

- **The Key person issue**: In some private businesses, with a personal component, the cashflows may be intertwined with the owner being part of the business.
Lesson 3: Illiquidity is a clear and present danger..

In private company valuation, illiquidity is a constant theme. All the talk, though, seems to lead to a rule of thumb. The illiquidity discount for a private firm is between 20-30% and does not vary across private firms.

But illiquidity should vary across:

- **Companies:** Healthier and larger companies, with more liquid assets, should have smaller discounts than money-losing smaller businesses with more illiquid assets.
- **Time:** Liquidity is worth more when the economy is doing badly and credit is tough to come by than when markets are booming.
- **Buyers:** Liquidity is worth more to buyers who have shorter time horizons and greater cash needs than for longer term investors who don’t need the cash and are willing to hold the investment.
The “standard” approaches to estimating illiquidity discounts…

- **Restricted stock**: These are stock issued by publicly traded companies to the market that bypass the SEC registration process but the stock cannot be traded for one year after the issue.

- **Pre-IPO transactions**: These are transactions prior to initial public offerings where equity investors in the private firm buy (sell) each other’s stakes.

In both cases, the discount is estimated to be the difference between the market price of the liquid asset and the observed transaction price of the illiquid asset.

- Discount_{Restricted stock} = Stock price – Price on restricted stock offering
- Discount_{IPO} = IPO offering price – Price on pre-IPO transaction
The “alternative” approaches

- **Bid-ask spreads**: All traded assets are illiquid. The bid ask spread, measuring the difference between the price at which you can buy and sell the asset at the same point in time is the illiquidity measure. I few can extrapolate what we know about bid ask spreads with public companies into the private company space, we could have a more dynamic, complete measure of illiquidity.
  
  \[
  \text{Spread} = 0.145 - 0.0022 \ln (\text{Annual Revenues}) - 0.015 (\text{DERN}) - 0.016 (\text{Cash/Firm Value}) - 0.11 (\$ \text{ Monthly trading volume/Firm Value})
  \]

- **Option pricing**: Liquidity can be viewed as a put option, where you get the right to sell at the prevailing market price. Illiquidity can therefore be viewed as the loss of this put option.
Closing Thoughts…

- Valuation becomes more difficult as we move away from the standard script: money making manufacturing companies with long histories.
- When valuation becomes more difficult, you will be tempted to abandon first principles in valuation and told that discounted cash flow (and intrinsic) valuation don’t work for “these” companies. Instead, you will be asked to look at alternate metrics and models to price these companies.
- The architecture of conventional valuation is strong enough to allow us to value any company, but it does require us to be flexible (in our approaches and use of models) and creative (in making estimates and dealing with uncertainty).
- The payoff to doing intrinsic valuation is greatest with these “difficult to value” companies, because most people give up.