VALUATION: SCIENCE, ART, CRAFT OR MAGIC?

Aswath Damodaran
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Some Initial Thoughts

"One hundred thousand lemmings cannot be wrong"

Graffiti

Aswath Damodaran
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.
Approaches to Valuation

- **Intrinsic valuation**, relates the value of an asset to the present value of expected future cashflows on that asset. In its most common form, this takes the form of a discounted cash flow valuation.

- **Relative valuation**, estimates the value of an asset by looking at the pricing of 'comparable' assets relative to a common variable like earnings, cash flows, book value or sales.

- **Contingent claim valuation**, uses option pricing models to measure the value of assets that share option characteristics.
Discounted Cash Flow Valuation

- **What is it**: In discounted cash flow valuation, the value of an asset is the present value of the expected cash flows on the asset.

- **Philosophical Basis**: Every asset has an intrinsic value that can be estimated, based upon its characteristics in terms of cash flows, growth and risk.

- **Information Needed**: To use discounted cash flow valuation, you need
  - to estimate the life of the asset
  - to estimate the cash flows during the life of the asset
  - to estimate the discount rate to apply to these cash flows to get present value

- **Market Inefficiency**: Markets are assumed to make mistakes in pricing assets across time, and are assumed to correct themselves over time, as new information comes out about assets.
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:

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

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

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

- The “Don’t Freak Out” Proposition: 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><strong>Existing Investments</strong></td>
<td><strong>Debt</strong></td>
</tr>
<tr>
<td>Generate cashflows today</td>
<td>Fixed Claim on cash flows</td>
</tr>
<tr>
<td>Includes long lived (fixed) and</td>
<td>Little or No role in management</td>
</tr>
<tr>
<td>short-lived (working capital) assets</td>
<td>Fixed Maturity</td>
</tr>
<tr>
<td></td>
<td>Tax Deductible</td>
</tr>
<tr>
<td><strong>Assets in Place</strong></td>
<td><strong>Equity</strong></td>
</tr>
<tr>
<td>**Expected Value that will be created by</td>
<td>Residual Claim on cash flows</td>
</tr>
<tr>
<td>future investments**</td>
<td>Significant Role in management</td>
</tr>
<tr>
<td></td>
<td>Perpetual Lives</td>
</tr>
<tr>
<td><strong>Growth Assets</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Equity valuation:** Value just the equity claim in the business
The Drivers of Value...

Current Cashflows
These are the cash flows from existing investment(s), net of any reinvestment needed to sustain future growth. They can be computed before debt cashflows (to the firm) or after debt cashflows (to equity investors).

Growth from new investments
Growth created by making new investments; function of amount and quality of investments

Efficiency Growth
Growth generated by using existing assets better

Expected Growth during high growth period

Length of the high growth period
Since value creating growth requires excess returns, this is a function of:
- Magnitude of competitive advantages
- Sustainability of competitive advantages

Cost of financing (debt or capital) to apply to discounting cashflows
Determined by:
- Operating risk of the company
- Default risk of the company
- Mix of debt and equity used in financing

Terminal Value of firm (equity)
Stable growth firm, with no or very limited excess returns

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**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)\(_n\)

- **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)

- **Discount at WACC**
  - Cost of Equity (Equity/(Debt + Equity)) + Cost of Debt (Debt/(Debt+ Equity))

- **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

- **Weights**
  - Based on Market Value

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Current Cashflow to Firm

\[
\text{EBIT}(1-t) = 7336(1-0.28) = 6058
\]

- Net CapX = 6443
- Change WC = 37
- FCFF = 6480

Reinvestment Rate = 6480/6058 = 106.98%
Return on capital = 16.71%

Expected Growth in EBIT (1-t)

\[0.60 \times 0.16 = 0.096\]

9.6%

First 5 years

<table>
<thead>
<tr>
<th>Year</th>
<th>EBIT</th>
<th>EBIT(1-t)</th>
<th>Reinvestment</th>
<th>FCFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$9,221</td>
<td>$6,639</td>
<td>$3,983</td>
<td>$2,656</td>
</tr>
<tr>
<td>2</td>
<td>$10,106</td>
<td>$7,276</td>
<td>$4,366</td>
<td>$2,911</td>
</tr>
<tr>
<td>3</td>
<td>$11,076</td>
<td>$7,975</td>
<td>$4,785</td>
<td>$3,190</td>
</tr>
<tr>
<td>4</td>
<td>$12,140</td>
<td>$8,741</td>
<td>$5,244</td>
<td>$3,496</td>
</tr>
<tr>
<td>5</td>
<td>$14,433</td>
<td>$9,580</td>
<td>$5,748</td>
<td>$3,832</td>
</tr>
<tr>
<td>6</td>
<td>$15,496</td>
<td>$10,392</td>
<td>$5,820</td>
<td>$4,573</td>
</tr>
<tr>
<td>7</td>
<td>$17,306</td>
<td>$11,157</td>
<td>$5,802</td>
<td>$5,355</td>
</tr>
<tr>
<td>8</td>
<td>$17,998</td>
<td>$12,460</td>
<td>$5,482</td>
<td>$6,164</td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>$12,958</td>
<td>$5,183</td>
<td>$6,978</td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td>$7,775</td>
</tr>
</tbody>
</table>

Cost of Capital (WACC) = 11.7% (0.90) + 3.66% (0.10) = 10.90%

Cost of Equity

11.70%

Cost of Debt

\[
(4.78\% + 8.85\%)(1 - 0.35) = 3.66\%
\]

Weights

E = 90% D = 10%

On May 1, 2007, Amgen was trading at $55/share
Arca (September 2014)

Current Cashflow to Firm

EBIT(1-t) = 10,259 (1-.3076) = MXN 7,103
- Nt Cpx = 5,213- 2,570 = 2,643
- Chg WC = 594
= FCFF = 3,866
Reinv Rate = (2,643+594)/7,103 = 45.6%
Return on capital = 7,103//48,895 = 14.53%

EBIT * (1 - tax rate)
MXN 7,582
MXN 8,093
MXN 8,638
MXN 9,220
MXN 9,842
MXN 10,453
MXN 11,048
MXN 11,618
MXN 12,157
MXN 12,657
- Reinvestment
MXN 3,455
MXN 3,688
MXN 3,937
MXN 4,202
MXN 4,485
MXN 4,637
MXN 4,766
MXN 4,871
MXN 4,949
MXN 4,999
Free Cashflow to Firm
MXN 4,127
MXN 4,405
MXN 4,702
MXN 5,018
MXN 5,356
MXN 5,816
MXN 6,282
MXN 6,747
MXN 7,208
MXN 7,659
=FCFF = MXN 7,895

Return on Capital 14.53%

Expected Growth from new investments
.456*.1453=0.0662 (6.62%)

Stable Growth

G = 4%; Beta = 0.80
Cost of capital = 10.13%
Tax rate = 30.00%
ROC= 9.999;
Reinvestment rate=g/ROC
=4% / 9.99% = 40.02%

Terminal Value 10= 7,895/(.1013-.04) = MXN 131,711

Op. Assets 81,152
+ Cash: 7,318
+ Min Hldg 8,750
- Debt 16,663
- Min Int 6,692
=Equity 73,866
Value/Share MXN 45.84

Cost of capital = 11.27% (.9039) + 4.66% (.0961) = 10.64%

Arca Continental Price = MXN 97/share

On September 10, 2014
DCF INPUTS

“Garbage in, garbage out”
I. Measure earnings right..

- Firm’s history
  - Comparable Firms
  - Normalize Earnings

- Operating leases
  - Convert into debt
  - Adjust operating income

- R&D Expenses
  - Convert into asset
  - Adjust operating income

- Cleanse operating items of
  - Financial Expenses
  - Capital Expenses
  - Non-recurring expenses

Measuring Earnings

Update
- Trailing Earnings
- Unofficial numbers
### Operating Leases at Amgen in 2007

- Amgen has lease commitments and its cost of debt (based on it’s A rating) is 5.63%.

<table>
<thead>
<tr>
<th>Year</th>
<th>Commitment</th>
<th>Present Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$96.00</td>
<td>$90.88</td>
</tr>
<tr>
<td>2</td>
<td>$95.00</td>
<td>$85.14</td>
</tr>
<tr>
<td>3</td>
<td>$102.00</td>
<td>$86.54</td>
</tr>
<tr>
<td>4</td>
<td>$98.00</td>
<td>$78.72</td>
</tr>
<tr>
<td>5</td>
<td>$87.00</td>
<td>$66.16</td>
</tr>
<tr>
<td>6-12</td>
<td>$107.43</td>
<td>$462.10 (752 million prorated)</td>
</tr>
</tbody>
</table>

Based on average operating lease expense over first 5 years (about $100 million), I am assuming that the lump sum in year 6 is a 7-year annuity.

- Debt Value of leases = $869.55 million
- Debt outstanding at Amgen = $7,402 + $870 = $8,272 million
- Adjusted Operating Income = Stated OI + Lease expense this year – Depreciation
  \[= 5,071 \text{ m} + 69 \text{ m} - 870/12\] = $5,068 million (12 year life for assets)
- Approximate Operating income = stated OI + PV of Lease commitment * Pre-tax cost of debt
  \[= 5,071 \text{ m} + 870 \text{ m} (.0563) = $5,120 million\]
## Capitalizing R&D Expenses: Amgen

- R & D was assumed to have a 10-year life.

<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>3366.00</td>
<td>1.00</td>
<td>$3366.00</td>
</tr>
<tr>
<td>-1</td>
<td>2314.00</td>
<td>0.90</td>
<td>2082.60</td>
</tr>
<tr>
<td>-2</td>
<td>2028.00</td>
<td>0.80</td>
<td>1622.40</td>
</tr>
<tr>
<td>-3</td>
<td>1655.00</td>
<td>0.70</td>
<td>1158.50</td>
</tr>
<tr>
<td>-4</td>
<td>1117.00</td>
<td>0.60</td>
<td>670.20</td>
</tr>
<tr>
<td>-5</td>
<td>865.00</td>
<td>0.50</td>
<td>432.50</td>
</tr>
<tr>
<td>-6</td>
<td>845.00</td>
<td>0.40</td>
<td>338.00</td>
</tr>
<tr>
<td>-7</td>
<td>823.00</td>
<td>0.30</td>
<td>246.90</td>
</tr>
<tr>
<td>-8</td>
<td>663.00</td>
<td>0.20</td>
<td>132.60</td>
</tr>
<tr>
<td>-9</td>
<td>631.00</td>
<td>0.10</td>
<td>63.10</td>
</tr>
<tr>
<td>-10</td>
<td>558.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

Value of Research Asset = $10,112.80 $1,149.90

- Adjusted Operating Income = $5,120 + 3,366 - 1,150 = $7,336 million
II. Get the big picture (not the accounting one) when it comes to cap ex and working capital

- Capital expenditures should include
  - Research and development expenses, once they have been re-categorized as capital expenses.
  - Acquisitions of other firms, whether paid for with cash or stock.
- Working capital should be defined not as the difference between current assets and current liabilities but as the difference between non-cash current assets and non-debt current liabilities.
- On both items, start with what the company did in the most recent year but do look at the company’s history and at industry averages.
Amgen’s Net Capital Expenditures

- The accounting net cap ex at Amgen is small:
  - Accounting Capital Expenditures = $1,218 million
  - - Accounting Depreciation = $963 million
  - Accounting Net Cap Ex = $255 million

- We define capital expenditures broadly to include R&D and acquisitions:
  - Accounting Net Cap Ex = $255 million
  - Net R&D Cap Ex = (3366-1150) = $2,216 million
  - Acquisitions in 2006 = $3,975 million
  - Total Net Capital Expenditures = $6,443 million

- Acquisitions have been a volatile item. Amgen was quiet on the acquisition front in 2004 and 2005 and had a significant acquisition in 2003.
III. The government bond rate is not always the risk free rate

- When valuing Amgen in US dollars, the US$ ten-year bond rate of 4.78% was used as the risk free rate. We assumed that the US treasury was default free.

- When valuing Tata Motors in Indian rupees in 2010, the Indian government bond rate of 8% was not default free. Using the Indian government’s local currency rating of Ba2 yielded a default spread of 3% for India and a riskfree rate of 5% in Indian rupees.

  Risk free rate in Indian Rupees = 8% - 3% = 5%

- To estimate a risk free rate in Mexican Pesos for Arca Continental, we started with the Mexican government bond rate in pesos of 5.81% and subtracted out a default risk spread for Mexico (estimated at 1.60% based on its ratings of Baa1 and at 1.25% in the CDS market):
  
  - Risk free rate in Mexican Peso (based on rating) = 5.81% - 1.60% = 4.21%
  - Risk free rate in Mexican Peso (based on CDS) = 5.81% - 1.25% = 4.56%

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Risk free rates will vary across currencies!

Figure 4.1: Risk free Rates in Different Currencies
<table>
<thead>
<tr>
<th></th>
<th>In Indian Rupees</th>
<th>In US $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk free Rate</td>
<td>5.00%</td>
<td>2.00%</td>
</tr>
<tr>
<td>Expected inflation rate</td>
<td>4.00%</td>
<td>1.00%</td>
</tr>
<tr>
<td><strong>Cost of capital</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High Growth</td>
<td>12.50%</td>
<td>9.25%</td>
</tr>
<tr>
<td>- Stable Growth</td>
<td>10.39%</td>
<td>7.21%</td>
</tr>
<tr>
<td><strong>Expected growth rate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High Growth</td>
<td>12.01%</td>
<td>8.78%</td>
</tr>
<tr>
<td>- Stable Growth</td>
<td>5.00%</td>
<td>2.00%</td>
</tr>
<tr>
<td><strong>Return on Capital</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High Growth</td>
<td>17.16%</td>
<td>13.78%</td>
</tr>
<tr>
<td>- Stable Growth</td>
<td>10.39%</td>
<td>7.21%</td>
</tr>
<tr>
<td><strong>Value per share</strong></td>
<td>Rs 614</td>
<td>$12.79/share (roughly Rs 614 at current exchange rate)</td>
</tr>
</tbody>
</table>
IV. Betas do not come from regressions... and are noisy...

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Look better for some companies, but not if run against narrow indices
Determinants of Betas

Beta of Equity

Beta of Firm

Nature of product or service offered by company:
Other things remaining equal, the more discretionary the product or service, the higher the beta.

Implications
1. Cyclical companies should have higher betas than non-cyclical companies.
2. Luxury goods firms should have higher betas than basic goods.
3. High priced goods/service firms should have higher betas than low prices goods/services firms.
4. Growth firms should have higher betas.

Operating Leverage (Fixed Costs as percent of total costs):
Other things remaining equal the greater the proportion of the costs that are fixed, the higher the beta of the company.

Implications
1. Firms with high infrastructure needs and rigid cost structures should have higher betas than firms with flexible cost structures.
2. Smaller firms should have higher betas than larger firms.
3. Young firms should have

Financial Leverage:
Other things remaining equal, the greater the proportion of capital that a firm raises from debt, the higher its equity beta will be

Implications
Highly levered firms should have higher betas than firms with less debt.

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Bottom-up Betas

Step 1: Find the business or businesses that your firm operates in.

Step 2: Find publicly traded firms in each of these businesses and obtain their regression betas. Compute the simple average across these regression betas to arrive at an average beta for these publicly traded firms. Unlever this average beta using the average debt to equity ratio across the publicly traded firms in the sample. Unlevered beta for business = Average beta across publicly traded firms/ (1 + (1- t) (Average D/E ratio across firms))

Possible Refinements

If you can, adjust this beta for differences between your firm and the comparable firms on operating leverage and product characteristics.

While revenues or operating income are often used as weights, it is better to try to estimate the value of each business.

Step 3: Estimate how much value your firm derives from each of the different businesses it is in.

Step 4: Compute a weighted average of the unlevered betas of the different businesses (from step 2) using the weights from step 3. Bottom-up Unlevered beta for your firm = Weighted average of the unlevered betas of the individual business

Step 5: Compute a levered beta (equity beta) for your firm, using the market debt to equity ratio for your firm. Levered bottom-up beta = Unlevered beta (1+ (1-t) (Debt/Equity))

If you expect the business mix of your firm to change over time, you can change the weights on a year-to-year basis.

If you expect your debt to equity ratio to change over time, the levered beta will change over time.

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Three examples...

- **Amgen**
  - The unlevered beta for US pharmaceutical firms is 1.59. Using Amgen’s debt to equity ratio of 11%, the bottom up beta for Amgen is
  - Bottom-up Beta = $1.59 \times (1+ (1-.35)(.11)) = 1.73$

- **Tata Motors**
  - The unlevered beta for 77 global automobile firms is 0.98. Using Tata Motor’s debt to equity ratio of 33.87%, the bottom up beta for Tata Motors is 1.20
  - Bottom-up Beta = $0.98 \times (1+ (1-.3399)(.3387)) = 1.20$

- **Arca Continental**
  - The unlevered beta for beverage companies is 0.71. Using Arca’s debt to equity ratio of 12.2% and the marginal tax rate for Mexico of 30%, the bottom up beta for Arca is 0.77.
  - Bottom-up Beta = $0.71 \times (1+ (1-.30)(.122)) = 0.77$

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A multi-business company: Vale

<table>
<thead>
<tr>
<th>Business</th>
<th>Sample Description</th>
<th>Sample Size</th>
<th>Unlevered Beta of Business</th>
<th>Revenues</th>
<th>Peer Group EV/Sales</th>
<th>Value of Business</th>
<th>Proportion of Vale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals &amp; Mining</td>
<td>Global firms in metals &amp; mining, Market cap&gt;$1 billion</td>
<td>48</td>
<td>0.86</td>
<td>$9,013</td>
<td>1.97</td>
<td>$17,739</td>
<td>16.65%</td>
</tr>
<tr>
<td>Iron Ore</td>
<td>Global firms in iron ore</td>
<td>78</td>
<td>0.83</td>
<td>$32,717</td>
<td>2.48</td>
<td>$81,188</td>
<td>76.20%</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>Global specialty chemical firms</td>
<td>693</td>
<td>0.99</td>
<td>$3,777</td>
<td>1.52</td>
<td>$5,741</td>
<td>5.39%</td>
</tr>
<tr>
<td>Logistics</td>
<td>Global transportation firms</td>
<td>223</td>
<td>0.75</td>
<td>$1,644</td>
<td>1.14</td>
<td>$1,874</td>
<td>1.76%</td>
</tr>
<tr>
<td><strong>Vale Operations</strong></td>
<td></td>
<td></td>
<td><strong>0.8440</strong></td>
<td><strong>$47,151</strong></td>
<td></td>
<td><strong>$106,543</strong></td>
<td><strong>100.00%</strong></td>
</tr>
</tbody>
</table>
V. And the past is not always a good indicator of the future

<table>
<thead>
<tr>
<th></th>
<th>Arithmetic Average</th>
<th></th>
<th>Geometric Average</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Stocks - T. Bills</td>
<td>Stocks - T. Bonds</td>
<td>Stocks - T. Bills</td>
<td>Stocks - T. Bonds</td>
</tr>
<tr>
<td>1928-2013</td>
<td>7.93%</td>
<td>6.29%</td>
<td>6.02%</td>
<td>4.62%</td>
</tr>
<tr>
<td>Std Error</td>
<td>2.19%</td>
<td>2.34%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1964-2013</td>
<td>6.18%</td>
<td>4.32%</td>
<td>4.83%</td>
<td>3.33%</td>
</tr>
<tr>
<td>Std Error</td>
<td>2.42%</td>
<td>2.75%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004-2013</td>
<td>7.55%</td>
<td>4.41%</td>
<td>5.80%</td>
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<td>Std Error</td>
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**Base year cash flow**

- Dividends (TTM): 34.32
- Buybacks (TTM): 49.85
- Cash to investors (TTM): 84.16
- Earnings in TTM:

\[
E(\text{Cash to investors}) = 87.77 + 91.53 + 95.45 + 99.54 + 103.80 = 87.77 \left(1 + r\right)^{1} + 91.53 \left(1 + r\right)^{2} + 95.45 \left(1 + r\right)^{3} + 99.54 \left(1 + r\right)^{4} + 103.80 \left(1 + r\right)^{5} = 1848.36
\]

**Expected growth in next 5 years**

Top down analyst estimate of earnings growth for S&P 500 with stable payout: 4.28%

**Beyond year 5**

- Expected growth rate = Riskfree rate = 3.04%
- Terminal value = \[103.8(1.0304)/(0.08 - .0304) = 1848.36\]

**Implied Equity Risk Premium (1/1/14) = 8% - 3.04% = 4.96%**
Implied Premiums in the US: 1960-2013

Aswath Damodaran
The Anatomy of a Crisis: Implied ERP from September 12, 2008 to January 1, 2009

Aswath Damodaran
Implied Premium for India using the Sensex: April 2010

- Level of the Index = 17559
- FCFE on the Index = 3.5% (Estimated FCFE for companies in index as % of market value of equity)

Other parameters
- Riskfree Rate = 5% (Rupee)
- Expected Growth (in Rupee)
  - Next 5 years = 20% (Used expected growth rate in Earnings)
  - After year 5 = 5%

Solving for the expected return:
- Expected return on Equity = 11.72%
- Implied Equity premium for India = 11.72% - 5% = 6.72%

Aswath Damodaran
Emerging versus Developed Markets: Implied Equity Risk Premiums

\[ PBV = \frac{(\text{Return on equity} - \text{Expected growth rate})}{(\text{Cost of equity} - \text{Expected growth rate})} \]

\[ \text{Cost of Equity} = \frac{(\text{ROE} - \text{Expected growth rate})}{PBV} + \text{Expected growth rate} \]

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<thead>
<tr>
<th>Year</th>
<th>PBV - Developed</th>
<th>PBV - Emerging</th>
<th>ROE - Developed</th>
<th>ROE - Emerging</th>
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</tbody>
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Aswath Damodaran
VI. There is a downside to globalization...

- Emerging markets offer growth opportunities but they are also riskier. If we want to count the growth, we have to also consider the risk.

- Two ways of estimating the country risk premium:
  - Sovereign Default Spread: In this approach, the country equity risk premium is set equal to the default spread of the bond issued by the country. In 2010, the numbers looked as follows:
    - Equity Risk Premium for mature market = 4.50%
    - Default Spread for India = 3.00% (based on rating)
    - Equity Risk Premium for India = 4.50% + 3.00% = 7.50%
  - 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 * \( \frac{\text{Std Deviation}_{\text{Country Equity}}}{\text{Std Deviation}_{\text{Country Bond}}} \)
    - Standard Deviation in Sensex = 21%
    - Standard Deviation in Indian government bond = 14%
    - Default spread on Indian Bond = 2%
    - Additional country risk premium for India = 2% (21/14) = 3%
    - Total equity risk premium = US equity risk premium + CRP for India = 6% + 3% = 9%
Mexico’s Country Risk Premium

- Default Spread for Mexico in September 2014
  - CDS Spread for Mexico in September 2014 = 1.25%
  - Spread based upon Mexico’s Baa1 rating = 1.60%

- Relative Volatility
  - Standard deviation in Mexican equities = 13.91% (100 week, annualized)
  - Standard deviation in Mexican Government Bond = 8.94% (100 weeks)
  - Relative standard deviation = 13.91%/8.94% = 1.56 (approximately)
  - Country risk premium for Mexico = 1.60% (1.58) = 2.49%
  - If you use the average relative volatility measure across all emerging markets (about 1.50), country risk premium = 1.60% (1.50) = 2.40%

- Estimating equity risk premium for Mexico
  - Mature market premium in 2014= 5.00% (US S&P 500)
  - Country risk premium for Mexico = 2.40%
  - Total Equity risk premium for Mexico = 5.00% + 2.40% = 7.40%
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<tr>
<th>Country</th>
<th>Canada</th>
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**Black #: Total ERP**
**Red #: Country risk premium**
**AVG: GDP weighted average**
Mexico country risk over time: The CDS spread
VII. And it is not just emerging market companies that are exposed to this risk.

- The “default” approach in valuation has been to assign country risk based upon your country of incorporation. Thus, if you are incorporated in a developed market, the assumption has been that you are not exposed to emerging market risks. If you are incorporated in an emerging market, you are saddled with the entire country risk.

- As companies globalize and look for revenues in foreign markets, this practice will under estimate the costs of equity of developed market companies with significant emerging market risk exposure and over estimate the costs of equity of emerging market companies with significant developed market risk exposure.
One way of dealing with this: Operation-based ERP for Arca Continental

<table>
<thead>
<tr>
<th>Country</th>
<th>Revenues in 2013 (in millions of MXN)</th>
<th>Weight</th>
<th>ERP</th>
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<tr>
<td>Arca Continental</td>
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<td>100.00%</td>
<td>9.17%</td>
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</table>
An alternate way: Estimating a company’s exposure to country risk (Lambda)

- **Just as beta measures exposure to macro economic risk, lambda measures exposure just to country risk. Like beta, it is scaled around one.**
- **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:**
  
  \[ \text{Lambda} = \frac{\% \text{ of revenues domestically}_{\text{firm}}}{\% \text{ of revenues domestically}_{\text{average firm}}} \]

- **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:**
  
  - \[ \text{Lambda}_{Tata \text{ Motors}} = \frac{91\%}{80\%} = 1.14 \]
  
  - The danger of focusing just on revenues is that it misses other exposures to risk (production and operations).

<table>
<thead>
<tr>
<th></th>
<th><strong>Tata Motors</strong></th>
<th><strong>TCS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>% of production/operations in India</td>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td>% of revenues in India</td>
<td>91.37% (in 2009)\nEstimated 70% (in 2010)</td>
<td>7.62%</td>
</tr>
<tr>
<td>Lambda</td>
<td>0.80</td>
<td>0.20</td>
</tr>
<tr>
<td>Flexibility in moving operations</td>
<td>Low. Significant physical assets.</td>
<td>High. Human capital is mobile.</td>
</tr>
</tbody>
</table>
VIII. Growth has to be earned (not endowed or estimated)

Expected Growth

Net Income

Retention Ratio = \(1 - \frac{\text{Dividends}}{\text{Net Income}}\)  

Return on Equity = \(\frac{\text{Net Income}}{\text{Book Value of Equity}}\)

Operating Income

Reinvestment Rate = \((\text{Net Cap Ex} + \text{Chg in WC/EBIT(1-t)})\)

Return on Capital = \(\frac{\text{EBIT(1-t)}}{\text{Book Value of Capital}}\)

\(\text{ROC} = \frac{\text{EBIT (1-tax rate)}}{\text{Book Value of Equity + Book value of debt - Cash}}\)

Adjust EBIT for:
- Extraordinary or one-time expenses or income
- Operating leases and R&D
- Cyclicality in earnings (Normalize)
- Acquisition Debris (Goodwill amortization etc.)

Use a marginal tax rate to be safe. A high ROC created by paying low effective taxes is not sustainable.

Adjust book equity for:
- Capitalized R&D
- Acquisition Debris (Goodwill)

Adjust book value of debt for:
- Capitalized operating leases

Use end of prior year numbers or average over the year but be consistent in your application.

Aswath Damodaran
### Operating income, Reinvestment & Return on Capital – Arca Continental

<table>
<thead>
<tr>
<th>Invested Capital at start of the period</th>
</tr>
</thead>
<tbody>
<tr>
<td>BV of Equity + BV of Debt - Cash - Cross holdings</td>
</tr>
<tr>
<td>= 41,184 + 14,078 - 2,566 - 3,801</td>
</tr>
<tr>
<td>= MXN 48,895 million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>After-tax Operating Income (Trailing 12 months)</th>
</tr>
</thead>
<tbody>
<tr>
<td>= MXN 10,259 (1 - .3076)</td>
</tr>
<tr>
<td>= MXN 7,103 million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reinvestment</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Cap Ex - Depreciation + Chg in WC)</td>
</tr>
<tr>
<td>= (5,213 - 2,570 + 594)</td>
</tr>
<tr>
<td>= MXN 3,237 million</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Return on Invested Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 7,103 / 48,895</td>
</tr>
<tr>
<td>= 14.53%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Reinvestment Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 3,237 / 7,103</td>
</tr>
<tr>
<td>= 45.57%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Expected Growth Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>= 1453 * .4557</td>
</tr>
<tr>
<td>= .0662 or 6.62%</td>
</tr>
</tbody>
</table>
Sounds simple, right? But companies seem to have trouble in practice

**ROIC versus Cost of Capital: A Global Assessment for 2013**

Of the 33,963 firms that had data available for ROC an cost of capital, 58.8% earned less than their cost of capital in 2013.
IX. All good things come to an end. And the terminal value is not an ATM...

\[ \text{Terminal Value}_n = \frac{\text{EBIT}_{n+1} (1 - \text{tax rate}) (1 - \text{Reinvestment Rate})}{\text{Cost of capital - Expected growth rate}} \]

- This tax rate locks in forever. Does it make sense to use an effective tax rate?
- Are you reinvesting enough to sustain your stable growth rate?
  \[ \text{Reinv Rate} = \frac{g}{\text{ROC}} \]
  Is the ROC that of a stable company?

This is a mature company. It’s cost of capital should reflect that.

This growth rate should be less than the nominal growth rate of the economy.
## Terminal Value and Growth

<table>
<thead>
<tr>
<th>Stable growth rate</th>
<th>Amgen</th>
<th>Tata Motors</th>
<th>Arca</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>$150,652</td>
<td>435,686₹</td>
<td>MXN 131,711.00</td>
</tr>
<tr>
<td>1%</td>
<td>$154,479</td>
<td>435,686₹</td>
<td>MXN 131,711.00</td>
</tr>
<tr>
<td>2%</td>
<td>$160,194</td>
<td>435,686₹</td>
<td>MXN 131,711.00</td>
</tr>
<tr>
<td>3%</td>
<td>$167,784</td>
<td>435,686₹</td>
<td>MXN 131,711.00</td>
</tr>
<tr>
<td>4%</td>
<td>$179,099</td>
<td>435,686₹</td>
<td></td>
</tr>
<tr>
<td>5%</td>
<td></td>
<td>435,686₹</td>
<td></td>
</tr>
<tr>
<td>Riskfree rate</td>
<td>4.78%</td>
<td>5%</td>
<td>4.21%</td>
</tr>
<tr>
<td>ROIC</td>
<td>10%</td>
<td>10.39%</td>
<td>9.99%</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>8.08%</td>
<td>10.39%</td>
<td>9.99%</td>
</tr>
</tbody>
</table>
THE LOOSE ENDS IN VALUATION...
Getting from DCF to value per share: The Loose Ends

Discount FCFF at Cost of capital = Operating Asset Value

The adjustments to get to firm value

+ Cash & Marketable Securities

Discount? Premium?

+ Value of Cross holdings

Book value? Market value?

+ Value of other non-operating assets

What should be here? What should not?

Intangible assets (Brand Name) Premium

Synergy Premium

Value of business (firm)

Complexity discount

Value of Equity

Debt

Underfunded pension/health care obligations?

Minority Discount

Distress discount

Liquidity discount

Value per share

Control Premium

Option Overhang

Debt

Lawsuits & Contingent liabilities?

Liquidity discount

Aswath Damodaran
1. The Value of Cash
An Exercise in Cash Valuation

<table>
<thead>
<tr>
<th></th>
<th>Company A</th>
<th>Company B</th>
<th>Company C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enterprise Value</td>
<td>$ 1 billion</td>
<td>$ 1 billion</td>
<td>$ 1 billion</td>
</tr>
<tr>
<td>Cash</td>
<td>$ 100 mil</td>
<td>$ 100 mil</td>
<td>$ 100 mil</td>
</tr>
<tr>
<td>Return on Capital</td>
<td>10%</td>
<td>5%</td>
<td>22%</td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>10%</td>
<td>10%</td>
<td>12%</td>
</tr>
<tr>
<td>Trades in</td>
<td>US</td>
<td>US</td>
<td>Argentina</td>
</tr>
</tbody>
</table>

- In which of these companies is cash most likely to trade at face value, at a discount and at a premium?
Cash: Discount or Premium?

Market Value of $1 in cash:
Estimates obtained by regressing Enterprise Value against Cash Balances

Aswath Damodaran
2. Dealing with Holdings in Other firms

- 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 estimate 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

- Non-public Tata companies, 112,238₹
- Tata Steel, 13,572₹
- Tata Chemicals, 2,431₹
- Other publicly held Tata Companies, 12,335₹
## Arca Continental: From operating assets to equity value

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV of FCFF in high growth phase</td>
<td>$32,434.93</td>
<td>40.35%</td>
</tr>
<tr>
<td>PV of Terminal Value of Firm</td>
<td>$47,949.13</td>
<td>59.65%</td>
</tr>
<tr>
<td>Value of operating assets of the firm</td>
<td><strong>$80,384.06</strong></td>
<td><strong>$80,384.06</strong></td>
</tr>
<tr>
<td>+ Value of Cash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ Value of cross holdings in other companies</td>
<td>$8,750.00</td>
<td></td>
</tr>
<tr>
<td>Value of Firm</td>
<td><strong>$96,452.06</strong></td>
<td><strong>$96,452.06</strong></td>
</tr>
<tr>
<td>- Market Value of outstanding debt</td>
<td>$16,663.00</td>
<td></td>
</tr>
<tr>
<td>- Minority Interests</td>
<td>$6,691.50</td>
<td></td>
</tr>
<tr>
<td>Market Value of Equity</td>
<td><strong>$73,097.56</strong></td>
<td></td>
</tr>
<tr>
<td>- Value of Equity in Options</td>
<td>$0.00</td>
<td></td>
</tr>
<tr>
<td>Value of Equity in Common Stock</td>
<td><strong>$73,097.81</strong></td>
<td></td>
</tr>
<tr>
<td>Market Value of Equity/share</td>
<td><strong>$45.37</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Aswath Damodaran*
3. Other Assets that have not been counted yet..

- **Unutilized assets**: If you have assets or property that are not being utilized (vacant land, for example), you have not valued it yet. You can assess a market value for these assets and add them on to the value of the firm.

- **Overfunded pension plans**: If you have a defined benefit plan and your assets exceed your expected liabilities, you could consider the over funding with two caveats:
  - Collective bargaining agreements may prevent you from laying claim to these excess assets.
  - There are tax consequences. Often, withdrawals from pension plans get taxed at much higher rates.

- **Do not double count an asset**: If you count the income from an asset in your cash flows, you cannot count the market value of the asset in your value.
Assume that Arca Continental has real estate investments underlying its factories (which are being used to generate its operating income). Assume that you estimate a value of 15 billion pesos for the real estate. Can you add this value on to your DCF value?

- Yes.
- No.
- Depends

What would you do if the value of the land under the factories exceeds the present value that you have estimated for them as factories?

- Nothing
- Use the higher of the two values
- Use the lower of the two values
- Use a weighted average of the two values
4. A Discount for Complexity: An Experiment

<table>
<thead>
<tr>
<th></th>
<th>Company A</th>
<th>Company B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Income</td>
<td>$1 billion</td>
<td>$1 billion</td>
</tr>
<tr>
<td>Tax rate</td>
<td>40%</td>
<td>40%</td>
</tr>
<tr>
<td>ROIC</td>
<td>10%</td>
<td>10%</td>
</tr>
<tr>
<td>Expected Growth</td>
<td>5%</td>
<td>5%</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>8%</td>
<td>8%</td>
</tr>
<tr>
<td>Business Mix</td>
<td>Single</td>
<td>Multiple Businesses</td>
</tr>
<tr>
<td>Holdings</td>
<td>Simple</td>
<td>Complex</td>
</tr>
<tr>
<td>Accounting</td>
<td>Transparent</td>
<td>Opaque</td>
</tr>
</tbody>
</table>

Which firm would you value more highly?
# Measuring Complexity: Volume of Data in Financial Statements

<table>
<thead>
<tr>
<th>Company</th>
<th>Number of pages in last 10Q</th>
<th>Number of pages in last 10K</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Electric</td>
<td>65</td>
<td>410</td>
</tr>
<tr>
<td>Microsoft</td>
<td>63</td>
<td>218</td>
</tr>
<tr>
<td>Wal-mart</td>
<td>38</td>
<td>244</td>
</tr>
<tr>
<td>Exxon Mobil</td>
<td>86</td>
<td>332</td>
</tr>
<tr>
<td>Pfizer</td>
<td>171</td>
<td>460</td>
</tr>
<tr>
<td>Citigroup</td>
<td>252</td>
<td>1026</td>
</tr>
<tr>
<td>Intel</td>
<td>69</td>
<td>215</td>
</tr>
<tr>
<td>AIG</td>
<td>164</td>
<td>720</td>
</tr>
<tr>
<td>Johnson &amp; Johnson</td>
<td>63</td>
<td>218</td>
</tr>
<tr>
<td>IBM</td>
<td>85</td>
<td>353</td>
</tr>
</tbody>
</table>
## Measuring Complexity: A Complexity Score

<table>
<thead>
<tr>
<th>Item</th>
<th>Factors</th>
<th>Follow-up Question</th>
<th>Answer</th>
<th>Weighting factor</th>
<th>Gerdau Score</th>
<th>GE Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating Income</td>
<td>1. Multiple Businesses</td>
<td>Number of businesses (with more than 10% of revenues) =</td>
<td>1</td>
<td>2.00</td>
<td>2</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>2. One-time income and expenses</td>
<td>Percent of operating income =</td>
<td>10%</td>
<td>10.00</td>
<td>1</td>
<td>0.8</td>
</tr>
<tr>
<td></td>
<td>3. Income from unspecified sources</td>
<td>Percent of operating income =</td>
<td>0%</td>
<td>10.00</td>
<td>0</td>
<td>1.2</td>
</tr>
<tr>
<td></td>
<td>4. Items in income statement that are volatile</td>
<td>Percent of operating income =</td>
<td>15%</td>
<td>5.00</td>
<td>0.75</td>
<td>1</td>
</tr>
<tr>
<td>Tax Rate</td>
<td>1. Income from multiple locales</td>
<td>Percent of revenues from non-domestic locales =</td>
<td>70%</td>
<td>3.00</td>
<td>2.1</td>
<td>1.8</td>
</tr>
<tr>
<td></td>
<td>2. Different tax and reporting books</td>
<td>Yes or No</td>
<td>No</td>
<td>Yes=3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3. Headquarters in tax havens</td>
<td>Yes or No</td>
<td>No</td>
<td>Yes=3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4. Volatile effective tax rate</td>
<td>Yes or No</td>
<td>Yes</td>
<td>Yes=2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Capital Expenditures</td>
<td>1. Volatile capital expenditures</td>
<td>Yes or No</td>
<td>Yes</td>
<td>Yes=2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>2. Frequent and large acquisitions</td>
<td>Yes or No</td>
<td>Yes</td>
<td>Yes=4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>3. Stock payment for acquisitions and investments</td>
<td>Yes or No</td>
<td>Yes</td>
<td>Yes=4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Working capital</td>
<td>1. Unspecified current assets and current liabilities</td>
<td>Yes or No</td>
<td>No</td>
<td>Yes=3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>2. Volatile working capital items</td>
<td>Yes or No</td>
<td>No</td>
<td>Yes=2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Expected Growth rate</td>
<td>1. Off-balance sheet assets and liabilities (operating leases and R&amp;D)</td>
<td>Yes or No</td>
<td>No</td>
<td>Yes=3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>2. Substantial stock buybacks</td>
<td>Yes or No</td>
<td>No</td>
<td>Yes=3</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>3. Changing return on capital over time</td>
<td>Is your return on capital volatile?</td>
<td>Yes</td>
<td>Yes=5</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>4. Unsustainably high return</td>
<td>Is your firm’s ROC much higher than industry average?</td>
<td>No</td>
<td>Yes=5</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>1. Multiple businesses</td>
<td>Number of businesses (more than 10% of revenues) =</td>
<td>1</td>
<td>1.00</td>
<td>1</td>
<td>20</td>
</tr>
<tr>
<td></td>
<td>2. Operations in emerging markets</td>
<td>Percent of revenues=</td>
<td>50%</td>
<td>5.00</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td></td>
<td>3. Is the debt market traded?</td>
<td>Yes or No</td>
<td>Yes</td>
<td>No=2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>4. Does the company have a rating?</td>
<td>Yes or No</td>
<td>Yes</td>
<td>No=2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>5. Does the company have off-balance sheet debt?</td>
<td>Yes or No</td>
<td>Yes</td>
<td>No=5</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>No-operating assets</td>
<td>Minority holdings as percent of book assets</td>
<td>Minority holdings as percent of book assets</td>
<td>0%</td>
<td>20.00</td>
<td>0</td>
<td>0.8</td>
</tr>
<tr>
<td>Firm to Equity value</td>
<td>Consolidation of subsidiaries</td>
<td>Minority interest as percent of book value of equity</td>
<td>63%</td>
<td>20.00</td>
<td>12.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Per share value</td>
<td>Shares with different voting rights</td>
<td>Does the firm have shares with different voting rights?</td>
<td>Yes</td>
<td>Yes = 10</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>Equity options outstanding</td>
<td>Options outstanding as percent of shares</td>
<td>0%</td>
<td>10.00</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Complexity Score =</td>
<td></td>
<td>Complexity Score =</td>
<td>48.95</td>
<td></td>
<td>90.55</td>
<td></td>
</tr>
</tbody>
</table>
Dealing with Complexity

- **In Discounted Cashflow Valuation**
  - The Aggressive Analyst: Trust the firm to tell the truth and value the firm based upon the firm’s statements about their value.
  - The Conservative Analyst: Don’t value what you cannot see.
  - The Compromise: Adjust the value for complexity
    - Adjust cash flows for complexity
    - Adjust the discount rate for complexity
    - Adjust the expected growth rate/length of growth period
    - Value the firm and then discount value for complexity

- **In relative valuation**
  - In a relative valuation, you may be able to assess the price that the market is charging for complexity:
  - With the hundred largest market cap firms, for instance:
    \[ \text{PBV} = 0.65 + 15.31 \text{ROE} - 0.55 \text{Beta} + 3.04 \text{Expected growth rate} - 0.003 \text{# Pages in 10K} \]

Aswath Damodaran
5. The Value of Synergy

Synergy is created when two firms are combined and can be either financial or operating.

Operating Synergy accrues to the combined firm as:

- Strategic Advantages
  - Higher returns on new investments
    - Higher ROC
    - Higher Growth Rate
  - More new Investments
  - More sustainable excess returns
    - Longer Growth Period
  - Higher Reinvestment
    - Higher Growth Rate
- Economies of Scale
  - Cost Savings in current operations
    - Higher Margin
    - Higher Base-year EBIT
- Financial Synergy
  - Tax Benefits
    - Lower taxes on earnings due to:
      - higher depreciation
      - operating loss carryforwards
  - Added Debt Capacity
  - Higher debt ratio and lower cost of capital
  - Diversification?
    - May reduce cost of equity for private or closely held firm
Valuing Synergy

(1) the firms involved in the merger are valued independently, by discounting expected cash flows to each firm at the weighted average cost of capital for that firm.

(2) the value of the combined firm, with no synergy, is obtained by adding the values obtained for each firm in the first step.

(3) The effects of synergy are built into expected growth rates and cashflows, and the combined firm is re-valued with synergy.

   Value of Synergy = Value of the combined firm, with synergy - Value of the combined firm, without synergy
Valuing Synergy: P&G + Gillette

Assume that $250 million in operating expenses will be cut immediately. Translates into an after-tax increase in operating income of approximately $158 million.

<table>
<thead>
<tr>
<th></th>
<th>P&amp;G</th>
<th>Gillette</th>
<th>Piglet: No Synergy</th>
<th>Piglet: Synergy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Free Cashflow to Equity</td>
<td>$5,864.74</td>
<td>$1,547.50</td>
<td>$7,412.24</td>
<td>$7,569.73</td>
</tr>
<tr>
<td>Growth rate for first 5 years</td>
<td>12%</td>
<td>10%</td>
<td>11.58%</td>
<td>12.50%</td>
</tr>
<tr>
<td>Growth rate after five years</td>
<td>4%</td>
<td>4%</td>
<td>4.00%</td>
<td>4.00%</td>
</tr>
<tr>
<td>Beta</td>
<td>0.90</td>
<td>0.80</td>
<td>0.88</td>
<td>0.88</td>
</tr>
<tr>
<td>Cost of Equity</td>
<td>7.90%</td>
<td>7.50%</td>
<td>7.81%</td>
<td>7.81%</td>
</tr>
<tr>
<td>Value of Equity</td>
<td>$221,292</td>
<td>$59,878</td>
<td>$281,170</td>
<td>$298,355</td>
</tr>
</tbody>
</table>

Assume that the combined company will grow at a faster rate (for the next decade) starting immediately.
6. Brand name, great management, superb product ...Are we short changing intangibles?

- There is often a temptation to add on premiums for intangibles. Here are a few examples.
  - Brand name
  - Great management
  - Loyal workforce
  - Technological prowess

- There are two potential dangers:
  - For some assets, the value may already be in your value and adding a premium will be double counting.
  - For other assets, the value may be ignored but incorporating it will not be easy.
# Valuing Brand Name

<table>
<thead>
<tr>
<th></th>
<th>Coca Cola</th>
<th>With Cott Margins</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current Revenues =</td>
<td>$21,962.00</td>
<td>$21,962.00</td>
</tr>
<tr>
<td>Length of high-growth period</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Reinvestment Rate =</td>
<td>50%</td>
<td>50%</td>
</tr>
<tr>
<td>Operating Margin (after-tax)</td>
<td>15.57%</td>
<td>5.28%</td>
</tr>
<tr>
<td>Sales/Capital (Turnover ratio)</td>
<td>1.34</td>
<td>1.34</td>
</tr>
<tr>
<td>Return on capital (after-tax)</td>
<td>20.84%</td>
<td>7.06%</td>
</tr>
<tr>
<td>Growth rate during period (g) =</td>
<td>10.42%</td>
<td>3.53%</td>
</tr>
<tr>
<td>Cost of Capital during period</td>
<td>7.65%</td>
<td>7.65%</td>
</tr>
<tr>
<td>Stable Growth Period</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Growth rate in steady state =</td>
<td>4.00%</td>
<td>4.00%</td>
</tr>
<tr>
<td>Return on capital =</td>
<td>7.65%</td>
<td>7.65%</td>
</tr>
<tr>
<td>Reinvestment Rate =</td>
<td>52.28%</td>
<td>52.28%</td>
</tr>
<tr>
<td>Cost of Capital =</td>
<td>7.65%</td>
<td>7.65%</td>
</tr>
<tr>
<td>Value of Firm =</td>
<td>$79,611.25</td>
<td>$15,371.24</td>
</tr>
</tbody>
</table>
7. Be circumspect about defining debt for cost of capital purposes...

- General Rule: Debt generally has the following characteristics:
  - Commitment to make fixed payments in the future
  - The fixed payments are tax deductible
  - Failure to make the payments can lead to either default or loss of control of the firm to the party to whom payments are due.

- Defined as such, debt should include
  - All interest bearing liabilities, short term as well as long term
  - All leases, operating as well as capital

- Debt should not include
  - Accounts payable or supplier credit
But should consider other potential liabilities when getting to equity value...

- If you have under funded pension fund or health care plans, you should consider the under funding at this stage in getting to the value of equity.
  - If you do so, you should not double count by also including a cash flow line item reflecting cash you would need to set aside to meet the unfunded obligation.
  - You should not be counting these items as debt in your cost of capital calculations....

- If you have contingent liabilities - for example, a potential liability from a lawsuit that has not been decided - you should consider the expected value of these contingent liabilities
  - Value of contingent liability = Probability that the liability will occur * Expected value of liability
8. The Value of Control

- The value of the control premium that will be paid to acquire a block of equity will depend upon two factors -
  - Probability that control of firm will change: This refers to the probability that incumbent management will be replaced. This can be either through acquisition or through existing stockholders exercising their muscle.
  - Value of Gaining Control of the Company: The value of gaining control of a company arises from two sources - the increase in value that can be wrought by changes in the way the company is managed and run, and the side benefits and perquisites of being in control.

- Value of Gaining Control = Present Value (Value of Company with change in control - Value of company without change in control) + Side Benefits of Control
Increase Cash Flows

- More efficient operations and cost cutting: Higher Margins
- Divest assets that have negative EBIT
- Reduce tax rate: moving income to lower tax locales, transfer pricing, risk management

Revenues
* Operating Margin
= EBIT
- Tax Rate * EBIT
EBIT (1-t)
+ Depreciation
- Capital Expenditures
- Chg in Working Capital
= FCFF

Live off past over-investment
Better inventory management and tighter credit policies

Increase Expected Growth

- Reinvest more in projects
- Increase operating margins

Reinvestment Rate
* Return on Capital
= Expected Growth Rate

Increase length of growth period

- Do acquisitions
- Increase capital turnover ratio

Increase length of growth period

- Build on existing competitive advantages
- Create new competitive advantages

Reduce the cost of capital

- Make your product/service less discretionary
- Reduce Operating leverage
- Reduce beta
- Cost of Equity * (Equity/Capital) + Pre-tax Cost of Debt (1- tax rate) * Debt/Capital
- Match your financing to your assets: Reduce your default risk and cost of debt
- Shift interest expenses to higher tax locales
- Change financing mix to reduce cost of capital

Firm Value

Aswath Damodaran
Adris Grupa (Status Quo): 4/2010

Current Cashflow to Firm
EBIT(1-t) : 436 HRK
- Nt CpX : 3 HRK
- Chg WC : -118 HRK
= FCFF : 551 HRK
Reinv Rate = (3-118)/436=-26.35%;
Tax rate = 17.35%
T
Return on capital = 8.72%

Expected Growth
Reinvestment Rate
70.83%
Return on Capital
9.69%

Cost of Equity
10.70%
Cost of Debt
(4.25%+ 0.5%+2%)(1-.20)
= 5.40 %
Weights
E = 97.4% D = 2.6%

Riskfree Rate:
HRK Riskfree Rate= 4.25%

Beta
0.70
Mature market premium
4.5%

Lambda
0.68
CRP for Croatia
(3%)

Country Default Spread
2%
Rel Equity
Mkt Vol
1.50

Terminal Value5 = 365/(.0992-.04) =6170 HRK

On May 1, 2010
AG Pfd price = 279 HRK
AG Common = 345 HRK

Aswath Damodaran
Adris Grupa: 4/2010 (Restructured)

Current Cashflow to Firm

| EBIT(1-t) | 436 HRK |
| - Nt CpX | 3 HRK  |
| - Chg WC | -118 HRK |
| = FCFF   | 551 HRK |

Reinv Rate = (3-118)/436 = -26.35%;
Tax rate = 17.35%
Return on capital = 8.72%

Average from 2004-09
70.83%

Reinvestment Rate 70.83%

Expected Growth from new inv.
70.83*.01054 = 0.686%

Return on Capital 10.54%

Increased ROIC to cost of capital

Stable Growth
- g = 4%; Beta = 0.80
- Country Premium = 2%
- Cost of capital = 9.65%
- Tax rate = 20.00%
- ROC=9.94%,
- Reinvestment Rate = g/ROC = 4/9.65 = 41.47%

On May 1, 2010
- AG Pfd price = 279 HRK
- AG Common = 345 HRK

Op. Assets 4545
+ Cash: 1787
- Debt 141
- Minority int 465
= Equity 5,735

Value/non-voting 334
Value/voting 362

HKR Cashflows

<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 (1-t)</td>
<td>HRK 469</td>
<td>HRK 503</td>
<td>HRK 541</td>
<td>HRK 581</td>
<td>HRK 623</td>
</tr>
<tr>
<td>- Reinvestment</td>
<td>HRK 332</td>
<td>HRK 356</td>
<td>HRK 383</td>
<td>HRK 411</td>
<td>HRK 442</td>
</tr>
<tr>
<td>FCFF</td>
<td>HRK 137</td>
<td>HRK 147</td>
<td>HRK 158</td>
<td>HRK 169</td>
<td>HRK 182</td>
</tr>
</tbody>
</table>

Discount at $ Cost of Capital (WACC) = 11.12% (.90) + 8.20% (0.10) = 10.55%

Terminal Value5 = 367/(.0965-.04) = 6508 HRK

Cost of Equity 11.12%

Cost of Debt
(4.25%+ 4%+2%)(1-.20) = 8.20%

Weights
E = 90 % D = 10 %

Riskfree Rate
HRK Riskfree Rate= 4.25%

Beta 0.75

Lambda 0.68

Mature market premium 4.5%

CRP for Croatia (3%)

Lambda 0.42

Country Default Spread 2%

CRP for Central Europe (3%)

Rel Equity Mkt Vol 1.50

On May 1, 2010
Firm's D/E Ratio: 11.1%

Aswath Damodaran
Adris Grupa has two classes of shares outstanding: 9.616 million voting shares and 6.748 million non-voting shares.

To value a non-voting share, we assume that all non-voting shares essentially have to settle for status quo value. All shareholders, common and preferred, get an equal share of the status quo value.

\[
\text{Status Quo Value of Equity} = 5,484 \text{ million HKR}
\]

\[
\text{Value for a non-voting share} = \frac{5484}{(9.616+6.748)} = 334 \text{ HKR/share}
\]

To value a voting share, we first value control in Adris Grup as the difference between the optimal and the status quo value:

\[
\text{Value of control at Adris Grupa} = 5,735 - 5484 = 249 \text{ million HKR}
\]

\[
\text{Value per voting share} = 334 \text{ HKR} + \frac{249}{9.616} = 362 \text{ HKR}
\]
THE DARK SIDE OF VALUATION: VALUING DIFFICULT-TO-VALUE COMPANIES
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?
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 ownership cycle**
  - Privately owned businesses: Exposure to firm specific risk and illiquidity bedevil valuations.
  - Venture Capital (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.

Aswath Damodaran
I. The challenge with young companies...

Figure 5.2: Estimation Issues - Young and Start-up 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?
- 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?
- What is the value added by 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...
Amazon in January 2000

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

<table>
<thead>
<tr>
<th>Year</th>
<th>Sales Turnover Ratio</th>
<th>Operational Margin</th>
<th>Expected Margin</th>
<th>Revenue Growth</th>
<th>Competitive Advantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3.00</td>
<td>-13.35%</td>
<td>7.08%</td>
<td>100.00%</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>5.58%</td>
<td>4.16%</td>
<td>8.54%</td>
<td>75.00%</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>9.774</td>
<td>10.00%</td>
<td>9.27%</td>
<td>50.00%</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>14,661</td>
<td>8.4%</td>
<td>9.64%</td>
<td>30.00%</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>19,059</td>
<td>7.08%</td>
<td>9.82%</td>
<td>25.20%</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>23,862</td>
<td>6.71%</td>
<td>9.91%</td>
<td>20.40%</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>28,729</td>
<td>6.12%</td>
<td>9.95%</td>
<td>15.60%</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>33,211</td>
<td>5.21%</td>
<td>10.00%</td>
<td>10.80%</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>36,798</td>
<td>3.77%</td>
<td>10.50%</td>
<td>6.00%</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>39,006</td>
<td>3.00%</td>
<td>10.00%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Revenue Growth

- 150.00%
- 100.00%
- 75.00%
- 50.00%
- 30.00%
- 25.20%
- 20.40%
- 15.60%
- 10.80%
- 6.00%
- 10.00%
- 8.00%
- 6.00%
- 4.00%
- 2.00%
- 1.00%
- 0.00%

Cost of Equity

- 12.90%
- 12.90%
- 12.90%
- 12.90%
- 12.90%
- 12.42%
- 11.94%
- 11.46%
- 10.98%
- 10.50%
- 10.00%
- 9.50%
- 9.00%
- 8.50%
- 8.00%
- 7.50%
- 7.00%

Cost of Debt

- 8.00%
- 8.00%
- 8.00%
- 8.00%
- 8.00%
- 7.80%
- 7.75%
- 7.75%
- 7.50%
- 7.00%

After-tax cost of debt

- 8.00%
- 8.00%
- 8.00%
- 8.00%
- 8.00%
- 6.71%
- 5.20%
- 5.07%
- 5.04%
- 4.98%
- 4.88%
- 4.55%

Cost of Capital

- 12.84%
- 12.84%
- 12.84%
- 12.83%
- 12.81%
- 12.13%
- 11.62%
- 11.08%
- 10.49%
- 9.61%

Value of Op Assets $15,170
+ Cash $26
= Value of Firm $15,196
- Value of Debt $349
= Value of Equity $14,847
- Equity Options $2,892
Value per share $35.08

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

Dot.com retailers for first 5 years

Convensional retailers after year 5

Riskfree Rate: T. Bond rate = 6.5%

Cost of Equity

12.90%

Cost of Debt

6.5% + 1.5% = 8.0%

Risk Premium

4%

Weighted Cost of Capital

= 12.84%

Amazon in January 2000

Amazon was trading at $84 in January 2000.

Pushed debt ratio to retail industry average of 15%.

Forever

Term. Year

6%

$41,346

10.00%

$4,135

7.80%

$2,688

7.75%

$155

9.61%

$1,881

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

Stable Growth

Terminal Value = 1881/(.0961 -.06) = 52,148

Stable ROC = 20%
Reinvest 30% of EBIT(1-t)

Amazon was trading at $84 in January 2000.

Pushed debt ratio to retail industry average of 15%.

From previous years

Ebit -410m

NOL: 500 m

Value of Op Assets $15,170
+ Cash $26
= Value of Firm $15,196
- Value of Debt $349
= Value of Equity $14,847
- Equity Options $2,892
Value per share $35.08

Amazon in January 2000

Cost of Equity 12.90%

Cost of Debt 6.5% + 1.5% = 8.0%

Tax rate = 0% -> 35%

Weights

Debt= 1.2% -> 15%

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

Cost of Capital

12.84%

12.84%

12.84%

12.83%

12.81%

12.13%

11.62%

11.08%

10.49%

9.61%

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

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

Stable Growth

Terminal Value = 1881/(.0961 -.06) = 52,148

Stable ROC = 20%
Reinvest 30% of EBIT(1-t)

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= Value of Equity $14,847
- Equity Options $2,892
Value per share $35.08

Amazon in January 2000

Cost of Equity 12.90%

Cost of Debt 6.5% + 1.5% = 8.0%

Tax rate = 0% -> 35%

Weights

Debt= 1.2% -> 15%

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

Stable Growth

Terminal Value = 1881/(.0961 -.06) = 52,148

Stable ROC = 20%
Reinvest 30% of EBIT(1-t)

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: Work backwards and keep it simple...

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenue Growth</th>
<th>Sales</th>
<th>Operating Margin</th>
<th>EBIT</th>
<th>EBIT (1-t)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr 12 mths</td>
<td>$1,117</td>
<td>-36.71%</td>
<td>-$410</td>
<td>-$410</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>150.00%</td>
<td>$2,793</td>
<td>-13.35%</td>
<td>-$373</td>
<td>-$373</td>
</tr>
<tr>
<td>2</td>
<td>100.00%</td>
<td>$5,585</td>
<td>-1.68%</td>
<td>-$94</td>
<td>-$94</td>
</tr>
<tr>
<td>3</td>
<td>75.00%</td>
<td>$9,774</td>
<td>4.16%</td>
<td>$407</td>
<td>$407</td>
</tr>
<tr>
<td>4</td>
<td>50.00%</td>
<td>$14,661</td>
<td>7.08%</td>
<td>$1,038</td>
<td>$871</td>
</tr>
<tr>
<td>5</td>
<td>30.00%</td>
<td>$19,059</td>
<td>8.54%</td>
<td>$1,628</td>
<td>$1,058</td>
</tr>
<tr>
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<td>25.20%</td>
<td>$23,862</td>
<td>9.27%</td>
<td>$2,212</td>
<td>$1,438</td>
</tr>
<tr>
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<td>$28,729</td>
<td>9.64%</td>
<td>$2,768</td>
<td>$1,799</td>
</tr>
<tr>
<td>8</td>
<td>15.60%</td>
<td>$33,211</td>
<td>9.82%</td>
<td>$3,261</td>
<td>$2,119</td>
</tr>
<tr>
<td>9</td>
<td>10.80%</td>
<td>$36,798</td>
<td>9.91%</td>
<td>$3,646</td>
<td>$2,370</td>
</tr>
<tr>
<td>10</td>
<td>6.00%</td>
<td>$39,006</td>
<td>9.95%</td>
<td>$3,883</td>
<td>$2,524</td>
</tr>
<tr>
<td>TY</td>
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<td>$41,346</td>
<td>10.00%</td>
<td>$4,135</td>
<td>$2,688</td>
</tr>
</tbody>
</table>
Lesson 3: 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.

Margin by which revenue growth rate exceeds industry average

Post-I.P.O. growth

Median of new issues from 1965 to 2005

Number of years after coming to market

Source: Andrew Metrick

The New York Times
Lesson 4: Don’t forget to pay for growth...

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues</th>
<th>Δ Revenue</th>
<th>Sales/Cap</th>
<th>Δ Investment</th>
<th>Invested Capital</th>
<th>EBIT (1-t)</th>
<th>Imputed ROC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tr 12 mths</td>
<td>$1,117</td>
<td>$1,676</td>
<td>3.00</td>
<td>$559</td>
<td>$</td>
<td>1,045</td>
<td>-$373</td>
</tr>
<tr>
<td>1</td>
<td>$2,793</td>
<td>$1,676</td>
<td>3.00</td>
<td>$559</td>
<td>$1,045</td>
<td>-$373</td>
<td>-76.62%</td>
</tr>
<tr>
<td>2</td>
<td>$5,585</td>
<td>$2,793</td>
<td>3.00</td>
<td>$931</td>
<td>$1,976</td>
<td>-$94</td>
<td>-8.96%</td>
</tr>
<tr>
<td>3</td>
<td>$9,774</td>
<td>$4,189</td>
<td>3.00</td>
<td>$1,396</td>
<td>$3,372</td>
<td>$407</td>
<td>20.59%</td>
</tr>
<tr>
<td>4</td>
<td>$14,661</td>
<td>$4,887</td>
<td>3.00</td>
<td>$1,629</td>
<td>$5,001</td>
<td>$871</td>
<td>25.82%</td>
</tr>
<tr>
<td>5</td>
<td>$19,059</td>
<td>$4,398</td>
<td>3.00</td>
<td>$1,466</td>
<td>$6,467</td>
<td>$1,058</td>
<td>21.16%</td>
</tr>
<tr>
<td>6</td>
<td>$23,862</td>
<td>$4,803</td>
<td>3.00</td>
<td>$1,601</td>
<td>$8,068</td>
<td>$1,438</td>
<td>22.23%</td>
</tr>
<tr>
<td>7</td>
<td>$28,729</td>
<td>$4,868</td>
<td>3.00</td>
<td>$1,623</td>
<td>$9,691</td>
<td>$1,799</td>
<td>22.30%</td>
</tr>
<tr>
<td>8</td>
<td>$33,211</td>
<td>$4,482</td>
<td>3.00</td>
<td>$1,494</td>
<td>$11,185</td>
<td>$2,119</td>
<td>21.87%</td>
</tr>
<tr>
<td>9</td>
<td>$36,798</td>
<td>$3,587</td>
<td>3.00</td>
<td>$1,196</td>
<td>$12,380</td>
<td>$2,370</td>
<td>21.19%</td>
</tr>
<tr>
<td>10</td>
<td>$39,006</td>
<td>$2,208</td>
<td>3.00</td>
<td>$736</td>
<td>$13,116</td>
<td>$2,524</td>
<td>20.39%</td>
</tr>
<tr>
<td>TY</td>
<td>$41,346</td>
<td>$2,340</td>
<td>NA</td>
<td>Assumed to be</td>
<td>=</td>
<td>20.00%</td>
<td></td>
</tr>
</tbody>
</table>
Lesson 5: There are always scenarios where the market price can be justified...

<table>
<thead>
<tr>
<th>Complied annual Revenue Growth rate</th>
<th>Target pre-tax Operating Margin</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6%</td>
</tr>
<tr>
<td>30%</td>
<td>$ (1.94)</td>
</tr>
<tr>
<td>35%</td>
<td>$ 1.41</td>
</tr>
<tr>
<td>40%</td>
<td>$ 6.10</td>
</tr>
<tr>
<td>45%</td>
<td>$ 12.59</td>
</tr>
<tr>
<td>50%</td>
<td>$ 21.47</td>
</tr>
<tr>
<td>55%</td>
<td>$ 33.47</td>
</tr>
<tr>
<td>60%</td>
<td>$ 49.53</td>
</tr>
</tbody>
</table>
Lesson 6: Don’t forget to mop up...

- Watch out for “other” equity claims: If you buy equity in a young, growth company, watch out for other (often hidden) claims on the equity that don’t take the form of common shares. In particular, watch for options granted to managers, employees, venture capitalists and others (you will be surprised...).
  - Value these options as options (not at exercise value)
  - Take into consideration expectations of future option grants when computing expected future earnings/cash flows.

- Not all shares are equal: If there are differences in cash flow claims (dividends or liquidation) or voting rights across shares, value these differences.
  - Voting rights matter even at well run companies
Lesson 7: 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).

Aswath Damodaran
And the market is often “more wrong”....
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?**
- **How risky are the cash flows from both existing assets and growth assets?**
- **What is the value added by growth assets?**
- **When will the firm become a mature firm, and what are the potential roadblocks?**
- **What is the value of equity in the 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.

Equity claims can vary in voting rights and dividends.

Operating risk should be stable, but the firm can change its financial leverage. This can affect both the cost of equity and capital.

Maintaining excess returns or high growth for any length of time is difficult to do for a mature firm.

Aswath Damodaran
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 Rate</th>
<th>Reinvestment</th>
<th>FCF</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></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>$3,974</td>
</tr>
<tr>
<td>1</td>
<td>$324</td>
<td>2.75%</td>
<td>14.34%</td>
<td>19.14%</td>
<td>$62</td>
<td>$262</td>
<td>6.79%</td>
<td>$245</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>$333</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>
<td></td>
</tr>
<tr>
<td>3</td>
<td>$342</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>
<td></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>
<td></td>
</tr>
</tbody>
</table>

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

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

1. Expected growth rate = ROC * Reinvestment Rate
   - Expected growth rate (status quo) = 14.34% * 19.14% = 2.75%
   - Expected growth rate (optimal) = 14.00% * 40% = 5.60%
   - ROC drops, reinvestment rises and growth goes up.

Financial restructuring

2. 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.

Probability of management change = 10%

Expected value = $31.91 (.90) + $37.80 (.10) = $32.50
Lesson 1: Cost cutting and increased efficiency are easier accomplished on paper than in practice...

Aswath Damodaran
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, $ billions</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>1.68</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>$2,892</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>

Current Cost of Capital

- 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.
- As cost of capital drops, firm value rises (as operating cash flows remain unchanged).
- At debt ratios > 80%, firm does not have enough operating income to cover interest expenses. Tax rate goes down to reflect lost tax benefits.

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. 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 are the cashflows from existing assets?

What is the value added by growth 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?

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.

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.

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?

Aswath Damodaran
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 \((\text{Probability of distress})\)

- 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).

Aswath Damodaran
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 riskfree rate, we can back out the probability of distress from the bond price:

\[
529 = \sum_{t=1}^{10} \frac{63.75(1-\pi_{\text{Distress}})^t}{(1.03)^t} + \frac{1000(1-\pi_{\text{Distress}})^7}{(1.03)^7}
\]

- Solving for the probability of bankruptcy, we get:
  - \( \pi_{\text{Distress}} \) = 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 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 (.7666) = $1.92

Aswath Damodaran
The “sunny” side of distress: Equity as a call option to liquidate the firm

Aswath Damodaran
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 = $100 million
- Exercise price = $80 million
- Life of the option = 10 years
- Variance in the value of the underlying asset = 0.16
- Riskless rate = 10%

The output
- The Black-Scholes model provides the following value for the call:
  - d1 = 1.5994, N(d1) = 0.9451
  - d2 = 0.3345, N(d2) = 0.6310
- Value of the call = $100 (0.9451) - $80 exp(-0.10)(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%
Firm value drops..

- 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:
    - $d_1 = 1.0515$  \quad N(d_1) = 0.8534
    - $d_2 = -0.2135$  \quad N(d_2) = 0.4155
  - Value of the call = $50 \times (0.8534) - 80 \times \exp(-0.10) \times (0.4155) = 30.44$ million
  - Value of the bond = $50 - 30.44 = 19.56$ million

Aswath Damodaran
Equity value persists .. As firm value declines..
IV. Valuing Financial Service Companies

What are the cashflows from existing assets?

Preferred stock is a significant source of capital.

What is the value of equity in the firm?

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.

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

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.

Aswath Damodaran
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%

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

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

Discount at Cost of Equity

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

Beta = 1.20
Payout = (1- 4/10) = .60 or 60%

ROE = 13.19%

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.

Left return on equity at 2008 levels. well below 16% in 2007 and 20% in 2004-2006.

Aswath Damodaran
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:
  - FCFE = Net Income – Reinvestment in regulatory capital (book equity)
### 2d. Deutsche Bank: March 2009

#### Last 2 years
- **2007**
  - Net Income: 3,954 m
  - Dividends: 2,146 m
  - Risk adjusted assets: 312,882 m
  - Book Equity: 31,914 m

- **2008**
  - Net Income: -3,855 m
  - Dividends: 285 m

#### Normalized
- Net Income for base year: 3,000 m
- Normalized ROE: 9.4%

#### Expected growth in asset base
- Normalized growth: 4%

#### Target capital ratio
- 10%

#### Target ROE
- 10.2%

#### Stable Growth
- g = 3%
- Beta = 1.00
- Cost of equity = 10.20%
- Return on equity = 10.20%
- Reinvestment rate = g/ROE
- Target ROE = 3/10.20% = 29.41%

#### Cashflows

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

#### Terminal Value
- In 2009: 39,209 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:
- Beta for commercial & Investment banking = 1.162

#### Mature market premium
- 6%

#### Lambda and CRP

<table>
<thead>
<tr>
<th>Region</th>
<th>Lambda</th>
<th>CRP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western Europe</td>
<td>0.68</td>
<td>0.00%</td>
</tr>
<tr>
<td>United States</td>
<td>0.42</td>
<td>0.00%</td>
</tr>
<tr>
<td>Latin America</td>
<td>0.01</td>
<td>4.50%</td>
</tr>
<tr>
<td>Africa &amp; Middle East</td>
<td>0.01</td>
<td>7.00%</td>
</tr>
<tr>
<td>Asia</td>
<td>0.11</td>
<td>3.50%</td>
</tr>
<tr>
<td>Eastern Europe</td>
<td>0.04</td>
<td>3.00%</td>
</tr>
<tr>
<td>Deutsche Bank</td>
<td>0.60%</td>
<td></td>
</tr>
</tbody>
</table>

Aswath Damodaran
V. 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?

What is the value added by growth 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?

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

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.

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 Vale in November 2013 (in US dollars)

Let's start with some history & estimate what a normalized year will look like

<table>
<thead>
<tr>
<th>Year</th>
<th>Operating Income ($)</th>
<th>Effective tax rate</th>
<th>BV of Debt</th>
<th>BV of Equity</th>
<th>Cash</th>
<th>Invested capital</th>
<th>Return on capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>2009</td>
<td>$6,057</td>
<td>27.79%</td>
<td>$18,168</td>
<td>$42,556</td>
<td>$12,639</td>
<td>$48,085</td>
<td>9.10%</td>
</tr>
<tr>
<td>2010</td>
<td>$23,033</td>
<td>18.67%</td>
<td>$23,613</td>
<td>$59,766</td>
<td>$11,040</td>
<td>$72,339</td>
<td>25.90%</td>
</tr>
<tr>
<td>2011</td>
<td>$30,206</td>
<td>18.54%</td>
<td>$27,668</td>
<td>$70,076</td>
<td>$9,913</td>
<td>$87,831</td>
<td>28.01%</td>
</tr>
<tr>
<td>2012</td>
<td>$13,346</td>
<td>18.96%</td>
<td>$23,116</td>
<td>$78,721</td>
<td>$3,538</td>
<td>$98,299</td>
<td>11.00%</td>
</tr>
<tr>
<td>2013 (TTM)</td>
<td>$15,487</td>
<td>20.65%</td>
<td>$30,196</td>
<td>$75,974</td>
<td>$5,818</td>
<td>$100,352</td>
<td>12.25%</td>
</tr>
<tr>
<td>Normalized</td>
<td>$17,626</td>
<td>20.92%</td>
<td>$31,705</td>
<td>$85,974</td>
<td>$7,895</td>
<td>$113,870</td>
<td>17.25%</td>
</tr>
</tbody>
</table>

Estimate the costs of equity & capital for Vale

<table>
<thead>
<tr>
<th>Business</th>
<th>Sample size</th>
<th>Unlevered beta of business</th>
<th>Revenues</th>
<th>Peer Group EV/Sales</th>
<th>Value of Business</th>
<th>Proportion of Vale</th>
<th>% of revenues</th>
<th>ERP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metals &amp; Mining</td>
<td>48</td>
<td>0.86</td>
<td>$9,013</td>
<td>1.97</td>
<td>$17,739</td>
<td>16.65%</td>
<td>4.90%</td>
<td>5.50%</td>
</tr>
<tr>
<td>Iron Ore</td>
<td>78</td>
<td>0.83</td>
<td>$32,717</td>
<td>2.48</td>
<td>$81,188</td>
<td>76.20%</td>
<td>16.90%</td>
<td>8.50%</td>
</tr>
<tr>
<td>Fertilizers</td>
<td>693</td>
<td>0.99</td>
<td>$3,777</td>
<td>1.52</td>
<td>$5,741</td>
<td>5.39%</td>
<td>1.70%</td>
<td>10.09%</td>
</tr>
<tr>
<td>Logistics</td>
<td>223</td>
<td>0.75</td>
<td>$1,644</td>
<td>1.14</td>
<td>$1,874</td>
<td>1.76%</td>
<td>37.00%</td>
<td>6.94%</td>
</tr>
<tr>
<td>Vale Operations</td>
<td>0.8440</td>
<td>$47,151</td>
<td>$106,543</td>
<td>100.00%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Market D/E = 54.99%
Marginal tax rate = 34.00% (Brazil)
Leveled Beta = 0.844 (1+(1-.34)(.5499)) = 1.15
Cost of equity = 2.75% + 1.15 (7.38%) = 10.87%

Cost of capital = 11.23% (.6452) + 4.05% (1-.34) (.3548) = 8.20%

Assume that the company is in stable growth, growing 2% a year in perpetuity

\[
Reinvestment Rate = \frac{g}{ROE} = \frac{2\%}{17.25\%} = 11.59\%
\]

\[
Value of Operating Assets = \frac{17,626 (1 - .2092)(1 - .1159)}{(.082 - .02)} = $202,832
\]

Value of operating assets = $202,832
+ Cash & Marketable Securities = $ 7,133
- Debt = $ 42,879
Value of equity = $167,086
Value per share = $ 32.44
Stock price (11/2013) = $ 13.57
Regressing Exxon’s operating income against the oil price per barrel from 1985-2008:

\[ \text{Operating Income} = -6,395 + 911.32 \times \text{(Average Oil Price)} \]

\[ R^2 = 90.2\% \]

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

Normalized Operating Income = -6,395 + 911.32 ($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.

Reinvestment Rate = g/ROC = 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%. It’s 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%.

Cost of capital = 8.35% (.9715) + 3.75% (1-.38) (.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.
Lesson 1: With “macro” companies, it is easy to get lost in “macro” assumptions...

- With cyclical and commodity companies, it is undeniable that the value you arrive at will be affected by your views on the economy or the price of the commodity.

- Consequently, you will feel the urge to take a stand on these macro variables and build them into your valuation. Doing so, though, will create valuations that are jointly impacted by your views on macro variables and your views on the company, and it is difficult to separate the two.

- The best (though not easiest) thing to do is to separate your macro views from your micro views. Use current market based numbers for your valuation, but then provide a separate assessment of what you think about those market numbers.

Aswath Damodaran
Lesson 2: Use probabilistic tools to assess value as a function of macro variables...

- If there is a key macro variable affecting the value of your company that you are uncertain about (and who is not), why not quantify the uncertainty in a distribution (rather than a single price) and use that distribution in your valuation.

- That is exactly what you do in a Monte Carlo simulation, where you allow one or more variables to be distributions and compute a distribution of values for the company.

- With a simulation, you get not only everything you would get in a standard valuation (an estimated value for your company) but you will get additional output (on the variation in that value and the likelihood that your firm is under or over valued)
Exxon Mobil Valuation: Simulation

![Histogram of Exxon Mobil Value per Share: Oil price Simulation](image)
The optionality in commodities: Undeveloped reserves as an option
Valuing Gulf Oil

- 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 * ($22.38 - $7) / 1.05^2 = $42,380.44
  - Exercise price = Estimated development cost of reserves = 3038 * $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:
  - \( d_1 = 1.6548 \) \( N(d_1) = 0.9510 \)
  - \( d_2 = 1.0548 \) \( N(d_2) = 0.8542 \)
  - Call Value = 42,380.44 \( \exp(-0.05)(12)(0.9510) - 30,380 \exp(-0.09)(12)(0.8542) = \$13,306 \) million

Aswath Damodaran
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 (1 - 1.125^{-10})/.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

Aswath Damodaran
VII. 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

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

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

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

Aswath Damodaran
## Kristin’s Kandy: Valuation in March 2006

### Current Cashflow to Firm
- **EBIT(1-t)**: 300
- **Nt CpX**: 100
- **Chg WC**: 40
- **FCFF**: 160

Reinvestment Rate = 46.67%

### Reinvestment Rate
- **Return on Capital**: 13.64%

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

### Stable Growth
- **g**: 4%; **Beta**: 3.00; **ROC**: 12.54%
- **Reinvestment Rate**: 31.90%

### Terminal Value
- \(5 = \frac{289}{.1254 - .04} = 3,403\)

### Cost of Equity
- 16.26%

### Cost of Debt
- \((4.5\% + 1.00)(1 - .40) = 3.30\%\)

### Weights
- **E**: 70%; **D**: 30%

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

### Firm Value
- **2,571**
- **Cash**: 125
- **Debt**: 900
- **Equity**: 1,796
- **Illiq Discount**: 12.5%
- **Adj Value**: 1,571

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

### Market Beta
- **Market Beta**: 0.98

### Unlevered Beta for Sectors
- **Unlevered Beta for Sectors**: 0.78

### Firm’s D/E Ratio
- **30/70

### Total Beta
- **2.94

### Risk Premium
- **4.00\%**

### Synthetic rating = A-

### Total Beta
- **2.94

### Mature risk premium
- **4\%**

### Country Risk premium
- **0\%**

### Aswath Damodaran
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>
Private Owner versus Publicly Traded Company Perceptions of Risk in an Investment

Private owner of business with 100% of your wealth invested in the business

Is exposed to all the risk in the firm

Demands a cost of equity that reflects this risk

80 units of firm specific risk

Market Beta measures just market risk

Eliminates firm-specific risk in portfolio

Publicly traded company with investors who are diversified

Demands a cost of equity that reflects only market risk

20 units of market risk

Total Beta measures all risk

= Market Beta/ (Portion of the total risk that is market risk)

Aswath Damodaran
Adjust the beta to reflect total risk rather than market risk. This adjustment is a relatively simple one, since the R squared of the regression measures the proportion of the risk that is market risk.

- Total Beta = Market Beta / Correlation of the sector with the market

To estimate the beta for Kristin Kandy, we begin with the bottom-up unlevered beta of food processing companies:

- Unlevered beta for publicly traded food processing companies = 0.78
- Average correlation of food processing companies with market = 0.333
- Unlevered total beta for Kristin Kandy = 0.78/0.333 = 2.34
- Debt to equity ratio for Kristin Kandy = 0.3/0.7 (assumed industry average)

- Total Beta = 2.34 (1 - (1-.40)(30/70)) = 2.94
- Total Cost of Equity = 4.50% + 2.94 (4%) = 16.26%
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.
RELATIVE VALUATION
Relative valuation is pervasive...

- Most asset valuations are relative.
- Most equity valuations on Wall Street are relative valuations.
  - Almost 85% of equity research reports are based upon a multiple and comparables.
  - More than 50% of all acquisition valuations are based upon multiples
  - Rules of thumb based on multiples are not only common but are often the basis for final valuation judgments.
- While there are more discounted cashflow valuations in consulting and corporate finance, they are often relative valuations masquerading as discounted cash flow valuations.
  - The objective in many discounted cashflow valuations is to back into a number that has been obtained by using a multiple.
  - The terminal value in a significant number of discounted cashflow valuations is estimated using a multiple.

Aswath Damodaran
The Reasons for the allure...

- “If you think I’m crazy, you should see the guy who lives across the hall”
  Jerry Seinfeld talking about Kramer in a Seinfeld episode

- “A little inaccuracy sometimes saves tons of explanation”
  H.H. Munro

- “If you are going to screw up, make sure that you have lots of company”
  Ex-portfolio manager

Aswath Damodaran
The Four Steps to Deconstructing Multiples

- Define the multiple
  - In use, the same multiple can be defined in different ways by different users. When comparing and using multiples, estimated by someone else, it is critical that we understand how the multiples have been estimated.

- Describe the multiple
  - Too many people who use a multiple have no idea what its cross sectional distribution is. If you do not know what the cross sectional distribution of a multiple is, it is difficult to look at a number and pass judgment on whether it is too high or low.

- Analyze the multiple
  - It is critical that we understand the fundamentals that drive each multiple, and the nature of the relationship between the multiple and each variable.

- Apply the multiple
  - Defining the comparable universe and controlling for differences is far more difficult in practice than it is in theory.
Definitional Tests

- **Is the multiple consistently defined?**
  - Proposition 1: Both the value (the numerator) and the standardizing variable (the denominator) should be to the same claimholders in the firm. In other words, the value of equity should be divided by equity earnings or equity book value, and firm value should be divided by firm earnings or book value.

- **Is the multiple uniformly estimated?**
  - The variables used in defining the multiple should be estimated uniformly across assets in the “comparable firm” list.
  - If earnings-based multiples are used, the accounting rules to measure earnings should be applied consistently across assets. The same rule applies with book-value based multiples.
Example 1: Price Earnings Ratio: Definition

PE = Market Price per Share / Earnings per Share

- There are a number of variants on the basic PE ratio in use. They are based upon how the price and the earnings are defined.

Price: is usually the current price
  - is sometimes the average price for the year

EPS: EPS in most recent financial year
  - EPS in trailing 12 months (Trailing PE)
  - Forecasted EPS in next year (Forward PE)
  - Forecasted EPS in future year

Aswath Damodaran
Example 2: Enterprise Value /EBITDA Multiple

- The enterprise value to EBITDA multiple is obtained by netting cash out against debt to arrive at enterprise value and dividing by EBITDA.

\[
\frac{\text{Enterprise Value}}{\text{EBITDA}} = \frac{\text{Market Value of Equity} + \text{Market Value of Debt} - \text{Cash}}{\text{Earnings before Interest, Taxes and Depreciation}}
\]

- Why do we net out cash from firm value?
- What happens if a firm has cross holdings which are categorized as:
  - Minority interests?
  - Majority active interests?
Descriptive Tests

- What is the average and standard deviation for this multiple, across the universe (market)?
- What is the median for this multiple?
  - The median for this multiple is often a more reliable comparison point.
- How large are the outliers to the distribution, and how do we deal with the outliers?
  - Throwing out the outliers may seem like an obvious solution, but if the outliers all lie on one side of the distribution (they usually are large positive numbers), this can lead to a biased estimate.
- Are there cases where the multiple cannot be estimated? Will ignoring these cases lead to a biased estimate of the multiple?
- How has this multiple changed over time?
1. Multiples have skewed distributions...

PE Ratios for US stocks: January 2014

- Current
- Trailing
- Forward
2. Making statistics “dicey”

<table>
<thead>
<tr>
<th></th>
<th>Current PE</th>
<th>Trailing PE</th>
<th>Forward PE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of firms</td>
<td>7766</td>
<td>7766</td>
<td>7766</td>
</tr>
<tr>
<td>Number with PE</td>
<td>3248</td>
<td>3186</td>
<td>2699</td>
</tr>
<tr>
<td>Average</td>
<td>52.13</td>
<td>50.14</td>
<td>38.62</td>
</tr>
<tr>
<td>Median</td>
<td>20.78</td>
<td>19.75</td>
<td>18.54</td>
</tr>
<tr>
<td>Minimum</td>
<td>0.25</td>
<td>0.4</td>
<td>0.52</td>
</tr>
<tr>
<td>Maximum</td>
<td>7,117.43</td>
<td>7,117.43</td>
<td>16,820.</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>242.03</td>
<td>249.64</td>
<td>349.38</td>
</tr>
<tr>
<td>Standard error</td>
<td>4.25</td>
<td>4.42</td>
<td>6.72</td>
</tr>
<tr>
<td>Skewness</td>
<td>18.29</td>
<td>17.62</td>
<td>42.99</td>
</tr>
<tr>
<td>25th percentile</td>
<td>13.004</td>
<td>12.97</td>
<td>14.7</td>
</tr>
<tr>
<td>75th percentile</td>
<td>33.66</td>
<td>30.47</td>
<td>25.13</td>
</tr>
</tbody>
</table>
3. Markets have a lot in common: Comparing Global PEs

PE Ratio Distribution: Global Comparison in January 2014

<table>
<thead>
<tr>
<th>Region</th>
<th>Average</th>
<th>25th percentile</th>
<th>Median</th>
<th>75th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>50.14</td>
<td>12.97</td>
<td>19.75</td>
<td>30.47</td>
</tr>
<tr>
<td>Europe</td>
<td>65.01</td>
<td>11.51</td>
<td>17.79</td>
<td>28.52</td>
</tr>
<tr>
<td>Japan</td>
<td>32.55</td>
<td>9.29</td>
<td>13.87</td>
<td>22.06</td>
</tr>
<tr>
<td>Aus, NZ &amp; Canada</td>
<td>44.98</td>
<td>9.52</td>
<td>15.69</td>
<td>27.46</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>109.51</td>
<td>8.60</td>
<td>14.84</td>
<td>29.77</td>
</tr>
<tr>
<td>Global</td>
<td>82.11</td>
<td>9.57</td>
<td>16.00</td>
<td>28.36</td>
</tr>
</tbody>
</table>

Aswath Damodaran
4. Simplistic rules almost always break down...6 times EBITDA may not be cheap...
But it may be in 2014, unless you are in Japan or in some emerging markets...

**EV/EBITDA: A Global Comparison - January 2014**

<table>
<thead>
<tr>
<th>Region</th>
<th>Average</th>
<th>25th percentile</th>
<th>Median</th>
<th>75th percentile</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>102.87</td>
<td>8.62</td>
<td>12.42</td>
<td>19.16</td>
</tr>
<tr>
<td>Europe</td>
<td>25.67</td>
<td>7.19</td>
<td>10.64</td>
<td>16.78</td>
</tr>
<tr>
<td>Japan</td>
<td>20.86</td>
<td>4.16</td>
<td>-6.79</td>
<td>11.04</td>
</tr>
<tr>
<td>Aus, NZ &amp; Canada</td>
<td>47.89</td>
<td>5.72</td>
<td>9.41</td>
<td>15.30</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>46.62</td>
<td>5.71</td>
<td>10.30</td>
<td>20.21</td>
</tr>
<tr>
<td>Global</td>
<td>46.72</td>
<td>5.91</td>
<td>10.08</td>
<td>17.80</td>
</tr>
</tbody>
</table>

---

Aswath Damodaran
Analytical Tests

- What are the fundamentals that determine and drive these multiples?
  - Proposition 2: Embedded in every multiple are all of the variables that drive every discounted cash flow valuation - growth, risk and cash flow patterns.
  - In fact, using a simple discounted cash flow model and basic algebra should yield the fundamentals that drive a multiple

- How do changes in these fundamentals change the multiple?
  - The relationship between a fundamental (like growth) and a multiple (such as PE) is seldom linear. For example, if firm A has twice the growth rate of firm B, it will generally not trade at twice its PE ratio
  - Proposition 3: It is impossible to properly compare firms on a multiple, if we do not know the nature of the relationship between fundamentals and the multiple.
PE Ratio: Understanding the Fundamentals

- To understand the fundamentals, start with a basic equity discounted cash flow model.
- With the dividend discount model,
  \[ P_0 = \frac{DPS_1}{r - g_n} \]

- Dividing both sides by the current earnings per share,
  \[ \frac{P_0}{EPS_0} = PE = \frac{\text{Payout Ratio} \times (1 + g_n)}{r - g_n} \]

- If this had been a FCFE Model,
  \[ P_0 = \frac{FCFE_1}{r - g_n} \]
  \[ \frac{P_0}{EPS_0} = PE = \frac{(FCFE/Earnings) \times (1 + g_n)}{r - g_n} \]
The Determinants of Multiples...

Equity Multiples

Value of Stock = \( \frac{\text{DPS}}{k_e - g} \)

- \( \text{PE} = \text{Payout Ratio} \frac{1+g}{r-g} \)
- \( \text{PEG} = \text{Payout ratio} \frac{1+g}{g(r-g)} \)
- \( \text{PBV} = \text{ROE} \text{ (Payout ratio)} \frac{1+g}{r-g} \)
- \( \text{PS} = \text{Net Margin} \text{ (Payout ratio)} \frac{1+g}{r-g} \)

Firm Multiples

- \( \frac{\text{V}}{\text{FCFF}} = \text{f(g, WACC)} \)
- \( \frac{\text{V}}{\text{EBIT}(1-t)} = \text{f(g, RIR, WACC)} \)
- \( \frac{\text{V}}{\text{EBIT}} = \text{f(g, RIR, WACC, t)} \)
- \( \frac{\text{V}}{\text{EBIT}} = \text{f(Oper Mgn, RIR, WACC, g)} \)

Value of Firm = \( \frac{\text{FCFF}}{\text{WACC} - g} \)
Given the firm that we are valuing, what is a “comparable” firm?

While traditional analysis is built on the premise that firms in the same sector are comparable firms, valuation theory would suggest that a comparable firm is one which is similar to the one being analyzed in terms of fundamentals.

Proposition 4: There is no reason why a firm cannot be compared with another firm in a very different business, if the two firms have the same risk, growth and cash flow characteristics.

Given the comparable firms, how do we adjust for differences across firms on the fundamentals?

Proposition 5: It is impossible to find an exactly identical firm to the one you are valuing.
An Example: Comparing PE Ratios across a Sector: PE

<table>
<thead>
<tr>
<th>Company Name</th>
<th>PE</th>
<th>Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT Indosat ADR</td>
<td>7.8</td>
<td>0.06</td>
</tr>
<tr>
<td>Telebras ADR</td>
<td>8.9</td>
<td>0.075</td>
</tr>
<tr>
<td>Telecom Corporation of New Zealand ADR</td>
<td>11.2</td>
<td>0.11</td>
</tr>
<tr>
<td>Telecom Argentina Stet - France Telecom SA ADR B</td>
<td>12.5</td>
<td>0.08</td>
</tr>
<tr>
<td>Hellenic Telecommunication Organization SA ADR</td>
<td>12.8</td>
<td>0.12</td>
</tr>
<tr>
<td>Telecomunicaciones de Chile ADR</td>
<td>16.6</td>
<td>0.08</td>
</tr>
<tr>
<td>Swisscom AG ADR</td>
<td>18.3</td>
<td>0.11</td>
</tr>
<tr>
<td>Asia Satellite Telecom Holdings ADR</td>
<td>19.6</td>
<td>0.16</td>
</tr>
<tr>
<td>Portugal Telecom SA ADR</td>
<td>20.8</td>
<td>0.13</td>
</tr>
<tr>
<td>Telefonos de Mexico ADR L</td>
<td>21.1</td>
<td>0.14</td>
</tr>
<tr>
<td>Matav RT ADR</td>
<td>21.5</td>
<td>0.22</td>
</tr>
<tr>
<td>Telstra ADR</td>
<td>21.7</td>
<td>0.12</td>
</tr>
<tr>
<td>Gilat Communications</td>
<td>22.7</td>
<td>0.31</td>
</tr>
<tr>
<td>Deutsche Telekom AG ADR</td>
<td>24.6</td>
<td>0.11</td>
</tr>
<tr>
<td>British Telecommunications PLC ADR</td>
<td>25.7</td>
<td>0.07</td>
</tr>
<tr>
<td>Tele Danmark AS ADR</td>
<td>27</td>
<td>0.09</td>
</tr>
<tr>
<td>Telekomunikasi Indonesia ADR</td>
<td>28.4</td>
<td>0.32</td>
</tr>
<tr>
<td>Cable &amp; Wireless PLC ADR</td>
<td>29.8</td>
<td>0.14</td>
</tr>
<tr>
<td>APT Satellite Holdings ADR</td>
<td>31</td>
<td>0.33</td>
</tr>
<tr>
<td>Telefonica SA ADR</td>
<td>32.5</td>
<td>0.18</td>
</tr>
<tr>
<td>Royal KPN NV ADR</td>
<td>35.7</td>
<td>0.13</td>
</tr>
<tr>
<td>Telecom Italia SPA ADR</td>
<td>42.2</td>
<td>0.14</td>
</tr>
<tr>
<td>Nippon Telegraph &amp; Telephone ADR</td>
<td>44.3</td>
<td>0.2</td>
</tr>
<tr>
<td>France Telecom SA ADR</td>
<td>45.2</td>
<td>0.19</td>
</tr>
<tr>
<td>Korea Telecom ADR</td>
<td>71.3</td>
<td>0.44</td>
</tr>
</tbody>
</table>

Aswath Damodaran
PE, Growth and Risk

- Dependent variable is: PE
- R squared = 66.2%  R squared (adjusted) = 63.1%

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>SE</th>
<th>t-ratio</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>13.1151</td>
<td>3.471</td>
<td>3.78</td>
<td>0.0010</td>
</tr>
<tr>
<td>Growth rate</td>
<td>121.223</td>
<td>19.27</td>
<td>6.29</td>
<td>≤ 0.0001</td>
</tr>
<tr>
<td>Emerging Market</td>
<td>-13.853</td>
<td>3.606</td>
<td>-3.84</td>
<td>0.0009</td>
</tr>
</tbody>
</table>

Emerging Market is a dummy: 1 if emerging market, 0 if not

- Was TelMex cheap?

PE = 13.13 + 121.22 (.14) -13.85 (1) = 16.3
At 21.1 times earnings, TelMex is over valued.
# Arca: A Relative Valuation against Latin American Beverage companies

<table>
<thead>
<tr>
<th>Name</th>
<th>Country</th>
<th>PE</th>
<th>PBV</th>
<th>EV/EBITDA</th>
<th>EV/Sales</th>
<th>EV/Invested Capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambev S.A. (BOVESPA:ABEV3)</td>
<td>Brazil</td>
<td>19.59</td>
<td>5.45</td>
<td>12.68</td>
<td>6.14</td>
<td>5.87</td>
</tr>
<tr>
<td>Arca Continental, S. A. B. de C. V. (BMV:AC *)</td>
<td>Mexico</td>
<td>24.80</td>
<td>3.43</td>
<td>12.75</td>
<td>2.66</td>
<td>3.00</td>
</tr>
<tr>
<td>Bodegas Esmeralda S.A. (BASE:ESME)</td>
<td>Argentina</td>
<td>10.36</td>
<td>2.51</td>
<td>6.82</td>
<td>1.34</td>
<td>2.56</td>
</tr>
<tr>
<td>Coca-Cola Embonor S.A. (SNSE:EMBONOR-B)</td>
<td>Chile</td>
<td>17.93</td>
<td>1.57</td>
<td>8.08</td>
<td>1.36</td>
<td>1.39</td>
</tr>
<tr>
<td>Coca-Cola FEMSA S.A. de C.V. (NYSE:KOF)</td>
<td>Mexico</td>
<td>24.62</td>
<td>2.45</td>
<td>10.58</td>
<td>1.92</td>
<td>2.07</td>
</tr>
<tr>
<td>Compania Cervecerias Unidas S.A. (SNSE:CCU)</td>
<td>Chile</td>
<td>17.26</td>
<td>2.05</td>
<td>8.36</td>
<td>1.74</td>
<td>2.15</td>
</tr>
<tr>
<td>Corporación Lindley S.A. (BVL:CORLINI1)</td>
<td>Peru</td>
<td>NA</td>
<td>2.53</td>
<td>11.41</td>
<td>1.53</td>
<td>1.45</td>
</tr>
<tr>
<td>Embotelladora Andina S.A. (SNSE:ANDINA-B)</td>
<td>Chile</td>
<td>20.23</td>
<td>1.70</td>
<td>9.32</td>
<td>1.38</td>
<td>1.39</td>
</tr>
<tr>
<td>Fomento Económico Mexicano, S.A.B de C.V (BMV:FEMSA UBD)</td>
<td>Mexico</td>
<td>27.60</td>
<td>1.89</td>
<td>11.19</td>
<td>1.68</td>
<td>1.76</td>
</tr>
<tr>
<td>Grupo Modelo, S.A.B. de C.V. (BMV:GMODELO C)</td>
<td>Mexico</td>
<td>40.04</td>
<td>3.65</td>
<td>NA</td>
<td>5.71</td>
<td>6.54</td>
</tr>
<tr>
<td>Organización Cultiba, S.A.B. de C.V. (BMV:CULTIBA B)</td>
<td>Mexico</td>
<td>NA</td>
<td>0.81</td>
<td>7.78</td>
<td>0.55</td>
<td>0.85</td>
</tr>
<tr>
<td>Unión de Cervecerías Peruanas Backus y Johnston SAA (BVL:BACKUSI1)</td>
<td>Peru</td>
<td>17.45</td>
<td>9.09</td>
<td>10.15</td>
<td>3.93</td>
<td>7.38</td>
</tr>
<tr>
<td>Viña Concha y Toro S.A. (SNSE:CONCHATORO)</td>
<td>Chile</td>
<td>18.96</td>
<td>1.87</td>
<td>13.79</td>
<td>2.02</td>
<td>1.54</td>
</tr>
<tr>
<td>Viña San Pedro Tarapacá S.A. (SNSE:SAN PEDRO)</td>
<td>Chile</td>
<td>10.85</td>
<td>0.92</td>
<td>7.25</td>
<td>1.26</td>
<td>0.93</td>
</tr>
<tr>
<td>Viñedos Emiliana Sociedad Anónima (SNSE:EMILIANA)</td>
<td>Chile</td>
<td>30.63</td>
<td>0.74</td>
<td>11.07</td>
<td>1.28</td>
<td>0.76</td>
</tr>
<tr>
<td>Watt’s S.A. (SNSE:WATTS)</td>
<td>Chile</td>
<td>13.31</td>
<td>1.92</td>
<td>9.25</td>
<td>1.19</td>
<td>1.54</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td></td>
<td>20.97</td>
<td>2.66</td>
<td>10.03</td>
<td>2.23</td>
<td>2.57</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td></td>
<td>19.28</td>
<td>1.99</td>
<td>10.15</td>
<td>1.61</td>
<td>1.65</td>
</tr>
</tbody>
</table>

Aswath Damodaran
Here is a test on your relative valuation skills

- If you wanted to convince me that Arca is cheap, what company or group of companies would you compare Arca to and what multiple would you use? Why?

- If you wanted to show me that Arca is expensive, what company or companies would you compare Arca to and what multiple would you use? Why?

- If you wanted to get as unbiased a relative valuation as you can, what company or companies would you compare Arca to and what multiple would you use? Why?

Aswath Damodaran
PBV and Return on Equity: Latin American Beverage Companies

- On a price to book ratio basis, Arca looks expensive, trading at 3.43 times book value, whereas the median for the sector is 1.99. However, Arca also has a ROE of 13.82%, higher than the median for the sector of 9.50%.

- Regressing PBV against ROE across the 15 companies:
  
  \[ PBV = 0.83 + 14.24 \times (ROE) \]
  
  \[ R^2 = 77.5\% \]

- Plugging in Arca’s return on equity of 13.82%
  
  PBV for Arca = 0.93 + 14.24 \times 0.1382 = 2.80

- At 3.43 times book value, Arca is still overvalued by about 22.5%.

Aswath Damodaran
Comparisons to the entire market: Why not?

- In contrast to the 'comparable firm' approach, the information in the entire cross-section of firms can be used to predict PE ratios.
- The simplest way of summarizing this information is with a multiple regression, with the PE ratio as the dependent variable, and proxies for risk, growth and payout forming the independent variables.
PE Ratio: Standard Regression for US stocks - January 2014

**Model Summary**

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std. Error of the Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.580^a</td>
<td>.336</td>
<td>.335</td>
<td>1562.73006</td>
</tr>
</tbody>
</table>

a. Predictors: (Constant), Payout Ratio, Expected Growth in EPS (next 5 years), Regression Beta

*The regression is run with growth and payout entered as decimals, i.e., 25% is entered as 0.25)*

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std. Error</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>(Constant)</td>
<td>4.199</td>
<td>1.255</td>
</tr>
<tr>
<td></td>
<td>Regression Beta</td>
<td>-2.864</td>
<td>.977</td>
</tr>
<tr>
<td>1</td>
<td>Expected Growth in EPS</td>
<td>149.0</td>
<td>5.56</td>
</tr>
<tr>
<td></td>
<td>(next 5 years)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Payout Ratio</td>
<td>13.39</td>
<td>.70</td>
</tr>
</tbody>
</table>
PE ratio regressions across markets

<table>
<thead>
<tr>
<th>Region</th>
<th>Regression – January 2014</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>US</td>
<td>$PE = 4.20 + 149.0 \ g_{EPS} + 13.40 \ \text{Payout} - 2.86 \ \text{Beta}$</td>
<td>33.6%</td>
</tr>
<tr>
<td>Europe</td>
<td>$PE = 11.51 + 41.73 \ g_{EPS} + 14.36 \ \text{Payout} - 1.75 \ \text{Beta}$</td>
<td>37.7%</td>
</tr>
<tr>
<td>Japan</td>
<td>$PE = 11.01 + 17.30 \ g_{EPS} + 31.22 \ \text{Payout}$</td>
<td>16.9%</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>$PE = 8.52 + 56.2 \ g_{EPS} + 10.04 \ \text{Payout} - 1.43 \ \text{Beta}$</td>
<td>20.0%</td>
</tr>
<tr>
<td>Global</td>
<td>$PE = 11.79 + 50.39 \ g_{EPS} + 15.86 \ \text{Payout} - 1.01 \ \text{Beta} - 61.15 \ \text{ERP}$</td>
<td>33.1%</td>
</tr>
</tbody>
</table>

* $g_{EPS} =$Expected Growth: Expected growth in EPS or Net Income: Next 5 years
  * Beta: Regression or Bottom up Beta
  * Payout ratio: Dividends/ Net income from most recent year. Set to zero, if net income < 0
  * ERP: Equity Risk Premium (total) for country in which company is incorporated

Aswath Damodaran
Choosing Between the Multiples

- As presented in this section, there are dozens of multiples that can be potentially used to value an individual firm.
- In addition, relative valuation can be relative to a sector (or comparable firms) or to the entire market (using the regressions, for instance)
- Since there can be only one final estimate of value, there are three choices at this stage:
  - Use a simple average of the valuations obtained using a number of different multiples
  - Use a weighted average of the valuations obtained using a number of different multiples
  - Choose one of the multiples and base your valuation on that multiple
Picking one Multiple

- This is usually the best way to approach this issue. While a range of values can be obtained from a number of multiples, the “best estimate” value is obtained using one multiple.

- The multiple that is used can be chosen in one of two ways:
  - Use the multiple that best fits your objective. Thus, if you want the company to be undervalued, you pick the multiple that yields the highest value.
  - Use the multiple that has the highest R-squared in the sector when regressed against fundamentals. Thus, if you have tried PE, PBV, PS, etc. and run regressions of these multiples against fundamentals, use the multiple that works best at explaining differences across firms in that sector.
  - Use the multiple that seems to make the most sense for that sector, given how value is measured and created.

Aswath Damodaran
## Conventional usage...

<table>
<thead>
<tr>
<th>Sector</th>
<th>Multiple Used</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cyclical Manufacturing</td>
<td>PE, Relative PE</td>
<td>Often with normalized earnings</td>
</tr>
<tr>
<td>Growth firms</td>
<td>PEG ratio</td>
<td>Big differences in growth rates</td>
</tr>
<tr>
<td>Young growth firms w/ losses</td>
<td>Revenue Multiples</td>
<td>What choice do you have?</td>
</tr>
<tr>
<td>Infrastructure</td>
<td>EV/EBITDA</td>
<td>Early losses, big DA</td>
</tr>
<tr>
<td>REIT</td>
<td>P/CFE (where CFE = Net income + Depreciation)</td>
<td>Big depreciation charges on real estate</td>
</tr>
<tr>
<td>Financial Services</td>
<td>Price/ Book equity</td>
<td>Marked to market?</td>
</tr>
<tr>
<td>Retailing</td>
<td>Revenue multiples</td>
<td>Margins equalize sooner or later</td>
</tr>
</tbody>
</table>
A closing thought...