TEN MYTHS ABOUT DISCOUNTED CASH FLOW VALUATION! WHY D+ CF ≠ DCF!

Aswath Damodaran
The essence of intrinsic value

- In **intrinsic valuation**, you value an asset based upon its fundamentals (or intrinsic characteristics).
- For **cash flow generating assets**, the intrinsic value will be a function of the magnitude of the **expected cash flows** on the asset over its lifetime and the **uncertainty** about receiving those cash flows.
- Discounted cash flow valuation is a **tool for estimating intrinsic value**, where the expected value of an asset is written as the present value of the expected cash flows on the asset, with either the cash flows or the discount rate adjusted to reflect the risk.
The two faces of discounted cash flow valuation

- The value of a risky asset can be estimated by discounting the expected cash flows on the asset over its life at a risk-adjusted discount rate:

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

where the asset has an n-year life, \(E(CF_t)\) is the expected cash flow in period \(t\) and \(r\) is a discount rate that reflects the risk of the cash flows.

- Alternatively, we can replace the expected cash flows with the guaranteed cash flows we would have accepted as an alternative (certainty equivalents) and discount these at the riskfree rate:

\[
\text{Value of asset} = \frac{CE(CF_1)}{(1 + r_f)} + \frac{CE(CF_2)}{(1 + r_f)^2} + \frac{CE(CF_3)}{(1 + r_f)^3} + \ldots + \frac{CE(CF_n)}{(1 + r_f)^n}
\]

where \(CE(CF_t)\) is the certainty equivalent of \(E(CF_t)\) and \(r_f\) is the riskfree rate.
Much talked about, Much used and Completed Misunderstood

- **The Academic DCF**: It's all about risk & return (and discount rates)
- **The Abstractionists**: Rules, rules and still more rules.
- **The Legal DCF**: Stick with established practice (precedence)
- **The Legal Gamers**: The Legal Gamers
- **The Defensive DCF**: A "show" of due diligence (to prevent lawsuits)
- **The Value Investors DCF**: Guarantee me the cash flows & give me a margin of safety.
- **The Skeptics**: A silly game played by pointy headed intellectuals
- **The Banking DCF**: It's a sales tool to get deals done
- **The Appraisers' DCF**: The DCF is just the start. It's all about the garnishes (premiums & discounts)
- **The Transactors**: The Transactors
Ten DCF Myths

1. $D + CF = DCF$
2. A DCF is an exercise in modeling & number crunching.
3. You cannot do a DCF when there is too much uncertainty.
4. The most critical input in a DCF is the discount rate and you have to believe in beta, to use that discount rate.
5. The biggest number in a DCF is the terminal value & it is unbounded.
6. A DCF requires too many assumptions and can be manipulated to yield any value you want.
7. A DCF cannot value brand name or other intangibles
8. A DCF yields a conservative estimate of value. It is better to underestimate value than over estimate it.
9. A DCF is static. It is pointless in a dynamic world.
10. A DCF is an academic exercise.
The DCF Myths

Dispelling Delusions
Myth 1: D + CF = DCF

- It is true that every good discounted cash flow valuation has expected cash flows that are discounted at a “risk-adjusted” discount rate.
- It does not follow, however, that just because you have expected cash flows and are discounting them at a “risk-adjusted” discount rate that you have a good discounted cash flow valuation.
- For a D+CF = DCF, you have to be consistent
  - In matching claimholder cash flows to claim discount rates
  - In matching the currency of your cash flows to the currency of your discount rate
  - In your assumptions about risk, growth and reinvestment.
1a. Claimholder Consistency

**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)</td>
<td>Little or No role in management</td>
</tr>
<tr>
<td>and short-lived (working</td>
<td><em>Fixed Maturity</em></td>
</tr>
<tr>
<td>capital) assets</td>
<td><em>Tax Deductible</em></td>
</tr>
<tr>
<td><strong>Assets in Place</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Growth Assets</strong></td>
<td><strong>Equity</strong></td>
</tr>
<tr>
<td>Expected Value that will be</td>
<td>Residual Claim on cash flows</td>
</tr>
<tr>
<td>created by future investments</td>
<td>Significant Role in management</td>
</tr>
<tr>
<td></td>
<td><em>Perpetual Lives</em></td>
</tr>
</tbody>
</table>

**Equity valuation:** Value just the equity claim in the business
## Same ingredients, different approaches...

<table>
<thead>
<tr>
<th>Input</th>
<th>Dividend Discount Model</th>
<th>FCFE (Potential dividend) discount model</th>
<th>FCFF (firm) valuation model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash flow</td>
<td>Dividend</td>
<td>Potential dividends = FCFE = Cash flows after taxes, reinvestment needs and debt cash flows</td>
<td>FCFF = Cash flows before debt payments but after reinvestment needs and taxes.</td>
</tr>
<tr>
<td>Expected growth</td>
<td>In equity income and dividends</td>
<td>In equity income and FCFE</td>
<td>In operating income and FCFF</td>
</tr>
<tr>
<td>Discount rate</td>
<td>Cost of equity</td>
<td>Cost of equity</td>
<td>Cost of capital</td>
</tr>
<tr>
<td>Steady state</td>
<td>When dividends grow at constant rate forever</td>
<td>When FCFE grow at constant rate forever</td>
<td>When FCFF grow at constant rate forever</td>
</tr>
</tbody>
</table>
In discounting these net cash flows, which of these discount rates would you use?

<table>
<thead>
<tr>
<th></th>
<th>Cost of equity</th>
<th>Cost of capital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kennecott (Acquirer)</td>
<td>13.00%</td>
<td>10.50%</td>
</tr>
<tr>
<td>Carborundum (Target)</td>
<td>16.50%</td>
<td>12.50%</td>
</tr>
<tr>
<td>Merged Entity</td>
<td>14.00%</td>
<td>11.00%</td>
</tr>
</tbody>
</table>
1b. Currency Consistency

Risk free Rates - January 2016

- Risk free Rate
- Default Spread based on rating
## Valuing Tata Motors in 2010

<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>Cost of capital</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>Expected growth rate</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>Return on Capital</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>Value per share</td>
<td>Rs 614</td>
<td>$12.79/share (roughly Rs 614 at current exchange rate)</td>
</tr>
</tbody>
</table>
1c. Internal Consistency

Is your risk consistent with your reinvestment strategy?

Is your risk reflective of how much, how & where you are growing?

Are you reinvesting enough, given your growth rate?
## Tesla: Summary 15-year DCF Analysis (DCF valuation as of mid-year 2013)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Volume</strong></td>
<td>24,298</td>
<td>36,883</td>
<td>64,684</td>
<td>86,713</td>
<td>149,869</td>
<td>214,841</td>
<td>291,861</td>
<td>384,747</td>
<td>466,559</td>
<td>550,398</td>
<td>643,850</td>
<td>726,655</td>
<td>820,645</td>
<td>922,481</td>
<td>1,034,215</td>
<td>1,137,780</td>
</tr>
<tr>
<td><strong>% Growth</strong></td>
<td>52%</td>
<td>73%</td>
<td>34%</td>
<td>73%</td>
<td>43%</td>
<td>36%</td>
<td>36%</td>
<td>32%</td>
<td>21%</td>
<td>18%</td>
<td>17%</td>
<td>13%</td>
<td>13%</td>
<td>12%</td>
<td>12%</td>
<td>10%</td>
</tr>
<tr>
<td><strong>Automotive Revenue Per Unit ($)</strong></td>
<td>93,403</td>
<td>85,342</td>
<td>83,432</td>
<td>78,932</td>
<td>65,465</td>
<td>58,258</td>
<td>56,407</td>
<td>55,553</td>
<td>56,553</td>
<td>56,586</td>
<td>56,969</td>
<td>57,540</td>
<td>58,138</td>
<td>58,603</td>
<td>59,002</td>
<td>59,544</td>
</tr>
<tr>
<td><strong>% Growth</strong></td>
<td>-9%</td>
<td>-2%</td>
<td>-5%</td>
<td>-17%</td>
<td>-11%</td>
<td>-3%</td>
<td>-2%</td>
<td>-1%</td>
<td>-1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td><strong>Automotive Sales</strong></td>
<td>2,462</td>
<td>3,321</td>
<td>5,613</td>
<td>7,051</td>
<td>10,025</td>
<td>12,720</td>
<td>16,685</td>
<td>21,565</td>
<td>26,347</td>
<td>31,357</td>
<td>36,897</td>
<td>42,022</td>
<td>47,949</td>
<td>54,283</td>
<td>61,221</td>
<td>67,980</td>
</tr>
<tr>
<td><strong>Development Service Sales</strong></td>
<td>16</td>
<td>40</td>
<td>42</td>
<td>44</td>
<td>46</td>
<td>49</td>
<td>51</td>
<td>54</td>
<td>58</td>
<td>60</td>
<td>62</td>
<td>65</td>
<td>67</td>
<td>70</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td><strong>Total Sales</strong></td>
<td>2,478</td>
<td>3,361</td>
<td>5,655</td>
<td>7,095</td>
<td>10,072</td>
<td>12,768</td>
<td>16,736</td>
<td>21,648</td>
<td>26,403</td>
<td>31,416</td>
<td>36,959</td>
<td>42,087</td>
<td>47,949</td>
<td>54,355</td>
<td>61,296</td>
<td>68,059</td>
</tr>
</tbody>
</table>

### Key Financial Metrics

- **EBITDA**: $148,417,000
- **Net Interest Income (Expense)**: $(27,000)
- **Pretax Income**: $46,258,000
- **Net Income**: $44,256,000
- **Change in Working Capital**: $(155,000)
- **Capital Expenditures**: $250,000
- **Unlevered Free Cash Flow**: $78,229,000

### Key Ratios

- **Discount Rate High**: 13.0%
- **Discount Rate Low**: 9.0%
- **FY Month of Valuation**: 1.0 (Beginning of this Month)
- **Month of FY End**: 12.0 (End of this Month)
- **EBITDA High**: 12.0 x
- **EBITDA Low**: 8.0 x
- **Sales**: 68,059
- **Net Debt (Cash)**: $(260)
- **Tesla Diluted Shares**: 142
Myth 2: DCF is all about Modeling

**Favored Tools**
- Accounting statements
- Excel spreadsheets
- Statistical Measures
- Pricing Data

**Illusions/Delusions**
1. Precision: Data is precise
2. Objectivity: Data has no bias
3. Control: Data can control reality

**Favored Tools**
- Anecdotes
- Experience (own or others)
- Behavioral evidence

**Illusions/Delusions**
1. Creativity cannot be quantified
2. If the story is good, the investment will be.
3. Experience is the best teacher
Every story has a number!
Uber, the Urban Car Service Company

The Story

Uber is an urban car service company, drawing in new users into car service. It will enjoy local networking benefits while preserving its current revenue sharing (80/20) and capital intensity (don't own cars or hire drivers) model.

The Assumptions

<table>
<thead>
<tr>
<th>Total Market</th>
<th>Base year</th>
<th>Years 1-5</th>
<th>Years 6-10</th>
<th>After year 10</th>
<th>Story link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Market</td>
<td>100 billion</td>
<td>Grow 6% a year</td>
<td>Grow 2.5%</td>
<td></td>
<td>Urban Car Service + New users</td>
</tr>
<tr>
<td>Gross Market Share</td>
<td>1.50%</td>
<td>1.50%&gt;10%</td>
<td>10%</td>
<td></td>
<td>Local Networking benefits</td>
</tr>
<tr>
<td>Revenue Share</td>
<td>20.00%</td>
<td>Stays at 20%</td>
<td>20.00%</td>
<td></td>
<td>Preserve revenue share</td>
</tr>
<tr>
<td>Operating Margin</td>
<td>3.33%</td>
<td>3.33% - 40%</td>
<td>40.00%</td>
<td></td>
<td>Strong competitive position</td>
</tr>
<tr>
<td>Reinvestment</td>
<td>NA</td>
<td>Sales to capital ratio of 5.00</td>
<td>Reinvestment rate = 10%</td>
<td></td>
<td>Low capital intensity model</td>
</tr>
<tr>
<td>Cost of capital</td>
<td>NA</td>
<td>12.00%</td>
<td>12%-&gt;8%</td>
<td>8%</td>
<td>90th percentile of US firms</td>
</tr>
<tr>
<td>Risk of failure</td>
<td></td>
<td></td>
<td>10% chance of failure (with equity worth zero)</td>
<td></td>
<td>Young company</td>
</tr>
</tbody>
</table>

The Cash Flows

<table>
<thead>
<tr>
<th>Year</th>
<th>Total Market</th>
<th>Market Share</th>
<th>Revenues</th>
<th>EBIT (1-t)</th>
<th>Reinvestment</th>
<th>FCFF</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$106,000</td>
<td>3.63%</td>
<td>$769</td>
<td>$37</td>
<td>$94</td>
<td>$(57)</td>
</tr>
<tr>
<td>2</td>
<td>$112,360</td>
<td>5.22%</td>
<td>$1,173</td>
<td>$85</td>
<td>$81</td>
<td>$4</td>
</tr>
<tr>
<td>3</td>
<td>$119,102</td>
<td>6.41%</td>
<td>$1,528</td>
<td>$147</td>
<td>$71</td>
<td>$76</td>
</tr>
<tr>
<td>4</td>
<td>$126,248</td>
<td>7.31%</td>
<td>$1,846</td>
<td>$219</td>
<td>$64</td>
<td>$156</td>
</tr>
<tr>
<td>5</td>
<td>$133,823</td>
<td>7.98%</td>
<td>$2,137</td>
<td>$301</td>
<td>$58</td>
<td>$243</td>
</tr>
<tr>
<td>6</td>
<td>$141,852</td>
<td>8.49%</td>
<td>$2,408</td>
<td>$390</td>
<td>$54</td>
<td>$336</td>
</tr>
<tr>
<td>7</td>
<td>$150,363</td>
<td>8.87%</td>
<td>$2,666</td>
<td>$487</td>
<td>$52</td>
<td>$435</td>
</tr>
<tr>
<td>8</td>
<td>$159,385</td>
<td>9.15%</td>
<td>$2,916</td>
<td>$591</td>
<td>$50</td>
<td>$541</td>
</tr>
<tr>
<td>9</td>
<td>$168,948</td>
<td>9.36%</td>
<td>$3,163</td>
<td>$701</td>
<td>$49</td>
<td>$652</td>
</tr>
<tr>
<td>10</td>
<td>$179,085</td>
<td>10.00%</td>
<td>$3,582</td>
<td>$860</td>
<td>$84</td>
<td>$776</td>
</tr>
<tr>
<td>Terminal year</td>
<td>$183,562</td>
<td>10.00%</td>
<td>$3,671</td>
<td>$881</td>
<td>$88</td>
<td>$793</td>
</tr>
</tbody>
</table>

The Value

<table>
<thead>
<tr>
<th>Value</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Terminal value</td>
<td>$14,418</td>
</tr>
<tr>
<td>PV(Terminal value)</td>
<td>$5,175</td>
</tr>
<tr>
<td>PV (CF over next 10 years)</td>
<td>$1,375</td>
</tr>
<tr>
<td>Value of operating assets =</td>
<td>$6,550</td>
</tr>
<tr>
<td>Probability of failure</td>
<td>10%</td>
</tr>
<tr>
<td>Value in case of failure</td>
<td>$-</td>
</tr>
<tr>
<td>Adjusted Value for operating assets</td>
<td>$5,895</td>
</tr>
</tbody>
</table>

VCs priced Uber at $17 billion at the time.
Myth 3: A DCF does not work when there is too much uncertainty

<table>
<thead>
<tr>
<th>Growth stage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage 1 Start-up</td>
<td>Have an idea for a business that meets an unmet need in the market.</td>
</tr>
<tr>
<td>Stage 2 Young Growth</td>
<td>Create a business model that converts ideas into potential revenues &amp; earnings</td>
</tr>
<tr>
<td>Stage 3: High Growth</td>
<td>Build the business, converting potential into revenues.</td>
</tr>
<tr>
<td>Stage 4 Mature Growth</td>
<td>Grow your business, shifting from losses to profits</td>
</tr>
<tr>
<td>Stage 5 Mature Stable</td>
<td>Defend your business from new competitors &amp; find new markets</td>
</tr>
<tr>
<td>Stage 6 Decline</td>
<td>Scale down your business as market shrinks</td>
</tr>
</tbody>
</table>

$Revenues/ Earnings

The Lightbulb (Idea) Moment

The Product Test

The Bar Mitzvah

The Scaling up Test

The Midlife Crisis

The End Game

Revenues

Earnings

Time

Aswath Damodaran
Valuing a young company is hard to do..

Figure 3: 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 added by growth assets?

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

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

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.

What is the value of equity in the firm?
# My Snap Valuation

## Simulation Results for Snap

<table>
<thead>
<tr>
<th>Trials</th>
<th>1,000,000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Base Case</td>
<td>$13,512</td>
</tr>
<tr>
<td>Mean</td>
<td>$14,860</td>
</tr>
<tr>
<td>Median</td>
<td>$13,334</td>
</tr>
<tr>
<td>Standard Deviation</td>
<td>$7,153</td>
</tr>
<tr>
<td>Skewness</td>
<td>1.1600</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>4.6100</td>
</tr>
<tr>
<td>Coeff. of Variability</td>
<td>0.4814</td>
</tr>
<tr>
<td>Minimum</td>
<td>$(828.93)</td>
</tr>
<tr>
<td>Maximum</td>
<td>$66,402</td>
</tr>
<tr>
<td>Range Width</td>
<td>$67,231</td>
</tr>
</tbody>
</table>

## Snap: Value of Equity Simulation Results

<table>
<thead>
<tr>
<th>Percentile</th>
<th>Snap Equity Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>$(828.93)</td>
</tr>
<tr>
<td>10%</td>
<td>$7,219.33</td>
</tr>
<tr>
<td>20%</td>
<td>$9,859.20</td>
</tr>
<tr>
<td>30%</td>
<td>$10,326.75</td>
</tr>
<tr>
<td>40%</td>
<td>$11,785.37</td>
</tr>
<tr>
<td>50%</td>
<td>$13,334.17</td>
</tr>
<tr>
<td>60%</td>
<td>$15,060.80</td>
</tr>
<tr>
<td>70%</td>
<td>$17,200.86</td>
</tr>
<tr>
<td>80%</td>
<td>$20,105.66</td>
</tr>
<tr>
<td>90%</td>
<td>$24,722.66</td>
</tr>
<tr>
<td>100%</td>
<td>$66,402.42</td>
</tr>
</tbody>
</table>
And using a Margin of Safety has a cost..

<table>
<thead>
<tr>
<th>Your Analysis</th>
<th>Stock is under priced</th>
<th>Stock is over priced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock is under priced</td>
<td>A Good Buy</td>
<td>Type 1 investment error: Buy the wrong stock or fail to sell the right stock.</td>
</tr>
<tr>
<td>Stock is over priced</td>
<td>Type 2 investment error: Fail to buy the right stock or sell the wrong one.</td>
<td>A Good Sell</td>
</tr>
</tbody>
</table>

**Does the trade off work in your favor?**
1. Are you more invested in cash than you would like to be?
2. Do you earn a return on your portfolio (cash included) that is more than you would have made investing passively?

**Increase the MOS**
- Price
- Value

Reduce the likelihood of Type 1 errors

Increase the likelihood of Type 2 errors
Myth 4: It’s all about the D in the DCF

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

- Myth 4.1: If you don’t believe in beta, betas or modern portfolio theory, you cannot use betas.
- Myth 4.2: The D is the most important input into a DCF.
- Myth 4.3: Once you have a D, your are stuck with it forever.
- Myth 4.4: The Discount rate is the receptacle for all your hopes & fears
- Myth 4.5: At a zero risk free rate, value becomes infinite and DCF stops working.
The Cost of Equity: A Big Picture Perspective

**Expectation of cash flows across all scenarios, good and bad. Incorporates all risks that affect the asset / business.**

\[
\text{Expected Cash Flows} = \frac{\text{Risk adjusted discount rate}}{\text{Risk free rate in the currency of analysis}} + \text{Relative risk of company/equity in question} \times \text{Equity Risk Premium required for average risk equity}
\]

Aswath Damodaran
Myth 4.1: If you don’t believe in beta or MPT, you cannot use a DCF

The required return on an asset is determined by the "non-diversifiable" or "market" risk and that risk can be measured by looking at prices.

**DIVERSIFIED MARGINAL INVESTOR**

The marginal investor, i.e., the investor who sets prices at the margin, is diversified.

**INFORMATIVE MARKET PRICES**

The movements in stock prices occur primarily because of fundamentals, with noise canceling out.

Since marginal investor holds multiple investments, risks that are firm or even sector specific get averaged out. The only risk that gets incorporated is the risk that cannot be diversified away, i.e., macroeconomic risk exposure.

The exposure to macroeconomic risk can be estimated by looking at how the price of the asset moves relative to the rest of the market.

CAPM: Beta against market portfolio
APM: Betas against unspecified statistical market factors
Multi-factor: Betas against macroeconomic factors
Measuring Relative Risk: You don’t like betas or modern portfolio theory? No problem.

Do you believe that the marginal investors who price risk are diversified?

Yes  
No

Do you believe in price-based risk measures?

Yes

The CAPM

APM

Multi-factor Models

No

Accounting Betas

Cost of Debt based models

Do you believe in price-based risk measures?

Yes

Relative Price Volatility

Proxy Models

The CAPM Plus

Implied Cost of Capital

No

Relative Earnings volatility

Accounting Ratio based models
Myth 4.2: It’s all about D in DCF – The Gordon Growth Model Legacy

Dividend Discount Model value per share of a stock with an expected dividend per share of $1.00 next year and expected growth rate of 3% in perpetuity.
The room to vary on discount rates is limited..
Myth 4.3: Discount Rates cannot change over time.

\[
\text{Value of an asset} = \frac{E(CF_1)}{(1 + r_1)} + \frac{E(CF_2)}{(1 + r_1)(1 + r_2)} + \ldots + \frac{E(CF_n)}{(1 + r_1)(1 + r_2)\ldots(1 + r_n)}
\]

As growth declines and maturity sets in, cost of capital drops for all three firms.

<table>
<thead>
<tr>
<th></th>
<th>Uber (June 2014)</th>
<th>Tesla (July 2016)</th>
<th>Apple (May 2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value with time-varying Discount Rate</td>
<td>$5,695</td>
<td>$22,364</td>
<td>$692,852</td>
</tr>
<tr>
<td>Value with constant Discount Rate</td>
<td>$3,601</td>
<td>$17,688</td>
<td>$633,336</td>
</tr>
<tr>
<td>Effect on value</td>
<td>-38.91%</td>
<td>-20.91%</td>
<td>-8.59%</td>
</tr>
</tbody>
</table>
## A Roadmap for Discount Rates Changing..

<table>
<thead>
<tr>
<th>Phase</th>
<th>Forecast years</th>
<th>Beta</th>
<th>Equity Risk Premium</th>
<th>Debt Ratio</th>
<th>Cost of debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start of valuation</td>
<td>1-2</td>
<td>Reflects current business mix</td>
<td>Current geography of operations</td>
<td>Current market debt ratio</td>
<td>Current bond rating or default risk assessment</td>
</tr>
<tr>
<td>Build up</td>
<td>3-5</td>
<td>Changes in business mix (if any)</td>
<td>Changes in geography (if any)</td>
<td>Targeted debt ratio (if any)</td>
<td>Default risk, given new debt ratio</td>
</tr>
<tr>
<td>Transition</td>
<td>6-10</td>
<td>Move incrementally to stable period beta</td>
<td>Adjust to stable period ERP</td>
<td>Adjust to stable period debt ratio</td>
<td>Adjust to stable period cost of debt</td>
</tr>
<tr>
<td>Stable growth (Steady State)</td>
<td>Year 10 &amp; beyond</td>
<td>Move to 1, if company grows across businesses, or to industry average, if it stays within business</td>
<td>Steady state geographic exposure and equity risk premium estimates for long term.</td>
<td>Market-average debt ratio (if growth across businesses) or industry-average debt ratio (if single business)</td>
<td>Stable company cost of debt</td>
</tr>
</tbody>
</table>
Myth 4.4: The discount rate is the receptacle for all your hopes & fears

For a public company

- Company Specific Risks get reflected in the expected cash flows
- Discount rate is adjusted for only the risk that cannot be diversified away (macro economic risk) by marginal investor
- Business Macro Risk Exposure
- Country Macro Risk Exposure
- Beta
- Country Risk Premium
- Risk-adjusted Discount Rate
- Value
- And probability adjusted to arrive at
- Adjusted Value
- Discrete risks (distress, nationalization, regulatory approval etc.) are brought in through probabilities and value consequences.

For a private business

- Company Specific Risks get reflected in the expected cash flows
- Beta adjusted for total risk
- Risk premium adjusted for company-specific risk
- Discount rate is adjusted (upwards) to reflect all risk that the investor in the private business is exposed to.
- Probability of discrete event
- Value if event occurs
Myth 4.5: When the riskfree rate is near-zero, DCF valuations explode..
And moving just one piece at a time can yield strange numbers. Example: Risk free Rate

Value of a business with $100 million in base year cash flow to equity, growing at 10% a year for next 5 years and 4% forever thereafter. ERP stays at 4%, while risk free rate changes.
But when risk free rates change, Equity risk premiums change.
As do default spreads..
And real growth..
Making the effect on value unpredictable..

**Riskfree Rate and Value: A Dynamic World**

Value of a business with $100 million in base year cash flow to equity, growing 4% faster than the economy for the next 5 years and growth rate = risk free rate forever thereafter. ERP adjusts to reflect a cost of equity of 8%, while risk free rate changes.
Myth 5: It’s all in about your terminal value

Myth 5.1: The only way to estimate terminal value is to use the perpetual growth model.

Myth 5.2: The perpetual growth model can give you an infinite value.

Myth 5.3: Your growth rate cannot be negative in a perpetual growth model.

Myth 5.4: The growth rate is your biggest driver of terminal value.

Myth 5.5: If your terminal value is a high proportion of your DCF value, it is flawed.

Value of an asset with life > n years = \( \frac{E(CF_1)}{(1+r)^1} + \frac{E(CF_2)}{(1+r)^2} + \cdots + \frac{E(CF_n)}{(1+r)^n} + \frac{Terminal\ Value_n}{(1+r)^n} \)
Myth 5.1: There is only one pathway to terminal value.

- **Multiple of Earnings, Revenues or BV**
  - Makes your intrinsic value into a forward pricing
  - Not acceptable

  - Terminal Value in Intrinsic Value
    - Acceptable

    - **Perpetual Growth Model**
      - Cashflows grow at a constant rate forever
    - **Growing or Constant Annuity**
      - Cashflows grow at a constant rate for finite period.
    - **Salvage or Liquidation Value**
      - Cashflow from sale of residual assets
Myths 5.2 & 5.3: Terminal Values can be infinite.. If growth is high enough..

- **Risk free Rate** = Expected Inflation + Expected Real Interest Rate
- The real interest rate is what borrowers agree to return to lenders in real goods/services.
- **Nominal GDP Growth** = Expected Inflation + Expected Real Growth
- The real growth rate in the economy measures the expected growth in the production of goods and services.

The argument for Risk free rate = Nominal GDP growth
1. In the long term, the real growth rate cannot be lower than the real interest rate, since the growth in goods/services has to be enough to cover the promised rate.
2. In the long term, the real growth rate can be higher than the real interest rate, to compensate risk taking.

<table>
<thead>
<tr>
<th>Period</th>
<th>10-Year T.Bond Rate</th>
<th>Inflation Rate</th>
<th>Real GDP Growth</th>
<th>Nominal GDP growth rate</th>
<th>Nominal GDP - T.Bond Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1954-2015</td>
<td>5.93%</td>
<td>3.61%</td>
<td>3.06%</td>
<td>6.67%</td>
<td>0.74%</td>
</tr>
<tr>
<td>1954-1980</td>
<td>5.83%</td>
<td>4.49%</td>
<td>3.50%</td>
<td>7.98%</td>
<td>2.15%</td>
</tr>
<tr>
<td>1981-2008</td>
<td>6.88%</td>
<td>3.26%</td>
<td>3.04%</td>
<td>6.30%</td>
<td>-0.58%</td>
</tr>
<tr>
<td>2009-2015</td>
<td>2.57%</td>
<td>1.66%</td>
<td>1.47%</td>
<td>3.14%</td>
<td>0.57%</td>
</tr>
</tbody>
</table>
A Practical Reason for using the Risk free Rate Cap – Preserve Consistency

- You are implicitly making assumptions about nominal growth in the economy, with your risk free rate. Thus, with a low risk free rate, you are assuming low nominal growth in the economy (with low inflation and low real growth) and with a high risk free rate, a high nominal growth rate in the economy.

- If you make an explicit assumption about nominal growth in cash flows that is at odds with your implicit growth assumption in the denominator, you are being inconsistent and bias your valuations:
  - If you assume high nominal growth in the economy, with a low risk free rate, you will over value businesses.
  - If you assume low nominal growth rate in the economy, with a high risk free rate, you will under value businesses.
Myth 5.4: The biggest assumption in your terminal value is your growth rate

- In the section on expected growth, we laid out the fundamental equation for growth:
  
  \[
  \text{Growth rate} = \text{Reinvestment Rate} \times \text{Return on invested capital} 
  + \text{Growth rate from improved efficiency}
  \]

- In stable growth, you cannot count on efficiency delivering growth and you have to reinvest to deliver the growth rate that you have forecast.

- Consequently, your reinvestment rate in stable growth will be a function of your stable growth rate and what you believe the firm will earn as a return on capital in perpetuity:
  
  - Reinvestment Rate = Stable growth rate/ Stable period ROC = \( \frac{g}{\text{ROC}} \)

- Your terminal value equation can then be rewritten as:

  \[
  \text{Terminal Value in year } n = \frac{\text{EBIT}_{n+1} (1-t)(1-\frac{g}{\text{ROC}})}{(\text{Cost of Capital} - g)}
  \]
Making this implicit assumption your biggest one..

<table>
<thead>
<tr>
<th>Growth rate forever</th>
<th>Return on capital in perpetuity</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>6%</td>
</tr>
<tr>
<td>0.0%</td>
<td>$1,000</td>
</tr>
<tr>
<td>0.5%</td>
<td>$965</td>
</tr>
<tr>
<td>1.0%</td>
<td>$926</td>
</tr>
<tr>
<td>1.5%</td>
<td>$882</td>
</tr>
<tr>
<td>2.0%</td>
<td>$833</td>
</tr>
<tr>
<td>2.5%</td>
<td>$778</td>
</tr>
<tr>
<td>3.0%</td>
<td>$714</td>
</tr>
</tbody>
</table>

Terminal value for a firm with expected after-tax operating income of $100 million in year n+1 and a cost of capital of 10%.
Myth 5.5: The terminal value should not be more than X% of your value today.

- The notion that a DCF becomes less reliable, as the percentage of the value that comes from the terminal value increases, is nonsense.
- The percentage of your DCF value that comes from your terminal value will be a function of the
  - The type of company that you are valuing, with a greater percentage of value coming from the terminal value for growth companies than for matures one.
  - The decision that you make about stretching out your time horizon. You can arbitrarily make the terminal value a lower percent of your overall value by stretching out your forecast period (with no change in your overall value).
Myth 6: DCFs can be “manipulated”

- **Preconceptions and priors**: When you start on the valuation of a company, you almost never start with a blank slate. Instead, your valuation is shaped by your prior views of the company in question.
  - Corollary 1: The more you know about a company, the more likely it is that you will be biased, when valuing the company.
  - Corollary 2: The “closer” you get to the management/owners of a company, the more biased your valuation of the company will become.

- **Value first, valuation to follow**: In principle, you should do your valuation first before you decide how much to pay for an asset. In practice, people often decide what to pay and do the valuation afterwards.
Biasing a DCF valuation: A template of "tricks"

Free Cashflow to Firm
EBIT (1 - tax rate)
- (Cap Ex - Depreciation)
- Change in non-cash WC
= Free Cashflow to firm

Expected Growth in FCFF during high growth

If you want to increase (decrease) value, you can
1. Assume a longer (shorter) growth period
2. Assume more (less) excess returns over the growth period

Stable Growth
When operating income and FCFF grow at constant rate forever.

If you want to increase value, you can
1. Use stable growth rates that are economically impossible (higher than the growth rate of the economy)
2. Allow this growth to be accompanied by high positive excess returns (low reinvestment)

If you want to decrease value, you can
1. Use lower growth rates in perpetuity
2. Accompany this growth with high negative excess returns

Cost of Capital
Weighted average of cost of equity & cost of debt

Value of Operating Assets today
+ Cash & non-operating assets
- Debt
Value of equity

If you want to increase (decrease) value, you can
add (subtract) premiums (discounts) for things you like (dislike) about the company.
Premiums: Control, Synergy, liquidity
Discounts: Illiquidity, private company

If you want to increase (decrease) value, you can
1. Augment (haircut) earnings
2. Reduce (increase) effective tax rate
3. Ignore (Count in) unconventional cap ex
4. Narrow (Broaden) definition of working capital

If you want higher (lower) value, you can
1. Use higher (lower) growth rates
2. Assume less (more) reinvestment with the same growth rate, thus raising (lowering) the quality and value of growth.

If you want to increase (decrease) value, you can
1. Use higher (lower) growth rates
2. Assume less (more) reinvestment with the same growth rate, thus raising (lowering) the quality and value of growth.

If you want to increase (decrease) value, you can
1. Augment (haircut) earnings
2. Reduce (increase) effective tax rate
3. Ignore (Count in) unconventional cap ex
4. Narrow (Broaden) definition of working capital
If you are the producer of the valuation, here is what you can do about bias...

- Try to minimize exposure to factors that may increase your bias
  - Don’t depend on management for your earnings/cash flows
  - Don’t tie your compensation to the outcome of the valuation
- Be honest with yourself about your biases.
  - Practice some “Bayesian Valuation”, i.e., be aware of your priors
- If you are going to bias your valuation, at least have the good sense to try to hide your bias well.
# The Myth of Fairness Opinions

<table>
<thead>
<tr>
<th>Tesla Valuation/ Pricing</th>
<th>Solar City Valuation/ Pricing</th>
<th>Implied Exchange Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Evercore</strong></td>
<td><strong>Lazard</strong></td>
<td><strong>Evercore</strong></td>
</tr>
<tr>
<td><strong>Cash flows used</strong></td>
<td><strong>Instructed by Tesla Board</strong> to use 1. Goldman Sachs Equity Research (GSER) forecasts for 2016-2020 2. IBES consensus forecasts</td>
<td><strong>Solar City supplied forecasts</strong> of cash flows with 1. Unrestricted access to capital markets (LIQ) 2. Restricted access to capital markets (NOLIQ)</td>
</tr>
<tr>
<td><strong>Discount Rate</strong></td>
<td>10-12% (Cost of capital)</td>
<td>12-13% (Cost of capital)</td>
</tr>
<tr>
<td><strong>Terminal Value</strong></td>
<td>6-8% growth rate in perpetuity</td>
<td>10-18 times EBITDA</td>
</tr>
<tr>
<td><strong>Value per share</strong></td>
<td>GSER: $88.36-$302.21  IBES: $132.92-$451.02</td>
<td>GSER: $145-$270  IBES: Not done/reported</td>
</tr>
<tr>
<td><strong>Compensation Received</strong></td>
<td><strong>Evercore</strong>: $1.25 million as opinion fee + $5.75 million contingent on deal happening  <strong>Lazard</strong>: $2 million + 0.4% of equity value of Solar City contingent on deal happening</td>
<td></td>
</tr>
</tbody>
</table>

47
If you are the consumer of the valuation, here is your bias checklist..

<table>
<thead>
<tr>
<th>Question</th>
<th>Green</th>
<th>Red</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Who is paying you to do this valuation and how much? Is any of the payment contingent on the deal happening?</td>
<td>Payment reflects reasonable payment for valuation services rendered and none of the payment is contingent on outcome</td>
<td>Payment is disproportionately large, relative to valuation services provided, and/or a large portion of it is contingent on deal occurring</td>
</tr>
<tr>
<td>2. Where are you getting the cash flows that you are using in this valuation?</td>
<td>Appraiser estimates revenues, operating margins and cash flows, with input from management on investment and growth plans.</td>
<td>Cash flows supplied by management/board of company.</td>
</tr>
</tbody>
</table>
| 3. Are the cash flows internally consistent?                   | 1. Currency: Cash flows & discount rate are in same currency, with same inflation assumptions.  
2. Claim holders: Cash flows are to equity (firm) and discount rate is cost of equity (capital).  
3. Operations: Reinvestment, growth and risk assumptions matched up. | No internal consistency tests run and/or DCF littered with inconsistencies, in currency and/or assumptions.  
- High growth + Low reinvestment  
- Low growth + High reinvestment  
- High inflation in cash flows + Low inflation in discount rate |
| 4. What discount rate are you using in your valuation?         | A cost of equity (capital) that starts with a sector average and is within the bounds of what is reasonable for the sector. | A cost of equity (capital) that falls outside the normal range for a sector, with no credible explanation for difference. |
| 5. How are you applying closure in your valuation?             | A terminal value that is estimated with a perpetual growth rate > growth rate of the economy and reinvestment & risk to match. | A terminal value based upon a perpetual growth rate > economy or a multiple (of earnings or revenues) that is not consistent with a healthy, mature firm. |
| 6. What valuation garnishes have you applied?                  | None.                                                                | A large dose of premiums (control, synergy etc.) pushing up value or a mess of discounts (illiquidity, small size etc.) pushing down value. |
| 7. What does your final judgment in value look like?           | A distribution of values, with a base case value and statistics.      | A range of value so large that any price can be justified. |
Myth 7: You cannot value the “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>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>

Aswath Damodaran
## Valuing a Franchise: Star Wars

**Star Wars Franchise Valuation: December 2015**

<table>
<thead>
<tr>
<th>Add-on $ per Box Office $</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Streaming/Video</td>
<td>$1.20</td>
</tr>
<tr>
<td>Toys &amp; Merchandise</td>
<td>$2.00</td>
</tr>
<tr>
<td>Books/eBooks</td>
<td>$0.20</td>
</tr>
<tr>
<td>Gaming</td>
<td>$0.50</td>
</tr>
<tr>
<td>Other</td>
<td>$0.50</td>
</tr>
</tbody>
</table>

### Add on $ per box office $

- **Main Movies**
  - World Box office of $1.5 billion, adjusted for 2% inflation.

- **Spin Off Movies**
  - World Box office is 50% of main movies.

### Operating Margin

- 20.14% for movies
- 15% for non-movies
- 30% tax rate

### Assumes that revenues from add ons continue after 2020, growing at 2% a year, with 15% operating margin

### Summary

- Value of new Star Wars movies = $4,809
- Value of continuing income = $5,163
- Value of Star Wars = $9,972
Many old time value investing books recommend that you be conservative in your estimate of value, essentially arguing that if you are going to make a mistake, you are better off under valuing a company than over valuing it.

Mechanically, this translates in your DCF valuation into:

- Using “lower” than expected cash flows, either by haircutting the cash flows or counting only the growth that you believe is certain. At the limit, this often takes the form of using only the cash flows that you see (dividends).
- Use “higher” discount rates than you should, given the risk and market price for risk.
- Making post-valuation adjustments to value for other concerns (illiquidity, corporate governance) that you have as an investor.
The cost to being conservative in your value estimates

<table>
<thead>
<tr>
<th>Your Analysis</th>
<th>Stock is under priced</th>
<th>Stock is over priced</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stock is under priced</td>
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<td>Type 1 investment error: Buy the wrong stock or fail to sell the right stock.</td>
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<tr>
<td>Stock is over priced</td>
<td>Type 2 investment error: Fail to buy the right stock or sell the wrong one.</td>
<td>A Good Sell</td>
</tr>
</tbody>
</table>

**Does the trade off work in your favor?**
1. Are you more invested in cash than you would like to be?
2. Are you a long only investor or can you sell short?
3. Do you earn a return on your portfolio (cash included) that is more than you would have made investing passively?

- Reduce the likelihood of Type 1 errors
- Increase the likelihood of Type 2 errors
- Underestimate cashflows
- Underestimate the value of the company
- Overestimate discount rate
Myth 9: A DCF is static

- **Uncertainty at a point in time:** In standard valuation, you are forced to make point estimates for inputs where you are uncertain about values.
  - In statistical terms, you are being asked to compress a probability distribution about a variable into an expected value.
  - You then obtain a single estimate of value, based upon your base case or expected values.

- **Uncertainty across time:** That value will change over time, as new information comes out about the firm and macro economic conditions change.
Shell’s Revenues & Oil Prices

Shell: Revenues vs Oil Price

Revenues = 39,992.77 + 4,039.39 * Average Oil Price
R squared = 96.44%
Revenue calculated from the oil price drawn from distribution
Revenue = 39992.77 + 4039.40 * Oil Price/Barrel

Pre-tax Operating Income based on revenue & selected margin
Pre-tax Operating Income = Revenues * Operating Margin

Value Shell based on operating income, assuming other assumptions (tax rate, revenue growth, cost of capital)

Percentiles:  
0%  $6.55  
10%  $23.90  
20%  $27.73  
30%  $30.89  
40%  $33.88  
50%  $35.99  
60%  $40.28  
70%  $44.22  
80%  $49.24  
90%  $57.49  
100% $197.11
## b. Uncertainty across time: How narratives change

<table>
<thead>
<tr>
<th>Narrative Break/End</th>
<th>Narrative Shift</th>
<th>Narrative Change (Expansion or Contraction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Events, external (legal, political or economic) or internal (management, competitive, default), that can cause the narrative to break or end.</td>
<td>Improvement or deterioration in initial business model, changing market size, market share and/or profitability.</td>
<td>Unexpected entry/success in a new market or unexpected exit/failure in an existing market.</td>
</tr>
<tr>
<td>Your valuation estimates (cash flows, risk, growth &amp; value) are no longer operative</td>
<td>Your valuation estimates will have to be modified to reflect the new data about the company.</td>
<td>Valuation estimates have to be redone with new overall market potential and characteristics.</td>
</tr>
<tr>
<td>Estimate a probability that it will occur &amp; consequences</td>
<td>Monte Carlo simulations or scenario analysis</td>
<td>Real Options</td>
</tr>
</tbody>
</table>

Aswath Damodaran
a. A Story Break? Valeant, the Star...

Valeant continues on its path of acquisition-driven growth, with a compounded revenue growth of 12% a year for the next 10 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues</th>
<th>Operating Margin</th>
<th>Operating Income</th>
<th>After-tax Operating Income</th>
<th>- Reinvestment</th>
<th>FCFF</th>
<th>Terminal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$9,990</td>
<td>49.82%</td>
<td>$4,977</td>
<td>$4,654</td>
<td>$2,506</td>
<td>$2,506</td>
<td>$101,258</td>
</tr>
<tr>
<td>1</td>
<td>$11,189</td>
<td>49.82%</td>
<td>$5,574</td>
<td>$5,213</td>
<td>$2,807</td>
<td>$1,847</td>
<td>$1,420</td>
</tr>
<tr>
<td>2</td>
<td>$12,532</td>
<td>49.82%</td>
<td>$6,243</td>
<td>$5,838</td>
<td>$3,144</td>
<td>$2,069</td>
<td>$30,883</td>
</tr>
<tr>
<td>3</td>
<td>$14,095</td>
<td>49.82%</td>
<td>$6,992</td>
<td>$6,539</td>
<td>$3,521</td>
<td>$2,317</td>
<td>$71,795</td>
</tr>
<tr>
<td>4</td>
<td>$15,720</td>
<td>49.82%</td>
<td>$7,832</td>
<td>$7,323</td>
<td>$3,944</td>
<td>$2,595</td>
<td>$208.16</td>
</tr>
<tr>
<td>5</td>
<td>$17,606</td>
<td>49.82%</td>
<td>$8,771</td>
<td>$8,202</td>
<td>$4,417</td>
<td>$2,906</td>
<td>$208.16</td>
</tr>
<tr>
<td>6</td>
<td>$19,719</td>
<td>49.82%</td>
<td>$9,824</td>
<td>$9,186</td>
<td>$4,947</td>
<td>$3,255</td>
<td>$208.16</td>
</tr>
<tr>
<td>7</td>
<td>$22,085</td>
<td>49.82%</td>
<td>$11,003</td>
<td>$10,289</td>
<td>$5,540</td>
<td>$3,646</td>
<td>$208.16</td>
</tr>
<tr>
<td>8</td>
<td>$24,735</td>
<td>49.82%</td>
<td>$12,323</td>
<td>$11,523</td>
<td>$6,205</td>
<td>$4,083</td>
<td>$208.16</td>
</tr>
<tr>
<td>9</td>
<td>$27,708</td>
<td>49.82%</td>
<td>$13,802</td>
<td>$12,906</td>
<td>$6,950</td>
<td>$4,573</td>
<td>$208.16</td>
</tr>
<tr>
<td>10</td>
<td>$31,028</td>
<td>49.82%</td>
<td>$15,458</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Operating margin settles in at 49.82%, Valeant’s operating margin (prior to acquisition expenses).

Effective tax rate stays at 16.51%.

Valeant maintains its current ROIC of 19.90% as its grows, with reinvestment rate =g/ 19.90%.

Valeant’s continues its use of debt in funding acquisitions. This creates a tax benefit, without substantial default risk. Cost of capital for the firm is 7.72%.
To Valeant, the Dog!

Valeant settles for mature drug company growth, with a compounded revenue growth of 3% a year for the next 10 years. Accounting adjustments reduce base year revenues by 2%.

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues</th>
<th>Operating Margin</th>
<th>Operating Income</th>
<th>After-tax Operating Income</th>
<th>Reinvestment</th>
<th>FCFF</th>
<th>Terminal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>$10,346</td>
<td>40.39%</td>
<td>$4,179</td>
<td>$3,443</td>
<td>$627</td>
<td>[$627]</td>
<td>$45,051</td>
</tr>
<tr>
<td>1</td>
<td>$10,656</td>
<td>40.39%</td>
<td>$4,304</td>
<td>$3,546</td>
<td>$645</td>
<td>$2,798</td>
<td>$44,488</td>
</tr>
<tr>
<td>2</td>
<td>$10,976</td>
<td>40.39%</td>
<td>$4,433</td>
<td>$3,653</td>
<td>$665</td>
<td>$2,882</td>
<td>$44,488</td>
</tr>
<tr>
<td>3</td>
<td>$11,305</td>
<td>40.39%</td>
<td>$4,566</td>
<td>$3,762</td>
<td>$685</td>
<td>$2,968</td>
<td>$44,488</td>
</tr>
<tr>
<td>4</td>
<td>$11,645</td>
<td>40.39%</td>
<td>$4,703</td>
<td>$3,875</td>
<td>$705</td>
<td>$3,057</td>
<td>$44,488</td>
</tr>
<tr>
<td>5</td>
<td>$11,994</td>
<td>40.39%</td>
<td>$4,844</td>
<td>$3,991</td>
<td>$726</td>
<td>$3,149</td>
<td>$44,488</td>
</tr>
<tr>
<td>6</td>
<td>$12,354</td>
<td>40.39%</td>
<td>$4,990</td>
<td>$4,111</td>
<td>$748</td>
<td>$3,243</td>
<td>$44,488</td>
</tr>
<tr>
<td>7</td>
<td>$12,724</td>
<td>40.39%</td>
<td>$5,139</td>
<td>$4,234</td>
<td>$771</td>
<td>$3,341</td>
<td>$44,488</td>
</tr>
<tr>
<td>8</td>
<td>$13,106</td>
<td>40.39%</td>
<td>$5,294</td>
<td>$4,362</td>
<td>$794</td>
<td>$3,441</td>
<td>$44,488</td>
</tr>
<tr>
<td>9</td>
<td>$13,499</td>
<td>40.39%</td>
<td>$5,452</td>
<td>$4,492</td>
<td>$817</td>
<td>$3,544</td>
<td>$44,488</td>
</tr>
<tr>
<td>10</td>
<td>$13,904</td>
<td>40.39%</td>
<td>$5,616</td>
<td></td>
<td>$976</td>
<td>$3,516</td>
<td></td>
</tr>
</tbody>
</table>

- Operating margin drops to 40.39%, as half of acquisition expenses are moved back to operating expenses.
- Effective tax rate rises to 20% as acquisition tax shields dissipate.
- Valeant maintains its ROIC of 16.01% as it grows, with reinvestment rate = g/ 16.01%.

Valeant’s debt is exposing the company to default risk, as rating drops to below investment grade. Cost of capital for the firm is 8.29%. There is also a 5% chance that the firm will default (and receive only 75% of fair value.)

Value per share: $43.56
Myth 10: DCFs are academic

Tools for intrinsic analysis
- Discounted Cashflow Valuation (DCF)
- Intrinsic multiples
- Book value based approaches
- Excess Return Models

Drivers of intrinsic value
- Cashflows from existing assets
- Growth in cash flows
- Quality of Growth

Drivers of "the gap"
- Information
- Liquidity
- Corporate governance

Tools for pricing
- Multiples and comparables
- Charting and technical indicators
- Pseudo DCF

Drivers of price
- Market moods & momentum
- Surface stories about fundamentals

Tools for "the gap"
- Behavioral finance
- Price catalysts

Value of cashflows, adjusted for time and risk

INTRINSIC VALUE → THE GAP
Value → Is there one? Will it close?

PRICE

Drivers of "the gap"
The Value dilemma and ways of dealing with it...

- Uncertainty about the magnitude of the gap:
  - Margin of safety: Many value investors swear by the notion of the “margin of safety” as protection against risk/uncertainty.
  - Collect more information: Collecting more information about the company is viewed as one way to make your investment less risky.
  - Ask what if questions: Doing scenario analysis or what if analysis gives you a sense of whether you should invest.
  - Confront uncertainty: Face up to the uncertainty, bring it into the analysis and deal with the consequences.

- Uncertainty about gap closing: This is tougher and you can reduce your exposure to it by
  - Lengthening your time horizon
  - Providing or looking for a catalyst that will cause the gap to close.
Do you have faith?

Figure 11.3: Apple, Price and Value - 2010 to 2015
Because you will be tested..

Amazon: Price versus DCF value - 1999 to 2015

Aswath Damodaran
Dealing with Dysfunction

The DCF Hall of Shame
1. The Chimera DCF

• The **Chimera DCF** makes basic consistency mistakes.
• It mixes dollar cash flows with peso discount rates, nominal cash flows with real costs of capital and cash flows before debt payments with costs of equity.
• The end result is junk.
2. The Dreamstate DCF

- In a Dreamstate DCF, you build amazing companies on spreadsheets, making outlandish assumptions about growth and operating margins over time.
- Put differently, the only place this company can exist is in your dreams.
3. The Dissonant DCF

- In a **Dissonant DCF**, assumptions about growth, risk and cash flows are not consistent with each other, with little or no explanation given for the mismatch.
- Thus, you can have companies that grow without reinvestment and profit without risk forever.
4. The Trojan Horse DCF

- In a *Trojan Horse DCF*, analysts use the Trojan Horse of cash flows to smuggle in a pricing (in the form of a terminal value, estimated by using a multiple).
- It provides the illusion of a DCF when what you are doing is a forward pricing.
5. The Kabuki DCF

- A Kabuki DCF is a work of art, where analyst goes through the motions of valuation, with the end value never in doubt.
- The intent is developing models that are legally or accounting-rule defensible rather than yielding reasonable values.
In a Robo DCF, the valuation almost runs itself, with most or all of the inputs being outsourced (management, outside services, other analysts) and the model itself becoming mechanized.

With data online and computer-built models, the future is here.

If you want a Robo DCF, try uValue. It works on an iPhone or an iPad.
7. Mutant DCFs

- A Mutant DCF is a collection of numbers where items have familiar names (free cash flow, cost of capital) but are defined in strange ways.

- Using EBITDA as cash flow and a made-up number as your discount rate is one way to get there, but there are others...
Don’t do a DCF, when your job is pricing, and better to do a good pricing than a bad DCF.

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