Valuation
Some Initial Thoughts

"One hundred thousand lemmings cannot be wrong"
Misconceptions about Valuation

Myth 1: A valuation is an objective search for “true” value

Truth 1.1: One’s understanding of a valuation model is inversely proportional to the number of inputs required for the model.

Truth 1.2: The direction and magnitude of the bias in your valuation is greatest when valuation is least precise.

Myth 2: A good valuation provides a precise estimate of value

Truth 2.1: The payoff to valuation is greatest when valuation is least precise.

Truth 2.2: There are no precise valuations proportional to who pays you and how much you are paid.

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 which direction.

Truth 3.2: Simpler valuation models do much better than complex ones.

Truth 3.3: The more quantitative a model, the better the valuation.
Approaches to Valuation

Discounted cashflow valuation, relates the value of an asset to the present value of expected future cashflows on that asset.

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

Contingent claim valuation, uses option pricing models to measure the value of assets that share option-like characteristics.

Discounted cashflow valuation, relates the value of an asset to the present value of expected future cashflows on that asset.
Aswath Damodaran

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. Present value of the expected cash flows on the asset.

**Information Needed:**
- 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.

**Information Needed:** To use discounted cash flow valuation, you need...
The value of the firm is obtained by discounting expected cashflows to the firm, i.e., the residual cashflows after meeting all operating expenses and taxes, but prior to debt payments, at the weighted average cost of capital, which is the cost of the different components of financing used by the firm, weighted by their market value proportions. The value of the firm is obtained by discounting expected cashflows to the firm, i.e., the residual cashflows to the firm, weighted by their market value proportions, at the weighted average cost of capital.

\[
\text{Value of Firm} = \sum_{t=1}^{\infty} \frac{\text{CF to Firm}_t}{(1 + \text{WACC})^t}
\]

**Valuing a Firm**
Discounted Cashflow Valuation

**Cashflow to Firm**

- EBIT (1-t)
- (Cap Ex - Dep)
- Change in WC

**Expected Growth**

- Reinvestment Rate
- Return on Capital

**Terminal Value**

- FCFF_n+1 / (r - g_n)

**Cost of Equity**

- (Riskfree Rate + Default Spread)

**Cost of Debt**

- (1 - t)

**WACC**

- Weighted Average Cost of Capital

- Value of Operating Assets + Cash & Non-op Assets

- Value of Firm - Value of Debt = Value of Equity

**Riskfree Rate**

- No default risk
- No reinvestment risk
- In same currency and terms

**Beta**

- Measures market risk

**Beta Risk**

- Premium for average risk investment

**Type of Business**

- Operating
- Financial

**Leverage**

- Operating Leverage
- Financial Leverage

**Country Risk**

- Premium

**Premium Country Risk**
Current Cashflow to Firm:

\[ \text{EBIT}(1-t) - Nt CpX - Chg WC = \text{FCFF} \]

Reinvestment Rate = 35.2%

Expected Growth in EBIT \((1-t)\) = \(0.6422 \times 0.1662 = 0.1068\)

Stable Growth:

\(g = 4\%\); Beta = 1.00; Country Premium = 0%

Cost of capital = 8.08%

ROC = 8.08%; Tax rate = 30%

Reinvestment Rate = 49.5%

Terminal Value:

\[ \frac{\text{FCFF}}{\text{Cost of capital} - \text{growth}} = \frac{113.79}{0.0808 - 0.04} = 2,780 \]

Cost of Equity = 9.71%

Cost of Debt = (5.1% + 0.35% + 1.8%)(1 - 0.2449) = 5.47%

Weights:

\(E = 79.9\%\), \(D = 20.1\%\)

Discount at Cost of Capital (WACC) = 9.71% \((0.799) + 5.47\% \times 0.201\) = 8.85%

Firm Value:

\[ \text{Value/Share} = \frac{2,084 + \text{Cash} - \text{Debt}}{\text{Equity}} \]

Titan Cements: Status Quo

Reinvestment Rate = 64.22%

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]

Term Year:

Year 1: 155.77
Year 2: 172.40
Year 3: 190.81
Year 4: 211.18
Year 5: 233.72

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]

Term Year:

Year 1: 155.77
Year 2: 172.40
Year 3: 190.81
Year 4: 211.18
Year 5: 233.72

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]

Term Year:

Year 1: 155.77
Year 2: 172.40
Year 3: 190.81
Year 4: 211.18
Year 5: 233.72

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]

Term Year:

Year 1: 155.77
Year 2: 172.40
Year 3: 190.81
Year 4: 211.18
Year 5: 233.72

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]

Term Year:

Year 1: 155.77
Year 2: 172.40
Year 3: 190.81
Year 4: 211.18
Year 5: 233.72

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]

Term Year:

Year 1: 155.77
Year 2: 172.40
Year 3: 190.81
Year 4: 211.18
Year 5: 233.72

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]

Term Year:

Year 1: 155.77
Year 2: 172.40
Year 3: 190.81
Year 4: 211.18
Year 5: 233.72

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]

Term Year:

Year 1: 155.77
Year 2: 172.40
Year 3: 190.81
Year 4: 211.18
Year 5: 233.72

Return on Capital = 16.62%

Expected Growth in EBIT \((1-t)\):

\[ 16.62\% \times 0.6422 \times 0.1662 = 1.068 \%
\]
Discounted Cash Flow Valuation: High Growth with Negative Earnings

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

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

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

Value of Firm - Value of Debt = Value of Equity

Value of Equity - Equity Options = Value of Equity in Stock

riskfree rate:
- No default risk
- No reinvestment risk
- In same currency and term (real or nominal as cash flows)

Beta:
- Measures market risk

Risk Premium:
- Premium for average risk investment

Type of Business
- Operating
- Financial

Leverage
- Base Equity
- Operating Leverage
- Financial Leverage

Premium
- Country Risk
- Premium

Weights
- Based on Market Value

Cost of Debt = Value of Debt / (Value of Debt + Equity)

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

Discounted Value = FCFF = Revenue * Op Margin (1 - t) - Reinvestment

EBIT

Reinvestment

Sales Turnover

Competitive Advantages

Margins

Expected Growth

Current Revenue

EBIT

NOLs - Tax Rate

FCFF = FCFF1 + FCFF2 + FCFF3 + FCFF4 + FCFF5

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

Amazon.com

January 2000

Stock Price = $ 84

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

Cost of Equity 12.90%
Cost of Debt 6.5% + 1.5% = 8.0%
Tax rate = 0% -> 35%

Debt = 1.2% -> 15%

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

Riskfree Rate: T. Bond rate = 6.5%

Beta 1.60 -> 1.00

Revenue $ 1,117

Current Margin: -36.71%

Growth: 42%

Expected Margin: -> 10.00%

Reinvestment:
Cap ex includes acquisitions
Sales Turnover

Stable Growth
Stable Operating Margin: 10.00%
Stable ROC = 20%

Stable Revenue Growth: 6%
Stable Revenue Growth: 20%

Competitive Advantages

Current

Operating Margin: 10.00%

EBIT 3.0%

Sales Turnover

EBIT (1-t)

NOL: 500 m

Value of Equity $14,396

Cost of Equity 12.90% 12.90% 12.90% 12.90% 12.90% 12.42% 12.30% 12.10% 11.70% 10.50%

Cost of Debt 8.00% 8.00% 8.00% 8.00% 8.00% 7.80% 7.75% 7.67% 7.50% 7.00%

Cost of Capital 12.84% 12.84% 12.84% 12.83% 12.81% 12.13% 11.96% 11.70% 11.15% 9.61%

Revenues $ 2,793  5,585  9,774  14,661 19,059 23,862 28,729 33,211 36,798 39,006

EBIT-$373 -$94 $407 $1,038 $1,628 $2,212 $2,768 $3,261 $3,646 $3,883

EBIT (1-t)-$373 -$94 $407 $871 $1,058 $1,438 $1,799 $2,119 $2,370 $2,524

- Reinvestment $559 $931 $1,396 $1,629 $1,466 $1,601 $1,623 $1,494 $1,196 $736

FCFF -$931-$1,024-$989 -$758 -$408 -$163$177 $625 $1,174 $1,788

Country Risk Premium 4%

Internet/Retail Operating Leverage Current D/E: 1.21%

Base Equity Premium Country Risk 3.43%
I. Discount Rates: Cost of Equity

Cost of Equity = Riskfree Rate + Beta * (Risk Premium)

1. Historical Premium
   - Mature Equity Market Premium: Average premium earned by stocks over T-Bonds in U.S.
   - Country Equity Market Premium = Average premium earned by Country bond

2. Country Risk Premium = Country Default Spread * (σ Equity / σ Country bond)

Preferably, a bottom-up beta, leverage, and risk-free rate (real or nominal) as the cash flows and defined in the same terms as the cash flows, has to be in the same currency as cash flows, and defined in the same terms as the cash flows.
You are valuing a Greek company in Euros and are attempting to estimate a risk-free rate to use in the analysis. The risk-free rate that you should use is the interest rate on a Euro-denominated Greek government bond (5.10%).

The interest rate on a Euro-denominated Greek government bond (5.45%)

The interest rate on a nominal drachma-denominated Greek government bond

The interest rate on a Euro-denominated Greek government bond

A Simple Test
The historical premium is the premium that stocks have historically earned over riskless securities. Practitioners never seem to agree on the premium; it is sensitive to:

- How far back you go in history...
- Whether you use geometric or arithmetic averages.
- Whether you use T-bill rates or T-bond rates.

For instance, looking at the US:

<table>
<thead>
<tr>
<th>Historical Period</th>
<th>Stocks - T.Bills</th>
<th>Stocks - T.Bonds</th>
</tr>
</thead>
<tbody>
<tr>
<td>1928-2001</td>
<td>10.62%</td>
<td>8.09%</td>
</tr>
<tr>
<td>1962-2001</td>
<td>5.89%</td>
<td>4.68%</td>
</tr>
<tr>
<td>1921-2001</td>
<td>3.17%</td>
<td>2.12%</td>
</tr>
</tbody>
</table>

Practitioners never seem to agree on the premium; it is sensitive to over riskless securities. The historical premium is the premium that stocks have historically earned.
Everyone uses historical premiums, but..
<table>
<thead>
<tr>
<th>Country</th>
<th>Rating</th>
<th>Default Spread (in basis points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Austria</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Belgium</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Denmark</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Finland</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>France</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Germany</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Greece</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Ireland</td>
<td>Aa2</td>
<td>24</td>
</tr>
<tr>
<td>Italy</td>
<td>Aa3</td>
<td>35</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Norway</td>
<td>Aa3</td>
<td>22</td>
</tr>
<tr>
<td>Portugal</td>
<td>A3</td>
<td>15</td>
</tr>
<tr>
<td>Sweden</td>
<td>Aa1</td>
<td>45</td>
</tr>
<tr>
<td>Switzerland</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Spain</td>
<td>Aa1</td>
<td>15</td>
</tr>
<tr>
<td>Country</td>
<td>Rating</td>
<td>Default Spread</td>
</tr>
<tr>
<td>-------------</td>
<td>--------</td>
<td>----------------</td>
</tr>
<tr>
<td>Croatia</td>
<td>Baa3</td>
<td>130</td>
</tr>
<tr>
<td>Cyprus</td>
<td>A2</td>
<td>90</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>Baa1</td>
<td>120</td>
</tr>
<tr>
<td>Hungary</td>
<td>B3</td>
<td>650</td>
</tr>
<tr>
<td>Latvia</td>
<td>Baa2</td>
<td>145</td>
</tr>
<tr>
<td>Lithuania</td>
<td>Baa1</td>
<td>120</td>
</tr>
<tr>
<td>Moldova</td>
<td>B3</td>
<td>650</td>
</tr>
<tr>
<td>Poland</td>
<td>Baa1</td>
<td>130</td>
</tr>
<tr>
<td>Russia</td>
<td>B3</td>
<td>550</td>
</tr>
<tr>
<td>Romania</td>
<td>Baa1</td>
<td>120</td>
</tr>
<tr>
<td>Slovenia</td>
<td>A2</td>
<td>90</td>
</tr>
<tr>
<td>Turkey</td>
<td>Baa3</td>
<td>145</td>
</tr>
</tbody>
</table>
Country ratings measure default risk. While default risk premiums and equity risk premiums are highly correlated, one would expect equity spreads to be higher than debt spreads.

• One way to adjust the country spread upwards is to use information from the US market. In the US, the equity risk premium has been roughly twice the default spread on junk bonds.

• Another is to multiply the bond spread by the relative volatility of stock and bond prices in that market. For example,

\[
\text{Adjusted Equity Spread} = \frac{0.32}{0.16} = 0.70\%
\]

\[
\text{Standard Deviation in Greek Euro Bond} = 16\%
\]

\[
\text{Standard Deviation in Greek ASE(Equity)} = 32\%
\]

One way to adjust the country spread upwards is to use information from the US market. In the US, the equity risk premium has been roughly twice the default spread on junk bonds.

Risk premiums are highly correlated, one would expect equity spreads to be higher than default spreads. Country raters measure default risk, while default risk premiums and equity risk premiums are highly correlated.
From Country Spreads to Corporate Risk Premiums

Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,

$$E(\text{Return}) = \text{Riskfree Rate} + \beta (\text{US premium} + \lambda (\text{Country Spread}))$$

Implicitly, this is what you are assuming when you use the local government’s dollar borrowing rate as your risk-free rate. Their revenues come from non-domestic sales (perhaps based upon the proportion of their revenue coming from non-domestic sales), they have different exposures to country risk (perhaps based upon the proportion of their revenue coming from non-domestic sales).

Approach 2: Treat country risk as a separate risk factor and allow firms to have different exposures to country risk. In this case,

$$E(\text{Return}) = \text{Riskfree Rate} + \beta (\text{US premium} + \text{Country Spread})$$

Approach 3: Treat country risk as a separate risk factor and allow firms to have different exposures to country risk (perhaps based upon the proportion of their revenue coming from non-domestic sales).
Different companies should be exposed to different degrees to country risk. A company’s risk exposure is determined by where it does business and not by where it is located.

The factor \( \lambda \) measures the relative exposure of a firm to country risk. One simplistic solution would be to do the following:

\[
\lambda = \frac{\% \text{ of revenues domestically firm}}{\% \text{ of revenues domestically avg firm}}
\]

For instance, if a firm gets 35% of its revenues domestically while the average firm in that market gets 70% of its revenues domestically, \( \lambda = \frac{35\%}{70\%} = 0.5 \).

There are two implications:

- A firm’s risk exposure is determined by where it does business and not by where it is located.
- Firms might be able to actively manage their country risk exposures.

Assume that the beta for Titan Cements is 0.98, and that the risk-free rate used:

\[ \text{E(Return)} = 5.10\% + 0.98 \times (5.17\% + 0.70\%) = 10.66\% \]

Titan is less exposed to country risk than the typical Greek firm since it gets about 50% of its revenues in Greece; the average for Greek firms is about 70%.

Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,

\[ \text{E(Return)} = 5.10\% + 0.98 \times 0.70\% + 0.70\% = 10.87\% \]

Approach 2: Assume that a company’s exposure to country risk is similar to its exposure to other market risk.

\[ \text{E(Return)} = 5.10\% + 0.98 \times (5.17\% + 0.70\%) = 10.83\% \]

Approach 3: Treat country risk as a separate risk factor and allow firms to have different exposures to country risk. Perhaps based upon the proportion of their revenues come from non-domestic sales or the proportion of their non-domestic sales.

\[ \text{E(Return)} = 5.10\% + 0.98 \times 0.70\% + 0.70\% = 10.66\% \]

Titan is less exposed to country risk than the typical Greek firm since it gets about 50% of its revenues in Greece; the average for Greek firms is about 70%.
An implied equity risk premium is a forward-looking estimate based upon how stocks are priced today and expected cashflows in the future. On January 1, 2002, for instance, these were the facts for the United States.

- Level of the index = 1148
- Treasury bond rate = 5.05%
- Expected growth rate in earnings (next 5 years) = 10.3% (Consensus estimate for S&P 500)
- Expected growth rate after year 5 = 5.05%
- Dividends + stock buybacks = 2.74% of index (Current year)

Expected dividends and buybacks in year 6 = 51.39 (1.0505) $ 54.73

\[
1148 = \frac{34.72}{1+r} + \frac{38.30}{(1+r)^2} + \frac{42.24}{(1+r)^3} + \frac{46.59}{(1+r)^4} + \frac{51.39 + \frac{54.73}{r - 0.0505}}{(1+r)^5}
\]

Solving for \( r \): \( r = 8.67\% \)

Implied risk premium = 8.67% - 5.05% = 3.62%
U.S. Equity Risk Premia - 1960 - 2002

Implied Premium for U.S. Equity Market
The historical risk premium of 5.17% for the United States is too high a premium to use in valuation. It is much higher than the actual implied equity risk premium in the market.

The current implied equity risk premium requires us to assume that the market is correctly priced today. (If I were required to be market neutral, this is the premium I would use.)

The average implied equity risk premium between 1960-2001 in the United States is about 4%. We will use this as the premium for a mature equity market.
Implied Premium for Greek Market: May 1, 2002

Aswath Damodaran

Implied Equity premium = 9.33% - 5.10% = 4.43%
Expected return on Equity = 9.33%

Solving for the expected return:
% After year 5 = 5.10%
Next 5 years = 9.31% (Used expected growth rate in Earnings)
Expected growth (in Euros)
Riskfree Rate = 5.10% (Euros)
Other parameters
Dividends on the Index = 3.55% of 2592 (Used weighted yield)
Level of the Index = 2592

Titan's value with implied premium: $ 44.41
Titan's value with historical premium (4%) plus country (7%): $ 47.64

Effect on valuation

Titan's value with implied premium (4%) plus country (7%): $ 47.64

Other parameters

• Riskfree Rate = 5.10% (Euros)
• Expected growth (in Euros)
• Next 5 years = 9.31% (Used expected growth rate in Earnings)
• After year 5 = 5.10%
The standard procedure for estimating betas is to regress stock returns ($R_j$) against market returns ($R_m$) -

$$R_j = a + b R_m$$

The slope of the regression corresponds to the beta of the stock, and measures

This beta has three problems:

- It has high standard error
- It reflects the firm's business mix over the period of the regression, not the current mix
- It reflects the firm's average financial leverage over the period rather than the current leverage

The standard procedure for estimating betas is to regress stock returns ($R_j$) against market returns ($R_m$).

Estimating Beta
Beta Estimation: Amazon
Aswath Damodaran

Beta Estimation for Titan Cement: The Index Effect
Determinants of Betas

Product or Service: The beta value for a firm depends upon the sensitivity of the demand for its products and services and of its costs to macroeconomic factors that affect the overall market.

Operating Leverage: The greater the proportion of fixed costs in the cost structure of a firm, the higher the beta will be, because higher fixed costs increase your exposure to market risk.

Financial Leverage: The more debt a firm takes on, the higher the beta will be of the equity in that business. Debt creates a fixed cost, interest expenses, that increases equity’s exposure to market risk.

Determinants of the unlevered beta and the debt-equity ratio:

\[ \beta^L = \beta^u (1 + \frac{(1-t)D}{E}) \]

where:
- \( \beta^L \) = Levered or Equity Beta
- \( \beta^u \) = Unlevered Beta
- \( D \) = Market Value of Debt
- \( E \) = Market Value of Equity
- \( t \) = Corporate marginal tax rate

Product or Service: The beta value for a firm depends upon the sensitivity of the demand for its products and services and of its costs to macroeconomic factors that affect the overall market.
The Solution: Bottom-up Betas

The bottom up beta can be estimated by:

- Taking a weighted (by sales or operating income) average of the unlevered betas of the different businesses a firm is in. (The unlevered beta of a business can be estimated by looking at other firms in the same business)
- Lever up using the firm's debt/equity ratio

\[
\beta_j = \frac{\sum_{i=1}^{n} \text{Operating Income}_i \text{Operating Income}_j}{\text{Firm}_j \text{Firm}_j} \times (1 + \frac{\text{Current Debt/Equity Ratio}}{1 - \text{tax rate}})
\]

The bottom up beta will give you a better estimate of the true beta when:

- It has lower standard error (\[SE_{\text{average}} = \frac{SE_{\text{firm}}}{\sqrt{n}}\])
- It reflects the firm's current business mix and financial leverage
- It can be estimated for divisions and private firms.

The unlevered beta of a business can be estimated by looking at other firms in the same business.
<table>
<thead>
<tr>
<th>Business</th>
<th>Revenues</th>
<th>Value/Sales</th>
<th>Unlevered Beta</th>
<th>Value</th>
<th>Weight</th>
<th>Weight*Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement</td>
<td>623</td>
<td>3.0</td>
<td>0.82</td>
<td>1869</td>
<td>79%</td>
<td>0.79*0.82</td>
</tr>
<tr>
<td>Technology</td>
<td>100</td>
<td>5.0</td>
<td>1.20</td>
<td>500</td>
<td>21%</td>
<td>0.21*1.20</td>
</tr>
<tr>
<td><strong>Firm</strong></td>
<td>1.20</td>
<td>3.0</td>
<td></td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A Hypothetical Scenario: Assume that Titan had been in two businesses—cement and technology.

\[
\text{Levered Beta} = \text{Unlevered Beta} \times \left(1 + \left(1 - \text{tax rate}\right) \times \text{D/E Ratio}\right)
\]

\[
= 0.82 \times \left(1 + (1 - 0.2449) \times 0.2521\right) = 0.988
\]

Titan's Bottom-up Beta

\[
\text{Firm} \times 100 = 0.988 \times 100 = 98.8%
\]

\[
\text{Cement} \times 21% = 0.988 \times 21% = 20.82%
\]

\[
\text{Technology} \times 79% = 0.988 \times 79% = 78.18%
\]
Aswath Damodaran

Amazon's Bottom-up Beta

Amazon's unlevered beta for firms in internet retailing = 1.60

Amazon's unlevered beta for firms in specialty retailing = 1.00

By the fifth year, we are estimating substantial revenues for Amazon and we move the valuation towards an online retailer. Hence we will use the beta of internet companies to begin the valuation that it is an online retailer. Hence, we will use the beta of Internet companies to begin the valuation.

Amazon is a specialty retailer, but its risk currently seems to be determined by the fact that Amazon is an online retailer. By the fifth year, we are estimating substantial revenues for Amazon and we move the valuation towards an online retailer. Hence, we will use the beta of Internet companies to begin the valuation.

Unlevered beta for firms in Internet Retailing = 1.60

Unlevered beta for firms in Specialty Retailing = 1.00

Amazon's Bottom-up Beta
From Cost of Equity to Cost of Capital

Cost of Capital = Cost of Equity \left( \frac{\text{Debt}}{\text{Debt} + \text{Equity}} \right) + \text{Cost of Borrowing} (1-t) \left( \frac{\text{Debt}}{\text{Debt} + \text{Equity}} \right)

Cost of Borrowing should be based upon:
1. Synthetic or actual bond rating
2. Default spread

Cost of Borrowing = \text{Riskfree rate} + \text{Default spread}

Weights should be market value weights.

Marginal tax rate, reflecting tax benefits of debt

Beta based upon bottom-up Cost of equity
The rating for a firm can be estimated using the financial characteristics of the firm. In its simplest form, the rating can be estimated from the interest coverage ratio:

\[
\text{Interest Coverage Ratio} = \frac{\text{EBIT}}{\text{Interest Expenses}}
\]

For Titan, we used the interest expenses and EBIT from 2000.

Interest Coverage Ratio = \frac{186.40}{26} = 7.17

Amazon.com has negative operating income, which yields a negative interest coverage ratio of \( \frac{-186.40}{-26} \approx 7.17 \) from 2000.

For Titan, to compute an average interest coverage ratio over the next 5 years, we used the interest expenses and EBIT in its simplest form, the rating can be estimated from the interest coverage ratio. The rating for a firm can be estimated using the financial characteristics of the firm.
Interest Coverage Ratios, Ratings, and Default Spreads

<table>
<thead>
<tr>
<th>Default Spread (1/00)</th>
<th>Estimated Bond Rating</th>
<th>Default Spread (1/00)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 1.50%</td>
<td>D</td>
<td>&gt; 0.20</td>
</tr>
<tr>
<td>1.50% - 7.00%</td>
<td>C</td>
<td>0.20 - 0.65</td>
</tr>
<tr>
<td>7.50% - 9.50%</td>
<td>CC</td>
<td>0.65 - 0.80</td>
</tr>
<tr>
<td>10.00% - 5.00%</td>
<td>CCC</td>
<td>0.80 - 1.25</td>
</tr>
<tr>
<td>8.00% - 3.25%</td>
<td>B</td>
<td>1.25 - 1.50</td>
</tr>
<tr>
<td>6.00% - 2.00%</td>
<td>B+</td>
<td>1.75 - 2.00</td>
</tr>
<tr>
<td>4.50% - 1.50%</td>
<td>BB</td>
<td>2.00 - 2.50</td>
</tr>
<tr>
<td>3.50% - 1.50%</td>
<td>BBB</td>
<td>2.50 - 3.00</td>
</tr>
<tr>
<td>2.75% - 1.50%</td>
<td>B</td>
<td>3.00 - 3.50</td>
</tr>
<tr>
<td>2.00% - 1.50%</td>
<td>A</td>
<td>3.50 - 4.00</td>
</tr>
<tr>
<td>1.50% - 1.00%</td>
<td>AA+</td>
<td>4.00 - 5.00</td>
</tr>
<tr>
<td>0.80% - 0.75%</td>
<td>AA</td>
<td>5.00 - 6.00</td>
</tr>
<tr>
<td>&lt; 0.75%</td>
<td>AAA</td>
<td>6.00 - 8.00</td>
</tr>
<tr>
<td>&lt; 0.20%</td>
<td>AAA</td>
<td>8.00 - 10.00</td>
</tr>
</tbody>
</table>
### Estimating the Cost of Debt for a Firm

The synthetic rating for Titan Cement in 2002 was A. Using the 2002 default spread of 1.80%, we estimate a cost of debt of 7.25% (using a risk-free rate of 5.1% and adding the country default spread of 0.35%):

\[
\text{Cost of debt} = \text{Riskfree rate} + \text{Default spread} = 5.1\% + 0.35\% = 5.45\%
\]

### Tax Rate Changes and the Cost of Debt

The firm's tax rate changes and its cost of debt changes. The after-tax cost of debt will:

<table>
<thead>
<tr>
<th>Tax Rate</th>
<th>Pre-Tax Cost of Debt</th>
<th>After-Tax Cost of Debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>8.00%</td>
<td>8.00%</td>
</tr>
<tr>
<td>3%</td>
<td>8.00%</td>
<td>7.97%</td>
</tr>
<tr>
<td>6%</td>
<td>8.00%</td>
<td>7.90%</td>
</tr>
<tr>
<td>9%</td>
<td>8.00%</td>
<td>7.80%</td>
</tr>
<tr>
<td>12%</td>
<td>8.00%</td>
<td>7.70%</td>
</tr>
<tr>
<td>15%</td>
<td>8.00%</td>
<td>7.60%</td>
</tr>
<tr>
<td>18%</td>
<td>8.00%</td>
<td>7.50%</td>
</tr>
<tr>
<td>21%</td>
<td>8.00%</td>
<td>7.40%</td>
</tr>
<tr>
<td>24%</td>
<td>8.00%</td>
<td>7.30%</td>
</tr>
<tr>
<td>27%</td>
<td>8.00%</td>
<td>7.20%</td>
</tr>
</tbody>
</table>

The firm is paying no taxes currently. As the firm's tax rate changes and its cost of debt changes, the after-tax cost of debt will change as well.

\[
\text{After-tax cost of debt} = (1 - \text{Tax rate}) \times \text{Pre-tax cost of debt} = (1 - 0) \times 8.00\% = 8.00\%
\]

\[
\text{After-tax cost of debt} = 8.00\% + 1.50\% = 9.50\%
\]

The synthetic rating for Amazon.com in 2000 was BBB. The default spread for BBB rated bond was 1.50% in 2000 and the treasury bond rate was 6.5%.

\[
\text{Cost of debt} = \text{Riskfree rate} + \text{Default spread} = 6.50\% + 1.50\% = 8.00\%
\]

\[
\text{Default spread} = 0.35\% + 1.80\% = 2.15\%
\]

The firm's tax rate changes and its cost of debt changes. The after-tax cost of debt will change as well.

\[
\text{After-tax cost of debt} = (1 - \text{Tax rate}) \times \text{Pre-tax cost of debt} = (1 - 0) \times 8.00\% = 8.00\%
\]

\[
\text{After-tax cost of debt} = 8.00\% + 1.50\% = 9.50\%
\]

### Table: After-Tax Cost of Debt

<table>
<thead>
<tr>
<th>Tax Rate</th>
<th>Pre-Tax Cost of Debt</th>
<th>After-Tax Cost of Debt</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>8.00%</td>
<td>8.00%</td>
</tr>
<tr>
<td>3%</td>
<td>8.00%</td>
<td>7.97%</td>
</tr>
<tr>
<td>6%</td>
<td>8.00%</td>
<td>7.90%</td>
</tr>
<tr>
<td>9%</td>
<td>8.00%</td>
<td>7.80%</td>
</tr>
<tr>
<td>12%</td>
<td>8.00%</td>
<td>7.70%</td>
</tr>
<tr>
<td>15%</td>
<td>8.00%</td>
<td>7.60%</td>
</tr>
<tr>
<td>18%</td>
<td>8.00%</td>
<td>7.50%</td>
</tr>
<tr>
<td>21%</td>
<td>8.00%</td>
<td>7.40%</td>
</tr>
<tr>
<td>24%</td>
<td>8.00%</td>
<td>7.30%</td>
</tr>
<tr>
<td>27%</td>
<td>8.00%</td>
<td>7.20%</td>
</tr>
<tr>
<td>30%</td>
<td>8.00%</td>
<td>7.10%</td>
</tr>
</tbody>
</table>
The weights used to compute the cost of capital should be the market value weights for debt and equity.

As a general rule, the debt that you should subtract from firm value to arrive at the value of equity should be the same debt that you used to compute the cost of capital.

There is an element of circularity that is introduced into every valuation by doing this, since the values that we attach to the firm and equity at the end of the analysis are different from the values we gave them at the beginning.

Weights for debt and equity.

The weights used to compute the cost of capital should be the market value weights for debt and equity.
Cost of Capital = 12.9% \times 0.988 + 8.00\% \times (1 - 0.012) = 12.84\%
Estimating Cost of Capital: Titan Cements

**Equity**

- Cost of Equity = 5.10% + 0.98 (4% + 0.70%) = 9.71%

- Market Value of Equity = 1517 million Euros (79.9%)

**Debt**

- Cost of Debt = 5.10% + 0.35% + 1.80% = 7.25%

- Average maturity of debt = 4 years

- Market Value of Debt = 382 million Euros (20.1%)

**Cost of Capital**

\[
\text{Cost of Capital} = 9.71\% \times (1 - 0.2449) + 7.25\% \times 0.201 = 8.85\%
\]

The book value of equity at Titan Cement is 390 million Euros; Interest expense is 26 million Euros.

- The book value of debt at Titan Cement is 458 million Euros.

- Estimated market value of debt = 382 million Euros (20.1%)

- Market Value of Equity = 1517 million Euros (79.9%)
II. Estimating Cash Flows to Firm

\[
\text{FCFF} = \text{EBIT} \times (1 - \text{tax rate}) - (\text{Capital Expenditures} - \text{Depreciation}) - \text{Change in non-cash working capital} - \text{Capital Expenditures} - \text{Depreciation} - \text{Change in non-cash working capital}
\]

**Update**
- Trailing Earnings
- Unofficial numbers

**Normalize**
- History
- Industry

**Cleanse**
- Non-recurring expenses
- Capital Expenditures
- Financial expenses
- Operating leases of R&D

**Adjust**
- Operating income
- Non-current asset
- R&D expenses
- Operating leases

**Include**
- Acquisitions
- R&D

**Adjust losses**
- Move to marginal near future, but can be effective for tax rate

**Defined as**
- Non-debt CL
- Non-cash CA

**Defined as**
- Non-debt CL
- Non-cash CA

**Defined as**
- Non-debt CL
- Non-cash CA
The Importance of Updating

The operating income and revenue that we use in valuation should be updated numbers. One of the problems with using financial statements is their have been no financial statements released since the last 10K.

- $ 410 million
- $ 125 million
$ 1,117 million

EBIT

Revenue

Last 10-K

Revenue

$ 610 million

Trail ing 12-month

$117 million

$610 million

Trail ing 12-month

The valuation of Titan is dated because there have been no financial statements released since the last 10K.

Growing rapidly.

As a general rule, it is better to use 12-month trailing estimates for earnings and revenues than numbers for the most recent financial year. This rule becomes even more critical when valuing companies that are evolving and growing rapidly.

The importance of updating numbers. One of the problems with using financial statements is that they are dated.
<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Trm)</th>
<th>Operating Margin</th>
<th>EBIT (Trm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$1,117</td>
<td>-36.71%</td>
<td>-$410</td>
</tr>
<tr>
<td>2</td>
<td>$2,793</td>
<td>-13.35%</td>
<td>-$373</td>
</tr>
<tr>
<td>3</td>
<td>$5,585</td>
<td>-1.68%</td>
<td>-$94</td>
</tr>
<tr>
<td>4</td>
<td>$9,774</td>
<td>4.16%</td>
<td>$407</td>
</tr>
<tr>
<td>5</td>
<td>$14,661</td>
<td>7.08%</td>
<td>$1,038</td>
</tr>
<tr>
<td>6</td>
<td>$19,059</td>
<td>8.54%</td>
<td>$1,628</td>
</tr>
<tr>
<td>7</td>
<td>$23,862</td>
<td>9.27%</td>
<td>$2,212</td>
</tr>
<tr>
<td>8</td>
<td>$28,729</td>
<td>9.64%</td>
<td>$2,768</td>
</tr>
<tr>
<td>9</td>
<td>$33,211</td>
<td>9.82%</td>
<td>$3,261</td>
</tr>
<tr>
<td>10</td>
<td>$36,798</td>
<td>9.91%</td>
<td>$3,646</td>
</tr>
<tr>
<td></td>
<td>$41,346</td>
<td>10.00%</td>
<td>$4,135</td>
</tr>
</tbody>
</table>

Industry Averages:

<table>
<thead>
<tr>
<th>Year</th>
<th>Revenues (Trm)</th>
<th>Operating Margin</th>
<th>EBIT (Trm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$3,906</td>
<td>9.95%</td>
<td>$361</td>
</tr>
<tr>
<td>2</td>
<td>$3,982</td>
<td>9.91%</td>
<td>$359</td>
</tr>
<tr>
<td>3</td>
<td>$3,321</td>
<td>9.82%</td>
<td>$332</td>
</tr>
<tr>
<td>4</td>
<td>$2,829</td>
<td>9.64%</td>
<td>$282</td>
</tr>
<tr>
<td>5</td>
<td>$2,386</td>
<td>9.27%</td>
<td>$238</td>
</tr>
<tr>
<td>6</td>
<td>$2,128</td>
<td>8.54%</td>
<td>$212</td>
</tr>
<tr>
<td>7</td>
<td>$1,629</td>
<td>7.08%</td>
<td>$162</td>
</tr>
<tr>
<td>8</td>
<td>$1,038</td>
<td>4.16%</td>
<td>$103</td>
</tr>
<tr>
<td>9</td>
<td>$9,059</td>
<td>4.16%</td>
<td>$905</td>
</tr>
<tr>
<td>10</td>
<td>$14,661</td>
<td>4.16%</td>
<td>$14,661</td>
</tr>
</tbody>
</table>

TY(11) | $41,346 | 10.00% | $4,135 |
Operating Leases at The Home Depot in 1998

The pre-tax cost of debt at the Home Depot is 6.25%.

Operating Lease Expense Present Value

<table>
<thead>
<tr>
<th>Year</th>
<th>Expense</th>
<th>PV</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$294</td>
<td>$277</td>
</tr>
<tr>
<td>2</td>
<td>$291</td>
<td>$258</td>
</tr>
<tr>
<td>3</td>
<td>$264</td>
<td>$220</td>
</tr>
<tr>
<td>4</td>
<td>$245</td>
<td>$192</td>
</tr>
<tr>
<td>5</td>
<td>$236</td>
<td>$174</td>
</tr>
<tr>
<td>6-15</td>
<td>$270</td>
<td>$1,450</td>
</tr>
</tbody>
</table>

Present Value of Operating Leases = $2,571

Debt outstanding at the Home Depot = $1,205 + $2,571 = $3,776 million

The Home Depot has other debt outstanding of $1,205 million.

Adjusted Operating Income = $2,016 + 2,571 (0.0625) = $2,177 million

The pre-tax cost of debt at the Home Depot is 6.25%.
To capitalize R&D,

1. Specify an amortizable life for R&D (2 - 10 years).
2. Collect past R&D expenses for as long as the amortizable life is 5 years. The research asset can be obtained by adding up 1/5th of the R&D expense from each year of the R&D expense from four years ago, 2/5th of the R&D expense from five years ago, 3/5th of the R&D expense from six years ago, etc.
3. Sum up the unamortized R&D over the period. Thus, if the amortizable life is 5 years, the research asset can be obtained by adding up 1/5th of the R&D expense from five years ago, 2/5th of the R&D expense from four years ago, 3/5th of the R&D expense from three years ago, etc.

**Adjusted Operating Income** = Adjusted Operating Income = Add back R&D and subtract amortization of R&D

Amortization of Research Asset in 2000 = £19.41

Value of Research Asset = £104.24

R&D was assumed to have a 5-year life.

<table>
<thead>
<tr>
<th>Year</th>
<th>R&amp;D</th>
<th>Unamortized R&amp;D</th>
<th>Amortization</th>
</tr>
</thead>
<tbody>
<tr>
<td>-5</td>
<td>£4.36</td>
<td>£20.00</td>
<td>£0.00</td>
</tr>
<tr>
<td>-4</td>
<td>£6.08</td>
<td>£11.00</td>
<td>£0.60</td>
</tr>
<tr>
<td>-3</td>
<td>£7.74</td>
<td>£15.70</td>
<td>£0.80</td>
</tr>
<tr>
<td>-2</td>
<td>£9.58</td>
<td>£20.30</td>
<td>£1.60</td>
</tr>
<tr>
<td>-1</td>
<td>£11.52</td>
<td>£25.30</td>
<td>£0.91</td>
</tr>
<tr>
<td>-1</td>
<td>£104.24</td>
<td>£50.00</td>
<td>£19.41</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Current</td>
<td></td>
</tr>
</tbody>
</table>

Adjusted Operating Income = £41.03 + £48.12 - £19.41 = £69.74
The Effect of Net Operating Losses: Amazon.com’s Tax Rate

<table>
<thead>
<tr>
<th>Year</th>
<th>EBIT (1)</th>
<th>Taxes</th>
<th>EBIT</th>
<th>NOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$1,058</td>
<td>$0</td>
<td>$1,058</td>
<td>$500</td>
</tr>
<tr>
<td>2</td>
<td>$1,670</td>
<td>$0</td>
<td>$1,670</td>
<td>$0</td>
</tr>
<tr>
<td>3</td>
<td>$474</td>
<td>$0</td>
<td>$474</td>
<td>$0</td>
</tr>
<tr>
<td>4</td>
<td>$873</td>
<td>$0</td>
<td>$873</td>
<td>$0</td>
</tr>
<tr>
<td>5</td>
<td>$967</td>
<td>$0</td>
<td>$967</td>
<td>$0</td>
</tr>
</tbody>
</table>

After year 5, the tax rate becomes 35%.

Rate

The Effect of Net Operating Losses: Amazon.com’s Tax Rate

Current EBIT × (1 - tax rate) = net capital expenditures - (capital spending - depreciation) - change in working capital

EBIT = 186.4 (1 - 24.49%) = 141 million Euros

Net capital expenditures = Cap Ex - Depreciation = 459 - 41 = 418 million Euros

Change in working capital = 77.1 million Euros

Estimating Actual FCFF: Titan Cement
Estimating FCFF: Amazon.com

Q EBIT (Trailing 1999) = -$410 million
Q Tax rate used = 0% (Assumed Effective = Marginal)
Q Capital spending (Trailing 1999) = $243 million
Q Depreciation (Trailing 1999) = $31 million
Q Non-cash Working capital Change (1999) = 80 million

Current EBIT * (1 - tax rate) = -410 (1-0) = Current EBIT (1999)

(2) Change in Working Capital = (Capital Spending - Depreciation) = 212 million

Current FCFF = -$542 million

Estimating FCFF: Amazon.com
IV. Expected Growth in EBIT and Fundamentals

Reinvestment Rate and Return on Capital

Reinvestment Rate =\frac{\text{Net Capital Expenditures} + \text{Change in WC}}{\text{EBIT}}\times(1-t) * \text{ROC}

Proposition: No firm can expect its operating income to grow over time without reinvesting some of its operating income in net capital expenditures and/or working capital.

Proposition: The net capital expenditures needs of a firm, for a given growth rate, should be inversely proportional to the quality of its investments.
<table>
<thead>
<tr>
<th>Year</th>
<th>Cp Ex</th>
<th>Depreciation</th>
<th>EBIT (1-t)</th>
<th>Net Cap Ex as %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1997</td>
<td>$25.09</td>
<td>$13.53</td>
<td>$86.39</td>
<td>17.72%</td>
</tr>
<tr>
<td>1998</td>
<td>$37.11</td>
<td>$20.08</td>
<td>$100.64</td>
<td>22.41%</td>
</tr>
<tr>
<td>1999</td>
<td>$136.65</td>
<td>$89.53</td>
<td>$122.55</td>
<td>50.92%</td>
</tr>
<tr>
<td>2000</td>
<td>$50.54</td>
<td>$39.26</td>
<td>$162.78</td>
<td>9.18%</td>
</tr>
<tr>
<td>2001</td>
<td>$81.00</td>
<td>$40.87</td>
<td>$186.39</td>
<td>28.51%</td>
</tr>
</tbody>
</table>

Normalizing Net Cap Ex: Titan Cement
Expected growth rate $= 6.42 \% 
\times 64.22 \% 
\times 16.62 \% 
\times 1.1662 = 10.68 \%$

Return on capital $\frac{1864(1-0.2449)(186.4-39.99)}{(186.4-39.99)} = 64.22 \%$

Normalized reinvestment rate $\frac{54.42+35.98}{186.4(1-0.2449)} = 35.98 \text{ million Euros}$

Normalized net Cap Ex $= \text{Net Cap Ex as } \% \text{ of EBIT (1-t) in 2001} \times \text{Change in revenues in 2000}$. Change in revenues in 2000 $= 1511 (982.9-622.7) = 54.42 \text{ million Euros}$

Normalized change in working capital $= \text{Working capital as percent of revenues}$
Revenue Growth and Operating Margins

For Amazon, the effect of reinvestment shows up in revenue growth rates and changes in expected operating margins:

\[ \text{Expected Revenue Growth in } \$ = \text{Reinvestment (in } \$ \text{ terms)} \times \left( \frac{\text{Sales}}{\text{Capital}} \right) \]

The effect on expected margins is more subtle. Amazon’s reinvestments (especially in acquisitions) may help create barriers to entry and other competitive advantages that will ultimately translate into high operating margins and high profits.

With negative operating income and return on capital, the fundamental growth equation is of little use for Amazon.com.
Growth in Revenues, Earnings and Reinvestment: Amazon

<table>
<thead>
<tr>
<th>Year</th>
<th>Growth Revenue</th>
<th>Chg in Reinvestment</th>
<th>Chg Rev/Chg Reinvestment</th>
<th>ROC</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>179</td>
<td>20.39%</td>
<td>10 6.00%</td>
<td>$2,028 $236 $1,736</td>
<td>10 6.00%</td>
<td>6</td>
</tr>
<tr>
<td>180</td>
<td>21.19%</td>
<td>00 3.00%</td>
<td>$3,587 $1,836</td>
<td>10 8.00%</td>
<td>6</td>
</tr>
<tr>
<td>181</td>
<td>21.87%</td>
<td>00 3.00%</td>
<td>$4,794 $2,162</td>
<td>15 6.00%</td>
<td>8</td>
</tr>
<tr>
<td>182</td>
<td>22.30%</td>
<td>00 3.00%</td>
<td>$8,223 $3,816</td>
<td>20 4.00%</td>
<td>7</td>
</tr>
<tr>
<td>183</td>
<td>22.33%</td>
<td>00 3.00%</td>
<td>$1,069 $4,183</td>
<td>16 2.00%</td>
<td>6</td>
</tr>
<tr>
<td>184</td>
<td>21.16%</td>
<td>00 3.00%</td>
<td>$4,397 $2,162</td>
<td>30 0.00%</td>
<td>5</td>
</tr>
<tr>
<td>185</td>
<td>25.82%</td>
<td>00 3.00%</td>
<td>$8,797 $4,469</td>
<td>50 0.00%</td>
<td>4</td>
</tr>
<tr>
<td>186</td>
<td>20.59%</td>
<td>00 3.00%</td>
<td>$6,189 $4,397</td>
<td>75 0.00%</td>
<td>3</td>
</tr>
<tr>
<td>187</td>
<td>-8.96%</td>
<td>00 3.00%</td>
<td>$7,93 $418 $2,797</td>
<td>100 0.00%</td>
<td>2</td>
</tr>
<tr>
<td>188</td>
<td>-7.62%</td>
<td>00 3.00%</td>
<td>$5,597 $1,676</td>
<td>150 0.00%</td>
<td>1</td>
</tr>
</tbody>
</table>

Assume that firm can earn high returns because of established economies of scale.
V. Growth Patterns

A key assumption in all discounted cash flow models is the period of high growth, and the pattern of growth during that period. In general, we can make one of three assumptions:

- There is no high growth, in which case the firm is already in stable growth.
- There will be high growth for a period, at the end of which the growth rate will decline gradually to a stable growth rate (§-stage).
- There will be high growth for a period, at the end of which the growth rate will drop to the stable growth rate (2-stage).

Stable Growth

2-Stage Growth

3-Stage Growth
Determinants of Growth Patterns

- Size of the firm
  - Success usually makes a firm larger. As firms become larger, it becomes much more difficult for them to maintain high growth rates.

- Current Growth Rate
  - While past growth is not always a reliable indicator of future growth, there is a correlation between current growth and future growth. Thus, a firm growing at 30% currently probably has higher growth and a longer expected growth period than a firm growing at 10% a year now.

- Barriers to entry and differential advantages
  - Ultimately, high growth comes from high project returns, which, in turn, comes from barriers to entry and differential advantages.
  - The question of how long growth will last and how high it will be can therefore be framed as a question about what the barriers to entry are, how strong they will remain, and how long they will stay up and how strong they will remain.

- Past growth is not always a reliable indicator of future growth.
Stable Growth Characteristics

In stable growth, firms should have characteristics of other stable growth firms. In particular,

- The reinvestment rate of the firm should reflect the expected growth rate and the firm's return on capital.
- Beta should move towards one
- The cost of debt should reflect the safety of stable firms (BBB or higher)
- The debt ratio of the firm might increase to reflect the larger and more stable earnings of these firms.
- If the managers of the firm are deeply averse to debt, this may never happen
- The debt ratio of the firm might move to the optimal or an industry average
- The optimal is the average of these firms.
- The cost of debt should reflect the safety of stable firms (BBB or higher)
- Beta should move towards one
- The risk of the firm, as measured by beta and ratings, should reflect that of a stable growth firm.
- In particular, in stable growth, firms should have the characteristics of other stable growth firms.
Titan and Amazon.com: Stable Growth Inputs

Titan Cement

- Beta: 0.98, 1.00
- Debt Ratio: 20.10%, 20.10%
- Return on Capital: 16.62%, 8.08%
- Cost of Capital: 8.85%, 8.08%
- Expected Growth Rate: 10.68%, 4%
- Reinvestment Rate: 64.22%, 4%/8.08% = 49.5%

Amazon.com

- Beta: 1.60, 1.00
- Debt Ratio: 1.20%, 15%
- Return on Capital: Negative 20%
- Expected Growth Rate: NMF 6%
- Reinvestment Rate: >100% 6%/20% = 30%
Dealing with Cash and Marketable Securities

The simplest and most direct way of dealing with cash and marketable securities is to keep them out of the valuation - the cash flows should be before interest income from cash and securities, and the discount rate should be the cost of equity alone to estimate the cost of equity. Assume a particularly incompetent management with a history of overpaying for acquisitions, markets may discount the value of this cash. If you have a particularly incompetent management with a history of overpaying for acquisitions, markets may discount the value of this cash.
Dealing with Cross Holdings

Proposition 1: It is almost impossible to correctly value firms with minority, passive interests in a large number of private subsidiaries. When the holding is a majority, active stake, the value that we obtain from the cash flows includes the share held by outsiders. While their holding is measured in the balance sheet as a minority interest, it is at book value. To get a measure of the market value of this holding, we need to subtract out the estimated market value of the minority interests from the firm value. In fact, we have to value the subsidiary as a separate entity to get a measure of the market value of the holding. Listing only this income will understate the value of the firm. The firm shows on its income statement only the share of dividends it receives on the holding. Listing only this income will understate the value of the firm. When the holding is a minority, passive interest, the problem is a different one. The firm shows on its income statement only the share of dividends it receives on the holding. Listing only this income will understate the value of the firm. When the holding is a majority, active stake, the value that we obtain from the cash flows includes the share held by outsiders. While their holding is measured in the balance sheet as a minority interest, it is at book value. To get a measure of the market value of this holding, we need to subtract out the estimated market value of the minority interests from the firm value. Therefore, it is almost impossible to correctly value firms with minority, passive interests in a large number of private subsidiaries.
Aswath Damodaran

Amazon: Estimating the Value of Equity Options

Details of options outstanding

- Average strike price of options outstanding = $13.375
- Average maturity of options outstanding = 8.4 years
- Standard deviation in ln(stock price) = 50.00%
- Annualized dividend yield on stock = 0.00%
- Treasury bond rate = 6.50%
- Number of options outstanding = 38 million
- Number of shares outstanding = 340.79 million

Value of options outstanding (using dilution-adjusted Black-Scholes model)

\[
\text{Value of equity options} = \frac{340.79 \text{ million}}{38 \text{ million}} \times 6.50\% \times 0.00\% \times 8.4 \text{ years} = 2.892 \text{ billion}
\]
Aswath Damodaran

Forever

Terminal Value = 1881 / (0.0961 - 0.10) x 1.00 = 52,148

Cost of Equity

12.90%

Cost of Debt

6.5% + 1.5% = 8.0%

Total Cost of Capital

12.90% x 1.2% = 1.55% = 10.45%

Weights

Debt = 1.2% = 15%

Equity = 85%

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

Risk Premium

Internet/Retail

Operating Leverage

Current D/E: 1.21%

Base Equity Premium

Country Risk Premium

Current Revenues $2,793

Expected Margin: -36.71%

Expected Margin: 10.00%

Stable Growth

Stable Revenue Growth: 6%

Stable Operating Margin: 10.00%

Stable ROC = 20%

Reinvestment

Reinvest 30% of EBIT(1-t)

EBIT $-410 m

NOL $500 m

$41,346

10.00% 35.00% $2,688 $807 $1,881

Term. Year 243 15 6 8 9 10 7

Cost of Equity 12.90% 12.90% 12.90% 12.90% 12.42% 12.30% 12.10% 11.70% 10.50%

Cost of Debt 8.00% 8.00% 8.00% 8.00% 7.80% 7.75% 7.67% 7.50% 7.00%

AT cost of debt 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% 11.96% 11.69% 11.15% 9.61%

Revenues $2,793 5,585 9,774 14,661 19,059 23,862 28,729 33,211 36,798 39,006

EBIT $-373 $-94 $407 $1,038 $1,628 $2,212 $2,768 $3,261 $3,646 $3,883

EBIT (1-t) $-373 $-94 $407 $871 $1,058 $1,438 $1,799 $2,119 $2,370 $2,524

- Reinvestment $559 $931 $1,396 $1,629 $1,466 $1,601 $1,623 $1,494 $1,196 $736

FCFF $-931 $-1,024 $-989 $-758 $-408 $-163 $177 $625 $1,174 $1,788

Value of Op Assets $14,936

+ Cash $26 = Value of Equity $14,587

Amazon.com

January 2000

Stock Price = $84
<table>
<thead>
<tr>
<th>%</th>
<th>191.77</th>
<th>137.95</th>
<th>97.54</th>
<th>67.48</th>
<th>45.34</th>
<th>29.21</th>
<th>21.47</th>
<th>15.93</th>
<th>12.59</th>
<th>9.53</th>
<th>6.10</th>
<th>4.11</th>
<th>2.95</th>
<th>1.94</th>
<th>1%</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>60%</td>
<td>$191.77</td>
<td>$137.95</td>
<td>$97.54</td>
<td>$67.48</td>
<td>$45.34</td>
<td>$29.21</td>
<td>$21.47</td>
<td>$15.93</td>
<td>$12.59</td>
<td>$9.53</td>
<td>$6.10</td>
<td>$4.11</td>
<td>$2.95</td>
<td>$1.94</td>
<td>$1</td>
</tr>
<tr>
<td>55%</td>
<td>$191.77</td>
<td>$137.95</td>
<td>$97.54</td>
<td>$67.48</td>
<td>$45.34</td>
<td>$29.21</td>
<td>$21.47</td>
<td>$15.93</td>
<td>$12.59</td>
<td>$9.53</td>
<td>$6.10</td>
<td>$4.11</td>
<td>$2.95</td>
<td>$1.94</td>
<td>$1</td>
</tr>
<tr>
<td>50%</td>
<td>$191.77</td>
<td>$137.95</td>
<td>$97.54</td>
<td>$67.48</td>
<td>$45.34</td>
<td>$29.21</td>
<td>$21.47</td>
<td>$15.93</td>
<td>$12.59</td>
<td>$9.53</td>
<td>$6.10</td>
<td>$4.11</td>
<td>$2.95</td>
<td>$1.94</td>
<td>$1</td>
</tr>
<tr>
<td>45%</td>
<td>$191.77</td>
<td>$137.95</td>
<td>$97.54</td>
<td>$67.48</td>
<td>$45.34</td>
<td>$29.21</td>
<td>$21.47</td>
<td>$15.93</td>
<td>$12.59</td>
<td>$9.53</td>
<td>$6.10</td>
<td>$4.11</td>
<td>$2.95</td>
<td>$1.94</td>
<td>$1</td>
</tr>
<tr>
<td>40%</td>
<td>$191.77</td>
<td>$137.95</td>
<td>$97.54</td>
<td>$67.48</td>
<td>$45.34</td>
<td>$29.21</td>
<td>$21.47</td>
<td>$15.93</td>
<td>$12.59</td>
<td>$9.53</td>
<td>$6.10</td>
<td>$4.11</td>
<td>$2.95</td>
<td>$1.94</td>
<td>$1</td>
</tr>
<tr>
<td>35%</td>
<td>$191.77</td>
<td>$137.95</td>
<td>$97.54</td>
<td>$67.48</td>
<td>$45.34</td>
<td>$29.21</td>
<td>$21.47</td>
<td>$15.93</td>
<td>$12.59</td>
<td>$9.53</td>
<td>$6.10</td>
<td>$4.11</td>
<td>$2.95</td>
<td>$1.94</td>
<td>$1</td>
</tr>
<tr>
<td>30%</td>
<td>$191.77</td>
<td>$137.95</td>
<td>$97.54</td>
<td>$67.48</td>
<td>$45.34</td>
<td>$29.21</td>
<td>$21.47</td>
<td>$15.93</td>
<td>$12.59</td>
<td>$9.53</td>
<td>$6.10</td>
<td>$4.11</td>
<td>$2.95</td>
<td>$1.94</td>
<td>$1</td>
</tr>
</tbody>
</table>

Amazon.com: Break Even at $84.97
Amazon.com

January 2001

Stock Price = $14

Terminal Value = 1064/(.0876-.05) = $28,310

Cost of Equity = 13.81%
Cost of Debt = 5.1% + 4.75% = 9.85%
Tax rate = 0% - 35%

Weights
- Debt = 27.38% - 15%
- Equity = 72.62%

Cost of Equity
- 10% risk-free rate
- Beta = 2.18
- Risk premium = 4%

Internet/Retail Operating Leverage
- Current D/E = 37.5%
- Current Margin = -34.60%
- Reinvestment: Cap ex includes acquisitions
- Sales Turnover Ratio: 3.02

Competitive Advantages
- Revenue Growth = 25.41%
- Expected Margin = -9.32%
- Stable Revenue Growth = 5%
- Stable Operating Margin = 9.32%
- Stable ROC = 16.94%

Reinvest 29.5% of EBIT (1-t)

EBIT
- NOL: $1,289
- Value of Debt: $1,890
- Value of Equity: $7,340
- Equity Options: $748
- Value per share: $18.74

Risk Free Rate
- T. Bond rate = 5.1%

Beta:
- Current: 2.18
- Reinvestment Beta: 1.07

Cost of Equity:
- Current: 13.81%
- Reinvestment: 11.93%

AT cost of debt:
- 10.00%

Cost of Capital:
- 12.77%
Current Cashflow to Firm

EBIT(1-t) : 141
Nt CpX : +419
Ch : -77
WC : -

FCFF : -355

Reinvestment Rate = 352%

Expected Growth

in EBIT (1-t) : 0.6422 * 0.1662 = 0.1068
10.68%

Stable Growth

g = 4%; Beta = 1.00;
Country Premium = 0%
Cost of capital = 8.08%
ROC = 8.08%; Tax rate = 30%
Reinvestment Rate = 49.5%

Terminal Value

= 113.79 / (0.0808 - 0.04) = 2,780

Cost of Equity

= 9.71% + 5.47%(1 - 0.2449) = 5.47%

Weights

E = 79.9%; D = 20.1%

Discount at Cost of Capital (WACC) = 9.71% * 0.799 + 5.47% * 0.201 = 8.85%

Firm Value:

Cash: 113
Debt: 382
Equity: 1,815

− Options = 0

− Value/Share = 47.64

Riskfree Rate:

Real riskfree rate = 5.1% + 0.98 * 4.70% = 10%

Unlevered Beta for Sectors: 0.80

Firm’s D/E Ratio: 29%

− Mature risk premium = 4%
− Country risk premium = 0.70%

Titan Cements: Status Quo

− Reinvestment Rate = 64.22%
− Return on Capital = 16.68%

<table>
<thead>
<tr>
<th>Year</th>
<th>EBIT(1-t)</th>
<th>Reinvestment</th>
<th>FCFF</th>
<th>Expected Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>€155.77</td>
<td>€100.04</td>
<td>€55.73</td>
<td>16.52%</td>
</tr>
<tr>
<td>2</td>
<td>€172.40</td>
<td>€110.72</td>
<td>€61.68</td>
<td>15.52%</td>
</tr>
<tr>
<td>3</td>
<td>€190.81</td>
<td>€122.54</td>
<td>€68.27</td>
<td>14.52%</td>
</tr>
<tr>
<td>4</td>
<td>€211.18</td>
<td>€135.62</td>
<td>€75.56</td>
<td>13.52%</td>
</tr>
<tr>
<td>5</td>
<td>€233.72</td>
<td>€150.10</td>
<td>€83.62</td>
<td>12.52%</td>
</tr>
</tbody>
</table>

+ Avg Reinvestment Rate = 64.22%
Value Enhancement: Back to Basics

http://www.stern.nyu.edu/~adamodar
Price Enhancement versus Value Enhancement
Using the DCF framework, there are four basic ways in which the value of a firm can be enhanced:

- Changing the firm's financial composition
- Changing the financial mix
- Reducing the operating risk in investments/assets
- The cost of capital can be reduced by
  - High growth.
  - The length of the high growth period can be extended to allow for more years of
    - Improving the return on capital on those reinvestments
    - Increasing the rate of reinvestment in the firm
  - The expected growth rate in the firm's cash flows can be increased by either
    - Reducing reinvestment needs (net capital expenditures or working capital)
    - Increasing after-tax earnings from assets in place of
  - The cash flows from existing assets to the firm can be increased, by either

The Paths to Value Creation

Using the DCF framework, there are four basic ways in which the value of a firm can be enhanced:

- Changing the firm's financial composition
- Changing the financial mix
- Reducing the operating risk in investments/assets
- The cost of capital can be reduced by
  - High growth.
  - The length of the high growth period can be extended to allow for more years of
    - Improving the return on capital on those reinvestments
    - Increasing the rate of reinvestment in the firm
  - The expected growth rate in the firm's cash flows can be increased by either
    - Reducing reinvestment needs (net capital expenditures or working capital)
    - Increasing after-tax earnings from assets in place of
  - The cash flows from existing assets to the firm can be increased, by either
For an action to affect the value of the firm, it has to affect:

- Current cash flows
- Future growth
- The length of the high growth period
- The discount rate (cost of capital)

Thus, actions that do not affect current cash flows, future growth, the length of the high growth period or the discount rate cannot affect value.
Value-Neutral Actions

Aswath Damodaran

Decisions that create new securities on the existing assets of the firm (without altering the financial mix) such as tracking stock cannot create value, though they might affect perceptions and hence the price.

1. Using poolings instead of purchase in acquisitions cannot change the value of a target firm.
2. Major non-cash restructuring charges that reduce reported earnings but are not tax deductible.
3. Changing the depreciation method used in financial reports (but not the tax books) from accelerated to straight-line depreciation.
4. Changing the inventory valuation method used in financial reports but not for tax purposes from FIFO to LIFO or vice versa.
5. Effect on value accounting decisions that affect reported earnings but not cash flows should have no effect on value since they do not affect cash flows, growth or risk.
6. Stock splits and stock dividends change the number of units of equity in a firm, but cannot affect firm value since they do not affect cash flows, growth or risk.

Value-Neutral Actions

- Stock splits and stock dividends change the number of units of equity in a firm, but cannot affect firm value since they do not affect cash flows, growth or risk.
- Using poolings instead of purchase in acquisitions cannot change the value of a target firm.
- Major non-cash restructuring charges that reduce reported earnings but are not tax deductible.
- Changing the depreciation method used in financial reports (but not the tax books) from accelerated to straight-line depreciation.
- Changing the inventory valuation method used in financial reports but not for tax purposes from FIFO to LIFO or vice versa.
- Effect on value accounting decisions that affect reported earnings but not cash flows should have no effect on value since they do not affect cash flows, growth or risk.
I. Ways of Increasing Cash Flows from Assets in Place

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

2. Divest assets that have negative EBIT

3. More efficient operations and cost cutting: Higher Margins

4. Reduce tax rate:  
   - Risk management  
   - Transfer pricing  
   - Moving income to lower tax locales

5. Live off past over-investment

6. Better inventory management and tighter credit policies

7. Better inventory management:  
   - Live off past over-investment
   - Tighter credit policies

8. Higher Margins:  
   - Cost cutting: operations and investments

9. More efficient operations:  
   - Higher Margins

10. Live off past over-investment
II. Value Enhancement through Growth

Reinvestment Rate

Return on Capital = Expected Growth Rate

- Reinvest in projects
- Increase operating margins
- Do acquisitions
- Increase capital turnover ratio
- Increase operating more in projects
III. Building Competitive Advantage: Increase Length of the Growth Period

- Cost
  - Switching Costs
  - Legal Protection
- Brand Name
  - Find new competitive advantages
  - Build on existing competitive advantages

Increase length of growth period
3.1: The Brand Name Advantage

Some firms are able to sustain above-normal returns and growth because they have well-recognized brand names that allow them to charge higher prices than their competitors. Firms that are able to improve their brand name value over time can increase both their growth rate and the period over which they can expect to grow at rates above the stable growth rate, thus increasing value.
## Illustration: Valuing a brand name: Coca Cola

<table>
<thead>
<tr>
<th></th>
<th>Generic Cola Company</th>
<th>Coca Cola</th>
</tr>
</thead>
<tbody>
<tr>
<td>$115</td>
<td>$115</td>
<td></td>
</tr>
<tr>
<td>12.13%</td>
<td>12.13%</td>
<td></td>
</tr>
<tr>
<td>2.35%</td>
<td>2.35%</td>
<td></td>
</tr>
<tr>
<td>4.16%</td>
<td>4.16%</td>
<td></td>
</tr>
<tr>
<td>65.00% (47.90%)</td>
<td>65.00% (19.35%)</td>
<td></td>
</tr>
<tr>
<td>12.33%</td>
<td>12.33%</td>
<td></td>
</tr>
<tr>
<td>1.67%</td>
<td>1.67%</td>
<td></td>
</tr>
<tr>
<td>10 years</td>
<td>10 years</td>
<td></td>
</tr>
<tr>
<td>8.15%</td>
<td>20.16%</td>
<td></td>
</tr>
<tr>
<td>67.97%</td>
<td>97.65%</td>
<td></td>
</tr>
<tr>
<td>18.56%</td>
<td>18.56%</td>
<td></td>
</tr>
<tr>
<td>AT Operating Margin</td>
<td>AT Operating Margin</td>
<td></td>
</tr>
<tr>
<td>AT Cost of Debt</td>
<td>AT Cost of Debt</td>
<td></td>
</tr>
<tr>
<td>E/(D+E)</td>
<td>E/(D+E)</td>
<td></td>
</tr>
<tr>
<td>AT Cost of Equity</td>
<td>AT Cost of Equity</td>
<td></td>
</tr>
<tr>
<td>Reinvestment Rate</td>
<td>Reinvestment Rate</td>
<td></td>
</tr>
<tr>
<td>Length</td>
<td>Length</td>
<td></td>
</tr>
<tr>
<td>Expected Growth</td>
<td>Expected Growth</td>
<td></td>
</tr>
<tr>
<td>ROC</td>
<td>ROC</td>
<td></td>
</tr>
<tr>
<td>Sales/BV of Capital</td>
<td>Sales/BV of Capital</td>
<td></td>
</tr>
<tr>
<td>AT Operating Margin</td>
<td>AT Operating Margin</td>
<td></td>
</tr>
<tr>
<td>Value</td>
<td>Value</td>
<td></td>
</tr>
<tr>
<td>Cost of Capital</td>
<td>Cost of Capital</td>
<td></td>
</tr>
<tr>
<td>D/(D+E)</td>
<td>D/(D+E)</td>
<td></td>
</tr>
<tr>
<td>E/(D+E)</td>
<td>E/(D+E)</td>
<td></td>
</tr>
</tbody>
</table>

Aswath Damodaran

Illustration: Valuing a brand name: Coca Cola
3.2: Patents and Legal Protection

The most complete protection that a firm can have from competitive pressure is to own a patent, copyright or some other kind of legal protection allowing it to be the sole producer for an extended period. Note that patents only provide partial protection, since they cannot protect a firm against a competitive product that meets the same need but is not covered by the patent protection. Licenses and government-sanctioned monopolies also provide protection.

Regulated when it comes to price increases and returns, utilities in the United States, for instance, are monopolies but are regulated against competition. They may, however, come with restrictions on excess returns and government-sanctioned monopolies also provide protection.
Another potential barrier is the cost associated with switching from one firm’s products to another. The greater the switching costs, the more difficult it is for competitors to come in and compete away excess returns. Firms that devise ways to increase the cost of switching from their products to competitors’ products, while reducing the costs of switching from competitors’ products to their own, will be able to increase their expected length of growth.
3.4: Cost Advantages

There are a number of ways in which firms can establish a cost advantage over their competitors and use this cost advantage as a barrier to entry:

- In businesses, where scale can be used to reduce costs, economies of scale can give firms a cost advantage over smaller firms.
- Owning exclusive right to distribution system can provide firms with a cost advantage over its competitors.
- Owning or having the rights to extract a natural resource which is in restricted supply (The undeveloped reserves of an oil or mining company, for instance)
- Owning or having the exclusive rights to a distribution system can provide firms with a cost advantage over their competitors.

These cost advantages will show up in valuation in one of two ways:

- The firm may charge lower prices than its competitors and have a much higher operating margin.
- The firm may charge the same price as its competitors, but have a much higher capital turnover ratio.
Gauging Barriers to Entry

Which of the following barriers to entry are most likely to work for Titan Cement?

- Brand Name
- Patents and Legal Protection
- Switching Costs
- Cost Advantages

What about for Amazon.com?

- Brand Name
- Patents and Legal Protection
- Switching Costs
- Cost Advantages

Which of the following barriers to entry are most likely to work for Titan Cement?
Reducing Cost of Capital

Cost of Equity (E/(D+E)) + Pre-tax Cost of Debt (D./(D+E)) = Cost of Capital

Change financing mix

Make product or service less discretionary to customers

Mix debt to assets, reducing default risk

Changing product characteristics

More effective advertising

Outsourcing

Flexible wage contracts & cost structure

Reduce operating leverage

More

Hybrids

Swaps

Derivatives
## Amazon.com: Optimal Debt Ratio

<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>1.58</td>
<td>12.82%</td>
<td>AAA</td>
<td>6.80%</td>
<td>0.00%</td>
<td>6.80%</td>
<td>12.82%</td>
<td>$29,192</td>
</tr>
<tr>
<td>10%</td>
<td>1.76</td>
<td>13.53%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>14.02%</td>
<td>$24,566</td>
</tr>
<tr>
<td>20%</td>
<td>1.98</td>
<td>14.40%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>15.22%</td>
<td>$21,143</td>
</tr>
<tr>
<td>30%</td>
<td>2.26</td>
<td>15.53%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>16.42%</td>
<td>$18,509</td>
</tr>
<tr>
<td>40%</td>
<td>2.63</td>
<td>17.04%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>17.62%</td>
<td>$16,419</td>
</tr>
<tr>
<td>50%</td>
<td>3.16</td>
<td>19.15%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>18.82%</td>
<td>$14,719</td>
</tr>
<tr>
<td>60%</td>
<td>3.95</td>
<td>22.31%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>20.02%</td>
<td>$13,311</td>
</tr>
<tr>
<td>70%</td>
<td>5.27</td>
<td>27.58%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>21.22%</td>
<td>$12,125</td>
</tr>
<tr>
<td>80%</td>
<td>7.90</td>
<td>38.11%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>22.42%</td>
<td>$11,112</td>
</tr>
<tr>
<td>90%</td>
<td>15.81</td>
<td>69.73%</td>
<td>D</td>
<td>18.50%</td>
<td>0.00%</td>
<td>18.50%</td>
<td>23.62%</td>
<td>$10,237</td>
</tr>
</tbody>
</table>
## Titan: Optimal Capital Structure

<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>0.83</td>
<td>9.02%</td>
<td>AAA</td>
<td>5.85%</td>
<td>30%</td>
<td>4.10%</td>
<td>9.02%</td>
<td>$1,805</td>
</tr>
<tr>
<td>10%</td>
<td>0.90</td>
<td>9.32%</td>
<td>AAA</td>
<td>5.85%</td>
<td>30%</td>
<td>4.10%</td>
<td>8.80%</td>
<td>$1,890</td>
</tr>
<tr>
<td>20%</td>
<td>0.98</td>
<td>9.70%</td>
<td>A</td>
<td>6.90%</td>
<td>30%</td>
<td>4.83%</td>
<td>8.73%</td>
<td>$1,920</td>
</tr>
<tr>
<td>30%</td>
<td>1.08</td>
<td>10.19%</td>
<td>A-</td>
<td>7.10%</td>
<td>30%</td>
<td>4.97%</td>
<td>8.62%</td>
<td>$1,964</td>
</tr>
<tr>
<td>40%</td>
<td>1.22</td>
<td>10.84%</td>
<td>B</td>
<td>11.60%</td>
<td>30%</td>
<td>8.12%</td>
<td>9.75%</td>
<td>$1,564</td>
</tr>
<tr>
<td>50%</td>
<td>1.42</td>
<td>11.76%</td>
<td>CCC</td>
<td>15.10%</td>
<td>30%</td>
<td>10.57%</td>
<td>11.16%</td>
<td>$1,242</td>
</tr>
<tr>
<td>60%</td>
<td>1.71</td>
<td>13.15%</td>
<td>CC</td>
<td>16.60%</td>
<td>29.55%</td>
<td>11.69%</td>
<td>12.28%</td>
<td>$1,065</td>
</tr>
<tr>
<td>70%</td>
<td>2.28</td>
<td>15.84%</td>
<td>CC</td>
<td>16.60%</td>
<td>25.33%</td>
<td>12.40%</td>
<td>13.43%</td>
<td>$926</td>
</tr>
<tr>
<td>80%</td>
<td>3.48</td>
<td>21.44%</td>
<td>C</td>
<td>17.80%</td>
<td>20.67%</td>
<td>14.12%</td>
<td>15.58%</td>
<td>$740</td>
</tr>
<tr>
<td>90%</td>
<td>6.95</td>
<td>37.78%</td>
<td>C</td>
<td>17.80%</td>
<td>18.37%</td>
<td>14.53%</td>
<td>16.85%</td>
<td>$659</td>
</tr>
</tbody>
</table>

| 85%        | 1.16 | 8.78%         | A           | 6.70%                 | 30%     | 4.83%                   | 8.47% | $1,880       |
| 90%        | 2.48 | 11.76%        | CCC         | 15.10%                | 30%     | 10.57%                  | 11.16%| $1,242       |
| 95%        | 3.71 | 14.76%        | CC          | 16.60%                | 29.55%  | 11.69%                  | 12.28%| $1,065       |
| 100%       | 5.04 | 17.76%        | C           | 17.80%                | 20.67%  | 14.12%                  | 15.58%| $740         |
| 105%       | 6.37 | 20.76%        | C           | 17.80%                | 18.37%  | 14.53%                  | 16.85%| $659         |
| 110%       | 7.71 | 23.76%        | C           | 17.80%                | 16.02%  | 14.04%                  | 15.58%| $573         |
| 115%       | 9.05 | 26.76%        | C           | 17.80%                | 13.27%  | 13.57%                  | 15.58%| $500         |
| 120%       | 10.40| 29.76%        | C           | 17.80%                | 12.41%  | 13.09%                  | 15.58%| $432         |
| 125%       | 11.75| 32.76%        | C           | 17.80%                | 11.55%  | 12.61%                  | 15.58%| $365         |

<table>
<thead>
<tr>
<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>0.83</td>
<td>9.02%</td>
<td>AAA</td>
<td>5.85%</td>
<td>30%</td>
<td>4.10%</td>
<td>9.02%</td>
<td>$1,805</td>
</tr>
<tr>
<td>0.90</td>
<td>9.32%</td>
<td>AAA</td>
<td>5.85%</td>
<td>30%</td>
<td>4.10%</td>
<td>8.80%</td>
<td>$1,890</td>
</tr>
<tr>
<td>0.98</td>
<td>9.70%</td>
<td>A</td>
<td>6.90%</td>
<td>30%</td>
<td>4.83%</td>
<td>8.73%</td>
<td>$1,920</td>
</tr>
<tr>
<td>1.08</td>
<td>10.19%</td>
<td>A-</td>
<td>7.10%</td>
<td>30%</td>
<td>4.97%</td>
<td>8.62%</td>
<td>$1,964</td>
</tr>
<tr>
<td>1.22</td>
<td>10.84%</td>
<td>B</td>
<td>11.60%</td>
<td>30%</td>
<td>8.12%</td>
<td>9.75%</td>
<td>$1,564</td>
</tr>
<tr>
<td>1.42</td>
<td>11.76%</td>
<td>CCC</td>
<td>15.10%</td>
<td>30%</td>
<td>10.57%</td>
<td>11.16%</td>
<td>$1,242</td>
</tr>
<tr>
<td>1.71</td>
<td>13.15%</td>
<td>CC</td>
<td>16.60%</td>
<td>29.55%</td>
<td>11.69%</td>
<td>12.28%</td>
<td>$1,065</td>
</tr>
<tr>
<td>2.28</td>
<td>15.84%</td>
<td>CC</td>
<td>16.60%</td>
<td>25.33%</td>
<td>12.40%</td>
<td>13.43%</td>
<td>$926</td>
</tr>
<tr>
<td>3.48</td>
<td>21.44%</td>
<td>C</td>
<td>17.80%</td>
<td>20.67%</td>
<td>14.12%</td>
<td>15.58%</td>
<td>$740</td>
</tr>
<tr>
<td>6.95</td>
<td>37.78%</td>
<td>C</td>
<td>17.80%</td>
<td>18.37%</td>
<td>14.53%</td>
<td>16.85%</td>
<td>$659</td>
</tr>
</tbody>
</table>

**From Value (G)**

- **WACC**
- **Beta**
- **Cost of Equity**
- **Bond Rating**
- **Interest rate on debt**
- **Tax Rate**
- **Cost of Debt (after-tax)**
- **Firm Value (G)**
- **Debt Ratio**
- **Cost of Equity**
- **Beta**
- **Bond Rating**
- **Interest rate on debt**
- **Tax Rate**
- **Cost of Debt (after-tax)**
- **Firm Value (G)**

**Debt Ratio**

- **%**
Aswath Damodaran

Current Cashflow to Firm

\[
\text{EBIT}(1-t) : \text{Nt CpX} = 419- \text{Ch} \]

\[
\text{g} = \text{WC} = \text{FCFF} = -355
\]

\[
\text{Reinvestment Rate} = 352\%
\]

Expected Growth in EBIT (1-t)

\[
0.6422 \times 0.18 = 0.1511
\]

15.11%

Stable Growth

\[
g = 4\% ; \text{Beta} = 1.00 ; \text{Country Premium} = 0\%
\]

Cost of capital = 8.08%

\[
\text{ROC} = 8.08\% ; \text{Tax rate} = 30\%
\]

\[
\text{Reinvestment Rate} = 49.5\%
\]

Terminal Value

\[
166.09 \div (0.08 - 0.15) = 4,053
\]

Cost of Equity

\[
\text{10.22}\%
\]

Cost of Debt

\[
(5.1\% + 0.35\% + 2\%) (1 - 0.2449) = 5.62\%
\]

Weights

\[
\text{E} = 70\% ; \text{D} = 30\%
\]

Discount at Cost of Capital (WACC) = 10.22% (.70) + 5.62% (0.30) = 8.84%

Firm Value: €2,394 + Cash: €113 - Debt: €382 = Equity: €2,127

Value/Share: €55.85

Riskfree Rate:

\[
\text{Real riskfree rate} = 5.1\%
\]

\[
\text{Beta} \times \text{Risk premium} = 1.09 \times 4.70\% = 5.15\%
\]

Unlevered Beta for Sectors: 0.80

Firm's D/E Ratio: 29%

Mature risk premium: 4%

Country Risk Premium: 0.70%

Titan Cements: Restructured

Return on Capital = 18%

Return on Capital = 18%

Terminal Value = 166.09 / (0.0808 - 0.04) = 4,053

Reinvestment Rate: 64.22%

Expected Growth Rate = 15.11%

EBIT (1-1/20): €157, €175, €195, €218, €243, €268, €290, €311, €328, €341

Reinvestment €101, €112, €126, €140, €156, €164, €172, €172, €169, €169

FCFF = €56, €63, €70, €78, €87, €104, €121, €139, €156, €172

In Year: 1 2 3 4 5 6 7 8 9 10

Current Cashflow to Firm

Avg Reinvestment rate = 64.22%
The Value of Control?

If the value of a firm run optimally is significantly higher than the value of the firm with the status quo (or incumbent management), you can write the value that you should be willing to pay as:

\[
\text{Value of control} = \text{Value of firm \ optimally run} - \text{Value of firm \ status quo run}
\]

Implications:

- The value of control is greatest at poorly run firms.
- Voting shares in poorly run firms should trade at a premium over non-voting shares if the votes associated with the shares will give you a chance to have a say in a hostile acquisition.
- When valuing private firms, your estimate of value will vary depending upon whether you gain control of the firm. For example, 49\% of a private firm may be worth less than 51\% of the same firm.

\[
\frac{51\% \text{ stake}}{49\% \text{ stake}} = \frac{\text{status quo value}}{\text{optimal value}}
\]

49\% stake = 49\% of status quo value

51\% stake = 51\% of optimal value

If the value of a firm run optimally is significantly higher than the value of the firm with the status quo (or incumbent management), you can write the value that you should be willing to pay as:

\[
\text{Value of control} = \text{Value of firm \ optimally run} - \text{Value of firm \ status quo run}
\]

The value of control is greatest at poorly run firms.
Back to Lemmings...