Discounted Cash Flow Valuation: The Inputs

Aswath Damodaran
I. Estimating Discount Rates

DCF Valuation
Critical ingredient in discounted cashflow valuation. Errors in estimating the discount rate or mismatching cashflows and discount rates can lead to serious errors in valuation.

At an intuitive level, the discount rate used should be consistent with both the riskiness and the type of cashflow being discounted.

- **Equity versus Firm**: If the cash flows being discounted are cash flows to equity, the appropriate discount rate is a cost of equity. If the cash flows are cash flows to the firm, the appropriate discount rate is the cost of capital.
- **Currency**: The currency in which the cash flows are estimated should also be the currency in which the discount rate is estimated.
- **Nominal versus Real**: If the cash flows being discounted are nominal cash flows (i.e., reflect expected inflation), the discount rate should be nominal.
The cost of equity should be higher for riskier investments and lower for safer investments.

While risk is usually defined in terms of the variance of actual returns around an expected return, risk and return models in finance assume that the risk that should be rewarded (and thus built into the discount rate) in valuation should be the risk perceived by the marginal investor in the investment.

Most risk and return models in finance also assume that the marginal investor is well diversified, and that the only risk that he or she perceives in an investment is risk that cannot be diversified away (i.e., market or non-diversifiable risk).
## The Cost of Equity: Competing Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Expected Return</th>
<th>Inputs Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAPM</td>
<td>$E(R) = R_f + \beta (R_m - R_f)$</td>
<td>Riskfree Rate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Beta relative to market portfolio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Market Risk Premium</td>
</tr>
<tr>
<td>APM</td>
<td>$E(R) = R_f + \sum_{j=1}^{# \text{Factors}} \beta_j (R_j - R_f)$</td>
<td>Riskfree Rate; # of Factors;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Betas relative to each factor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Factor risk premiums</td>
</tr>
<tr>
<td>Multi factor</td>
<td>$E(R) = R_f + \sum_{j=1,\text{#\text{Factors}}}^{N} \beta_j (R_j - R_f)$</td>
<td>Riskfree Rate; Macro factors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Betas relative to macro factors</td>
</tr>
<tr>
<td>Proxy</td>
<td>$E(R) = a + \sum_{j=1,\text{Proxies}}^{N} b_j Y_j$</td>
<td>Proxies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Regression coefficients</td>
</tr>
</tbody>
</table>
Consider the standard approach to estimating cost of equity:
\[
\text{Cost of Equity} = R_f + \text{Equity Beta} \times (E(R_m) - R_f)
\]
where,
\[
R_f = \text{Riskfree rate}
\]
\[
E(R_m) = \text{Expected Return on the Market Index (Diversified Portfolio)}
\]

In practice,
- Short term government security rates are used as risk free rates
- Historical risk premiums are used for the risk premium
- Betas are estimated by regressing stock returns against market returns
Short term Governments are not riskfree

- On a riskfree asset, the actual return is equal to the expected return. Therefore, there is no variance around the expected return.
- For an investment to be riskfree, then, it has to have
  - No default risk
  - No reinvestment risk
- Thus, the riskfree rates in valuation will depend upon when the cash flow is expected to occur and will vary across time
- A simpler approach is to match the duration of the analysis (generally long term) to the duration of the riskfree rate (also long term)
- In emerging markets, there are two problems:
  - The government might not be viewed as riskfree (Brazil, Indonesia)
  - There might be no market-based long term government rate (China)
Estimating a Riskfree Rate

- Estimate a range for the riskfree rate in local terms:
  - *Upper limit*: Obtain the rate at which the largest, safest firms in the country borrow at and use as the riskfree rate.
  - *Lower limit*: Use a local bank deposit rate as the riskfree rate.

- Do the analysis in real terms (rather than nominal terms) using a real riskfree rate, which can be obtained in one of two ways –
  - from an inflation-indexed government bond, if one exists
  - set equal, approximately, to the long term real growth rate of the economy in which the valuation is being done.

- Do the analysis in another more stable currency, say US dollars.
A Simple Test

- You are valuing Brahma, a Brazilian company, in U.S. dollars and are attempting to estimate a riskfree rate to use in the analysis. The riskfree rate that you should use is
  - The interest rate on a Brazilian Real denominated long term Government bond
    - The interest rate on a US $ denominated Brazilian long term bond (called a C-Bond)
    - The interest rate on a US $ denominated Brazilian Brady bond (which is partially backed by the US Government)
  - The interest rate on a US treasury bond
Everyone uses historical premiums, but..

- 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 T.bill rates or T.Bond rates
  - Whether you use geometric or arithmetic averages.
- 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></td>
<td>Arith</td>
<td>Geom</td>
</tr>
<tr>
<td>1928-2000</td>
<td>8.41%</td>
<td>7.17%</td>
</tr>
<tr>
<td>1962-2000</td>
<td>6.42%</td>
<td>5.25%</td>
</tr>
<tr>
<td>1990-2000</td>
<td>11.31%</td>
<td>8.35%</td>
</tr>
</tbody>
</table>
If you choose to use historical premiums….

- Go back as far as you can. A risk premium comes with a standard error. Given the annual standard deviation in stock prices is about 25%, the standard error in a historical premium estimated over 25 years is roughly:

  \[
  \text{Standard Error in Premium} = \frac{25\%}{\sqrt{25}} = \frac{25\%}{5} = 5\%
  \]

- Be consistent in your use of the risk-free rate. Since we argued for long term bond rates, the premium should be the one over T.Bonds

- Use the geometric risk premium. It is closer to how investors think about risk premiums over long periods.
Assessing Country Risk Using Country Ratings: Latin America

<table>
<thead>
<tr>
<th>Country</th>
<th>Rating</th>
<th>Typical Spread</th>
<th>Market Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argentina</td>
<td>B1</td>
<td>450</td>
<td>433</td>
</tr>
<tr>
<td>Bolivia</td>
<td>B1</td>
<td>450</td>
<td>469</td>
</tr>
<tr>
<td>Brazil</td>
<td>B2</td>
<td>550</td>
<td>483</td>
</tr>
<tr>
<td>Colombia</td>
<td>Ba2</td>
<td>300</td>
<td>291</td>
</tr>
<tr>
<td>Ecuador</td>
<td>Caa2</td>
<td>750</td>
<td>727</td>
</tr>
<tr>
<td>Guatemala</td>
<td>Ba2</td>
<td>300</td>
<td>331</td>
</tr>
<tr>
<td>Honduras</td>
<td>B2</td>
<td>550</td>
<td>537</td>
</tr>
<tr>
<td>Mexico</td>
<td>Baa3</td>
<td>145</td>
<td>152</td>
</tr>
<tr>
<td>Paraguay</td>
<td>B2</td>
<td>550</td>
<td>581</td>
</tr>
<tr>
<td>Peru</td>
<td>Ba3</td>
<td>400</td>
<td>426</td>
</tr>
<tr>
<td>Uruguay</td>
<td>Baa3</td>
<td>145</td>
<td>174</td>
</tr>
<tr>
<td>Venezuela</td>
<td>B2</td>
<td>550</td>
<td>571</td>
</tr>
</tbody>
</table>
Using Country Ratings to Estimate Equity Spreads

- 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,
    - Standard Deviation in Bovespa (Equity) = 30.64%
    - Standard Deviation in Brazil C-Bond = 15.28%
    - Adjusted Equity Spread = 4.83% \( \times \frac{30.64\%}{15.28\%} = 9.69\% \)
- Ratings agencies make mistakes. They are often late in recognizing and building in risk.
### Assessing Country Risk Using Currency Ratings: Western Europe

<table>
<thead>
<tr>
<th>Country</th>
<th>Rating</th>
<th>Default Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>Belgium</td>
<td>Aa1</td>
<td>75</td>
</tr>
<tr>
<td>Denmark</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>A2</td>
<td>120</td>
</tr>
<tr>
<td>Ireland</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Italy</td>
<td>Aa3</td>
<td>90</td>
</tr>
<tr>
<td>Netherlands</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Norway</td>
<td>Aaa</td>
<td>0</td>
</tr>
<tr>
<td>Portugal</td>
<td>Aa2</td>
<td>85</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>Aaa</td>
<td>0</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,
  - Standard Deviation in Greek ASE( Equity) = 40.5%
  - Standard Deviation in Greek GDr Bond = 26.1%
  - Adjusted Equity Spread = 1.20% (40.5%/26.1%) = 1.86%

Ratings agencies make mistakes. They are often late in recognizing and building in risk.
Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,

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

Implicitly, this is what you are assuming when you use the local Government’s dollar borrowing rate as your riskfree rate.

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

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

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 revenues come from non-domestic sales)

\[ E(\text{Return}) = \text{Riskfree Rate} + \beta \text{ (US premium)} + \lambda \text{ (Country Spread)} \]
Estimating Company Exposure to Country Risk

- Different companies should be exposed to different degrees to country risk. For instance, a Brazilian firm that generates the bulk of its revenues in the United States should be less exposed to country risk in Brazil than one that generates all its business within Brazil.

- The factor “$\lambda$” measures the relative exposure of a firm to country risk. One simplistic solution would be to do the following:
  \[
  \lambda = \frac{\% \text{ of revenues domestically}_{\text{firm}}}{\% \text{ of revenues domestically}_{\text{avg firm}}}
  \]
  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 company’s risk exposure is determined by where it does business and not by where it is located
  - Firms might be able to actively manage their country risk exposures
Aswath Damodaran

Estimating E(Return) for Brahma

- Assume that the beta for Brahma is 0.66, and that the riskfree rate used is 5%. (Real Riskfree Rate)
- Approach 1: Assume that every company in the country is equally exposed to country risk. In this case,
  \[
  E(\text{Return}) = 5\% + 9.69\% + 0.66 \times (6.60\%) = 19.05\%
  \]
- Approach 2: Assume that a company’s exposure to country risk is similar to its exposure to other market risk.
  \[
  E(\text{Return}) = 5\% + 0.66 \times (6.60\% + 9.69\%) = 15.75\%
  \]
- 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)
  \[
  E(\text{Return}) = 5\% + 0.66 \times 6.60\% + 1.10 \times 9.69\% = 20.01\%
  \]

Brahma is more exposed to country risk than the typical Brazilian firm since much of its business is in the country.
If we use a basic discounted cash flow model, we can estimate the implied risk premium from the current level of stock prices. For instance, if stock prices are determined by a variation of the simple Gordon Growth Model:

- Value = Expected Dividends next year/ (Required Returns on Stocks - Expected Growth Rate)
- Dividends can be extended to included expected stock buybacks and a high growth period.
- Plugging in the current level of the index, the dividends on the index and expected growth rate will yield a “implied” expected return on stocks. Subtracting out the riskfree rate will yield the implied premium.

This model can be extended to allow for two stages of growth - an initial period where the entire market will have earnings growth greater than that of the economy, and then a stable growth period.
Estimating Implied Premium for U.S. Market:
Jan 1, 2001

- Level of the index = 1320
- Treasury bond rate = 5.10%
- Expected Growth rate in earnings (next 5 years) = 7.50% (Consensus estimate for S&P 500)
- Expected growth rate after year 5 = 5.50%
- Expected dividends + stock buybacks = 2.14% of index

<table>
<thead>
<tr>
<th>Year</th>
<th>Expected Dividends</th>
<th>Stock Buybacks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1</td>
<td>$30.38</td>
<td></td>
</tr>
<tr>
<td>Year 2</td>
<td>$32.66</td>
<td></td>
</tr>
<tr>
<td>Year 3</td>
<td>$35.11</td>
<td></td>
</tr>
<tr>
<td>Year 4</td>
<td>$37.75</td>
<td></td>
</tr>
<tr>
<td>Year 5</td>
<td>$40.58</td>
<td></td>
</tr>
</tbody>
</table>

Expected dividends + buybacks in year 6 = $40.58 (1.055) = $43.22

\[ 1320 = \frac{30.38}{1+r} + \frac{32.66}{(1+r)^2} + \frac{35.11}{(1+r)^3} + \frac{37.75}{(1+r)^4} + \frac{(40.55+(43.22/(r-0.055))}{(1+r)^5} \]

Solving for r, r = 7.97%. (Only way to do this is trial and error)

Implied risk premium = 7.97% - 5.10% = 2.87%
Implied Premium for US Equity Market

Year


Implied Premium

0.00% 1.00% 2.00% 3.00% 4.00% 5.00% 6.00% 7.00%
Implied Premium for Brazilian Market: April 1, 2000

- Level of the Index = 17647
- Dividends on the Index = 4.15% of 17064 (Used weighted yield)
- Other parameters
  - Riskfree Rate = 5% (Real BR)
  - Expected Growth (in real terms)
    - Next 5 years = 15% (Used expected growth rate in Earnings)
    - After year 5 = 5%

- Solving for the expected return:
  - Expected return on Equity = 11.56%
  - Implied Equity premium = 11.56% - 5% = 6.56%
The Effect of Using Implied Equity Premiums on Value

- Brahma’s value per share (using historical premium + country risk adjustment) = 584 BR
- Brahma’s value per share (using implied equity premium of 6.56%) = 968 BR
- Brahma’s stock price (at the time of the valuation) = 910 BR
Estimating Beta

- The standard procedure for estimating betas is to regress stock returns \( R_j \) against market returns \( R_m \) -
  \[
  R_j = a + b R_m
  \]
  - where \( a \) is the intercept and \( b \) is the slope of the regression.
- The slope of the regression corresponds to the beta of the stock, and measures the riskiness of the stock.
- 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.
Beta Estimation: The Noise Problem
Beta Estimation: 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.
  - Cyclical companies have higher betas than non-cyclical firms
  - Firms which sell more discretionary products will have higher betas than firms that sell less discretionary products

- **Operating Leverage**: The greater the proportion of fixed costs in the cost structure of a business, the higher the beta will be of that business. This is because higher fixed costs increase your exposure to all risk, including 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 exposure to market risk.
The beta of equity alone can be written as a function of the unlevered beta and the debt-equity ratio:

$$\beta_L = \beta_u (1 + ((1-t)D/E))$$

where

- $\beta_L$ = Levered or Equity Beta
- $\beta_u$ = Unlevered Beta
- $t$ = Corporate marginal tax rate
- $D$ = Market Value of Debt
- $E$ = Market Value of Equity

While this beta is estimated on the assumption that debt carries no market risk (and has a beta of zero), you can have a modified version:

$$\beta_L = \beta_u (1 + ((1-t)D/E)) - \beta_{\text{debt}} (1-t) (D/E)$$
Solutions to the Regression Beta Problem

- Modify the regression beta by
  - changing the index used to estimate the beta
  - adjusting the regression beta estimate, by bringing in information about the fundamentals of the company

- Estimate the beta for the firm using
  - the standard deviation in stock prices instead of a regression against an index.
  - accounting earnings or revenues, which are less noisy than market prices.

- Estimate the beta for the firm from the bottom up without employing the regression technique. This will require
  - understanding the business mix of the firm
  - estimating the financial leverage of the firm

- Use an alternative measure of market risk that does not need a regression.
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.

\[
\sum_{j=1}^{j=k} \beta_j \left( \frac{\text{Operating Income}_j}{\text{Operating Income}_{\text{Firm}}} \right)
\]

(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

\[
\beta_{\text{levered}} = \beta_{\text{unlevered}} [1 + (1 - \text{tax rate}) \text{ (Current Debt/Equity Ratio)}]
\]

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

- It has lower standard error \(SE_{\text{average}} = SE_{\text{firm}} / \sqrt{n}\) (n = number of firms)
- It reflects the firm’s current business mix and financial leverage
- It can be estimated for divisions and private firms.
Bottom-up Beta: Firm in Multiple Businesses
Boeing in 1998

<table>
<thead>
<tr>
<th>Segment</th>
<th>Estimated Value</th>
<th>Unlevered Beta</th>
<th>Segment Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commercial Aircraft</td>
<td>30,160.48</td>
<td>0.91</td>
<td>70.39%</td>
</tr>
<tr>
<td>Defense</td>
<td>12,687.50</td>
<td>0.80</td>
<td>29.61%</td>
</tr>
</tbody>
</table>

Unlevered Beta of firm = 0.91 (.7039) + 0.80 (.2961) = 0.88

Levered Beta Calculation

Market Value of Equity = $33,401
Market Value of Debt = $8,143
Market Debt/Equity Ratio = 24.38%
Tax Rate = 35%

Levered Beta for Boeing = 0.88 (1 + (1 - .35) (.2438)) = 1.02
Siderar’s Bottom-up Beta

Siderar is an Argentine steel company.

<table>
<thead>
<tr>
<th>Business</th>
<th>Unlevered D/E Ratio</th>
<th>Levered Beta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel</td>
<td>0.68</td>
<td>5.97% 0.71</td>
</tr>
</tbody>
</table>

Proportion of operating income from steel = 100%

Levered Beta for Siderar = 0.71

Can an unlevered beta estimated using U.S. steel companies be used to estimate the beta for an emerging market steel company?
The Cost of Equity: A Recap

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

- Preferably, a bottom-up beta, based upon other firms in the business, and firm's own financial leverage

- Has to be in the same currency as cash flows, and defined in same terms (real or nominal) as the cash flows

- **Historical Premium**
  1. Mature Equity Market Premium: Average premium earned by stocks over T.Bonds in U.S.
  2. Country risk premium = Country Default Spread* (σ Equity/σ Country bond)

- **Implied Premium**
  Based on how equity market is priced today and a simple valuation model
Estimating the Cost of Debt

- The cost of debt is the rate at which you can borrow at currently. It will reflect not only your default risk but also the level of interest rates in the market.

- The two most widely used approaches to estimating cost of debt are:
  - Looking up the yield to maturity on a straight bond outstanding from the firm. The limitation of this approach is that very few firms have long term straight bonds that are liquid and widely traded.
  - Looking up the rating for the firm and estimating a default spread based upon the rating. While this approach is more robust, different bonds from the same firm can have different ratings. You have to use a median rating for the firm.
  - When in trouble (either because you have no ratings or multiple ratings for a firm), estimate a synthetic rating for your firm and the cost of debt based upon that rating.
Estimating Synthetic Ratings

- 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 Siderar, for instance

  \[ \text{Interest Coverage Ratio} = \frac{161}{48} = 3.33 \]

  - Based upon the relationship between interest coverage ratios and ratings, we would estimate a rating of A- for Siderar. With a default spread of 1.25\% (given the rating of A-)

- For Telecom Italia, for instance

  \[ \text{Interest Coverage Ratio} = \frac{4313}{306} = 14.09 \]

  - Based upon the relationship between interest coverage ratios and ratings, we would estimate a rating of AAA for Telecom Italia.
### Interest Coverage Ratios, Ratings and Default Spreads

<table>
<thead>
<tr>
<th>Interest Coverage Ratio is</th>
<th>Estimated Bond Rating</th>
<th>Default Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 8.50</td>
<td>AAA</td>
<td>0.20%</td>
</tr>
<tr>
<td>6.50 - 8.50</td>
<td>AA</td>
<td>0.50%</td>
</tr>
<tr>
<td>5.50 - 6.50</td>
<td>A+</td>
<td>0.80%</td>
</tr>
<tr>
<td>4.25 - 5.50</td>
<td>A</td>
<td>1.00%</td>
</tr>
<tr>
<td>3.00 - 4.25</td>
<td>A–</td>
<td>1.25%</td>
</tr>
<tr>
<td>2.50 - 3.00</td>
<td>BBB</td>
<td>1.50%</td>
</tr>
<tr>
<td>2.00 - 2.50</td>
<td>BB</td>
<td>2.00%</td>
</tr>
<tr>
<td>1.75 - 2.00</td>
<td>B+</td>
<td>2.50%</td>
</tr>
<tr>
<td>1.50 - 1.75</td>
<td>B</td>
<td>3.25%</td>
</tr>
<tr>
<td>1.25 - 1.50</td>
<td>B –</td>
<td>4.25%</td>
</tr>
<tr>
<td>0.80 - 1.25</td>
<td>CCC</td>
<td>5.00%</td>
</tr>
<tr>
<td>0.65 - 0.80</td>
<td>CC</td>
<td>6.00%</td>
</tr>
<tr>
<td>0.20 - 0.65</td>
<td>C</td>
<td>7.50%</td>
</tr>
<tr>
<td>&lt; 0.20</td>
<td>D</td>
<td>10.00%</td>
</tr>
</tbody>
</table>
Cost of Debt computations

- Companies in countries with low bond ratings and high default risk might bear the burden of country default risk
  - For Siderar, the rating estimated of A- yields a cost of debt as follows:
    Pre-tax Cost of Debt
    \[= \text{US T.Bond rate} + \text{Country default spread} + \text{Company Default Spread}\]
    \[= 6\% + 5.25\% + 1.25\% = 12.50\%\]

- For Telecom Italia, the rating of AAA yields a cost of debt in Euros as follows:
  Pre-tax Cost of Debt = Riskfree Rate + Default Spread
  \[= 4.24\% + 0.20\% = 4.44\%\]
Synthetic Ratings: Some Caveats

- The relationship between interest coverage ratios and ratings, developed using US companies, tends to travel well, as long as we are analyzing large manufacturing firms in markets with interest rates close to the US interest rate.
- They are more problematic when looking at smaller companies in markets with higher interest rates than the US.
Weights for the Cost of Capital Computation

- The weights used to compute the cost of capital should be the market value weights for debt and equity.
- 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.
- 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.
Estimating Cost of Capital: Telecom Italia

- **Equity**
  - Cost of Equity = 4.24% + 0.87 (4% + 1.53%) = 9.05%
  - Market Value of Equity = 9.92* 5255.13 = 52,110 Mil (84.16%)

- **Debt**
  - Cost of debt = 4.24% + 0.2% (default spread) = 4.44%
  - Market Value of Debt = 9,809 Mil (15.84%)

- **Cost of Capital**
  
  Cost of Capital = 9.05 % (.8416) + 4.44% (1- .4908) (.1584)) = 7.98%
Telecom Italia: Book Value Weights


- Is this more conservative?
Estimating A U.S. Dollar Cost of Capital: Siderar - An Argentine Steel Company

- **Equity**
  - Cost of Equity = 6.00% + 0.71(4% +10.53%) = 16.32%
  - Market Value of Equity = 3.20*310.89 = 995 million (94.37%)

- **Debt**
  - Cost of debt = 6.00% + 5.25% (Country default) +1.25% (Company default) = 12.5%
  - Market Value of Debt = 59 Mil (5.63%)

- **Cost of Capital**
  
  Cost of Capital = 16.32 % (.9437) + 12.50% (1-.3345) (.0563))
  
  = 16.32 % (.9437) + 8.32% (.0563)) = 15.87 %
Converting a Dollar Cost of Capital into a Peso cost of capital

- Approach 1: Use a peso riskfree rate in all of the calculations above. For instance, if the peso riskfree rate was 10%, the cost of capital would be computed as follows:
  - Cost of Equity = 10.00% + 0.71 (4% +10.53%) = 20.32%
  - Cost of Debt = = 10.00% + 5.25% (Country default) +1.25% (Company default) = 16.5%

  (This assumes the peso riskfree rate has no country risk premium embedded in it.)

- Approach 2: Use the differential inflation rate to estimate the cost of capital. For instance, if the inflation rate in pesos is 7% and the inflation rate in the U.S. is 3%

\[
\text{Cost of capital} = \left(1 + \text{Cost of Capital}_\$\right) \frac{1 + \text{Inflation}_{\text{Peso}}}{1 + \text{Inflation}_\$}
\]

\[
= 1.1587 \times \left(\frac{1.07}{1.03}\right) = 1.2037 --> 20.37\%
\]
Dealing with Hybrids and Preferred Stock

- When dealing with hybrids (convertible bonds, for instance), break the security down into debt and equity and allocate the amounts accordingly. Thus, if a firm has $125 million in convertible debt outstanding, break the $125 million into straight debt and conversion option components. The conversion option is equity.

- When dealing with preferred stock, it is better to keep it as a separate component. The cost of preferred stock is the preferred dividend yield. (As a rule of thumb, if the preferred stock is less than 5% of the outstanding market value of the firm, lumping it in with debt will make no significant impact on your valuation).
Recapping the Cost of Capital

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

Marginal tax rate, reflecting tax benefits of debt

Weights should be market value weights

Cost of equity based upon bottom-up beta