Estimating Cost of Capital

1. Vocabulary – the following all mean the same thing:
   a. Required return
   b. Appropriate discount rate
   c. Cost of capital (or cost of money)

2. The cost of capital is an opportunity cost – it depends on where the money goes, not where it comes from
   • We assume that the return earned on assets depends on the risk of those assets
   • The return to an investor is the same as the cost to the company
   • Our cost of capital provides us with an indication of how the market views the risk of our assets
   • Knowing our cost of capital can also help us determine our required return for capital budgeting projects
   • For now, assume the firm’s capital structure (mix of debt and equity) is fixed.

Cost of Equity:
Cost of equity can be estimated using the Capital Asset Pricing Model (CAPM), the Dividend Discount Model (DDM), and the Earnings Capitalization Model (ECM).

The Capital Asset Pricing Model (CAPM):
   • The required return should be equal to the risk-free rate plus the compensation for risk
   • The compensation for risk depends on the amount of systematic risk ($\beta$) and equity risk premium ($k_m - k_{rf}$)

Estimation of Beta ($\beta$):

\[ k_j = k_{rf} + \beta_j (k_m - k_{rf}) \]

where,
- $k_j$ : the required return on security j
- $k_{rf}$ : the risk-free rate of interest
- $\beta_j$ : the beta of security j
- $k_m$ : the return on the market index

- Do it yourself:
Estimate:

\[ k_{it} = \alpha_i + \beta_i (k_{mt}) + \epsilon_{it} \]

- $k_{it}$ : the return on stock i in period t
- $k_{mt}$ : the return on the market portfolio in period t
- $\alpha_i$ : regression constant for stock i
- $\beta_i$ : Beta for stock i
- $\epsilon_{it}$ : random error term of the regression
BDK vs. SP500

\[ y = 1.0918x + 0.0141 \]
\[ R^2 = 0.295 \]

(See Excel File)

- Use publicly available estimations, Value Line, Quicken etc.

Keep in mind that Beta is not static over time. As expectations and leverage change so will Beta.

Estimation of Market Risk-Premium:

- Use of historical data…

Professor Kenneth French provides the market premium at [http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html](http://mba.tuck.dartmouth.edu/pages/faculty/ken.french/data_library.html) as

\[(k_m - k_{rf}) = 8.48\% \text{ (Arithmetic Average over 1927 – 2003)}\] or
\[(k_m - k_{rf}) = 6.35\% \text{ (Geometric Average over 1927 – 2003)}\]

(See Excel File)

Your case Exhibit 8 on page 196 (as of December 4, 2000) reports 7.5%, which is the arithmetic average of annual market returns over the Treasury-bill rate from 1926 to 1998, and 5.9%, which is the geometric average of market returns over Treasury bonds from 1926 to 1998.

Cost of Equity for BDK:

\[ k_{cs} = 4.014\% + 1.0918 \times (8.48\%) = 13.2725\% \]

\[ k_{cs} = 4.014\% + 1.0918 \times (6.35\%) = 10.9469\% \]

The Dividend Discount Model (DDM)

\[ D_1: \text{the next period’s dividend based on a constant growth rate of } g, D_1 = D_0 \times (1 + g) \]
$k_{cs} = \frac{D_1}{P_0} + g$

$P_0$: the current stock price
$g$: the expected constant growth rate of dividends.

- The most important information you need to come up with here is the growth rate of dividends. Value Line forecast or historical dividend growth rate can be used.
- It can also be determined by the product of earnings retention ratio (Retained Earnings / Net Income) and Return on Equity (ROE)
- This method would not be easy to implement for companies that grow fast and/or don’t pay dividends.

The Earnings Capitalization Model (ECM)

$$k_{cs} = \frac{E_1}{P_0}$$

$E_1$ = projected EPS for the following year
$P_0$ = current stock price.

- The earnings capitalization model is notoriously poor in estimating equity costs for growing firms.
- Reasonable for only no growth firms.

Cost of Debt:

- The cost of debt, $RD$, is the interest rate on new borrowing
- The cost of debt is observable:
  a. Yield on currently outstanding debt
  b. Yields on newly-issued similarly-rated bonds
- The historic debt cost is irrelevant – why?

Example: We sold a 20-year, 12% bond 10 years ago at par (1,000). It is currently priced at 89 percent of par. Coupon payments are semi-annual. What is our cost of debt?

<table>
<thead>
<tr>
<th>N</th>
<th>I/Y</th>
<th>P/Y</th>
<th>PV</th>
<th>PMT</th>
<th>FV</th>
<th>MODE</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>14.08</td>
<td>2</td>
<td>-890</td>
<td>60</td>
<td>1000</td>
<td></td>
</tr>
</tbody>
</table>

The yield to maturity is about 14.08%, so this is what we use as the cost of debt, not 12%.

Cost of Preferred Stock:

Preferred stock is perpetuity, so the cost is

$$k_{ps} = \frac{D_0}{P_0}$$

Notice that cost is simply the dividend yield.
Example: We sold an $8 preferred issue 10 years ago. It sells for $120/share today. The cost of preferred stock today is $8 / $120 = 6.67%.

Capital Structure Weights:

Let: 
\[ E = \text{the market value of the equity.} \]
\[ D = \text{the market value of the debt.} \]
\[ P = \text{the market value of the preferred stock} \]
Then: \[ V = E + D + P, \text{ so } E / V + D / V + P / V = 100\% \]
The firm’s capital structure weights are E/V, D/V and P/V.

Interest payments on debt are tax-deductible, so the after-tax cost of debt is the pretax cost multiplied by (1 - corporate tax rate).

After-tax cost of debt = \( k_{ps} \times (1 - T_c) \)

Thus the weighted average cost of capital is

\[
k_{wacc} = \frac{D}{V} k_d (1 - T_c) + \frac{P}{V} (k_{ps}) + \frac{C}{V} (k_{cs})
\]

Practical Issues:

- What happens when you deal with many different bond issues?

Example:
Eastman Chemical has three debt issues outstanding.

<table>
<thead>
<tr>
<th>Coupon</th>
<th>Book Value</th>
<th>Market Value</th>
<th>Yield-to-Maturity</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.375%</td>
<td>$499m</td>
<td>$521m</td>
<td>5.70%</td>
</tr>
<tr>
<td>7.250%</td>
<td>$495m</td>
<td>$543m</td>
<td>6.50%</td>
</tr>
<tr>
<td>7.625%</td>
<td>$200m</td>
<td>$226m</td>
<td>6.60%</td>
</tr>
</tbody>
</table>

Weighted cost of debt can be calculated as:

<table>
<thead>
<tr>
<th>Yield-to-Maturity</th>
<th>Market Value</th>
<th>Weighted Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.70%</td>
<td>$521m</td>
<td>5.70% \times ($521m / $1,290m)</td>
</tr>
<tr>
<td>6.50%</td>
<td>$543m</td>
<td>6.50% \times ($543m / $1,290m)</td>
</tr>
<tr>
<td>6.60%</td>
<td>$226m</td>
<td>6.60% \times ($226m / $1,290m)</td>
</tr>
<tr>
<td>Total</td>
<td>$1,290m</td>
<td>6.20%</td>
</tr>
</tbody>
</table>

- When is the WACC the appropriate discount rate?
The WACC is the appropriate discount rate for a given project only if that project’s risk is about the same as the risk of the firm. Projects that are riskier (less risky) than the firm should be evaluated using a higher (lower) discount rates. What would happen if we use the WACC for all projects regardless of risk? Assume the WACC = 15%.

<table>
<thead>
<tr>
<th>Project</th>
<th>Required Return</th>
<th>IRR</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>20%</td>
<td>17%</td>
</tr>
<tr>
<td>B</td>
<td>15%</td>
<td>18%</td>
</tr>
<tr>
<td>C</td>
<td>10%</td>
<td>12%</td>
</tr>
</tbody>
</table>
• Other Approaches to Getting a Discount Rate

Pure Play Approach:
• Find one or more companies that specialize in the product or service that we are considering
• Compute the beta for each company
• Take an average
• Use that beta along with the CAPM to find the appropriate return for a project of that risk
• Often difficult to find pure play companies
• Betas have to be adjusted for leverage

\[
\beta_l = \beta_u \left[ 1 + (1 - t) \frac{D}{E} \right]
\]

where

\[\beta_l: \text{levered Beta}\]
\[\beta_u: \text{unlevered Beta}\]
\[t: \text{marginal tax rate}\]
\[\frac{D}{E}: \text{the debt-to-equity ratio}\]

Subjective Approach:
• Consider the project’s risk relative to the firm overall
• If the project is more risky than the firm, use a discount rate greater than the WACC
• If the project is less risky than the firm, use a discount rate less than the WACC
• You may still accept projects that you shouldn’t and reject projects you should accept, but your error rate should be lower than not considering differential risk at all

Flotation costs:
• They should be used to adjust for cost of external capital. The adjustment is made on the amount of net receipts from issuance, increasing its cost to the firm.

Marginal WACC:

The marginal WACC graph shows the relationship between capital budget and WACC. (See Excel File)

QUIZ:

What is the relationship between cost of capital and firm value?

Cet. par., the lower the cost of capital, the higher the value of the firm.

When we use the dividend growth model to estimate the firm’s cost of equity, we make a key assumption about future dividends of the firm. What is that assumption?

We assume that dividends will grow at a constant growth rate, \(g\).
In calculating the firm’s WACC, we use the market value weights of debt and equity, if possible. Why?

Because market values reflect the market’s expectations about the size, timing, and risk of future cash flows.

What happens if we use the WACC to evaluate all potential investment projects, regardless of their risk?

Estimated NPVs will be understated (overstated) for projects, which are less risky (riskier) than the firm.