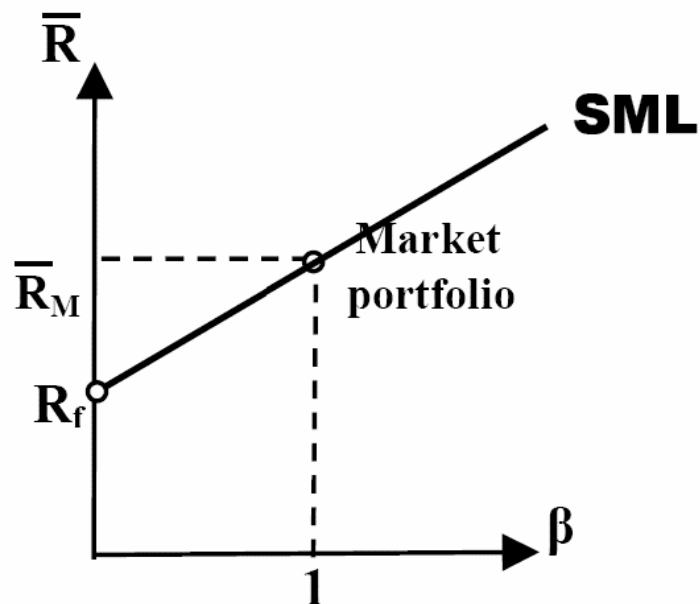




More on the SML and Ch. 12

SML and Weighted Average Cost of Capital

Previously, we obtained the CAPM



$$\bar{R}_i = \bar{R}_{rf} + (\bar{R}_M - \bar{R}_{rf})\beta_i$$

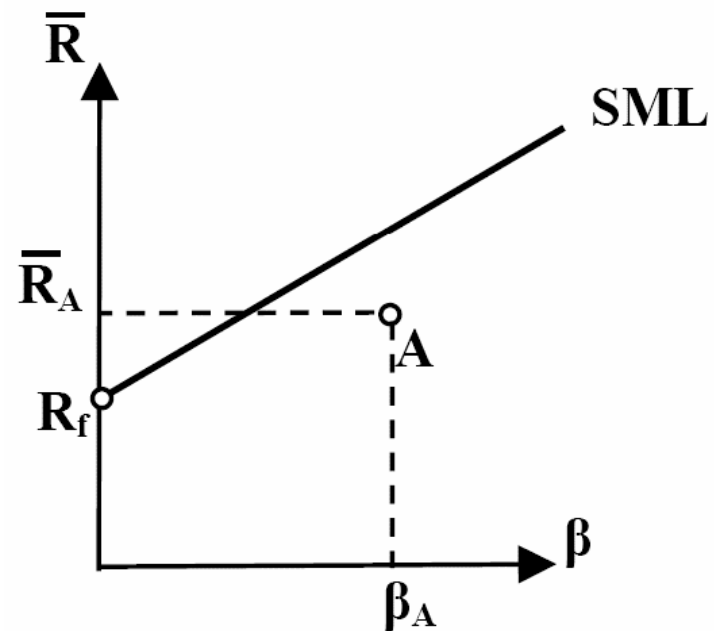
The SML gives the (positive) relationship between risk and expected return. Risk is given by beta.

What can we say if an asset isn't on the SML?

Suppose there is a stock A. You are given its Beta and its expected return; this is graphically represented on the right.

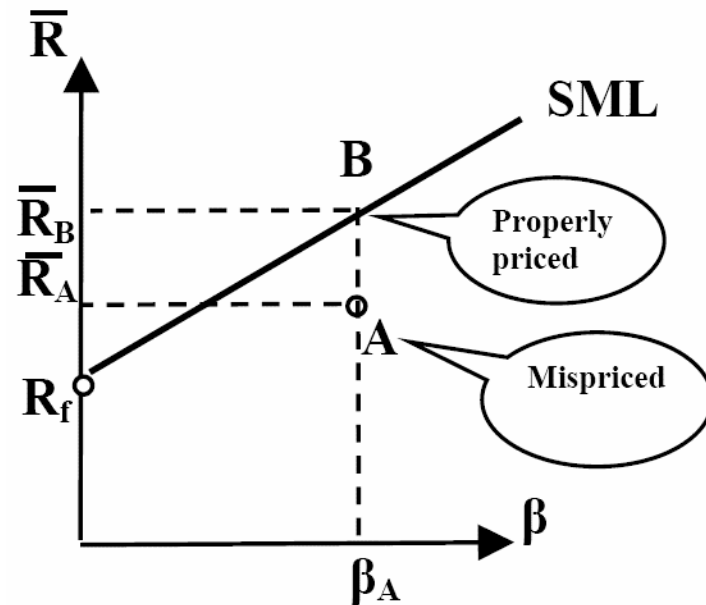
Is security A priced correctly? Overpriced? Underpriced?

Remember $r = (W - I) / I$



Its overpriced.

Security A is overpriced, since there is a stock B that will lie on the SML and give the required return. Investors will choose B over A



Example:

A stock has a beta of 1.8. A security analyst who specializes in studying this stock expects its return to be 18 percent. Suppose the risk-free rate is 5 percent and the expected market risk premium is 8 percent.

Is the analyst pessimistic or optimistic about this stock relative to the market's expectations?

Example 2:

A portfolio that combines the risk-free asset and the market portfolio has an expected return of 25 percent and a standard deviation of 4 percent. The risk-free rate is 5 percent, and the expected return on the market portfolio is 20 percent.

Assume the capital-asset-pricing model holds.

What expected rate of return would a security earn if it had a 0.5 correlation with the market portfolio and a standard deviation of 2 percent?

Problems with CAPM

Problem 1:

CAPM assumes homogeneous expectations.

This implies that one of CAPM's biggest assumptions is that no one had valuable information, and they think nobody else does either.

Second problem

There are other problems with Beta:

For example:

Betas may vary over time (example: last month)

Betas are affected by a company's change in technology, product line, etc.

Third problem

Empirical evidence on CAPM:

“Is Beta dead?” (See Appendix to Ch.10)

CAPM predicts that high-beta stocks have high expected returns (this is what SML line shows).

Empirical tests, which use historical data on stocks, do not always show that this positive relationship is correct.

Chapter 12, Capital budgeting with CAPM

Connecting CAPM with NPV:

- CAPM will give us the discount rate.
- Discount the expected cash flows using this risk-adjusted discount rate.

$$NPV = -\bar{C}_0 + \frac{\bar{C}_1}{1 + \bar{R}} + \frac{\bar{C}_2}{(1 + \bar{R})^2} + \dots$$

where \bar{C}_n is the expected return from the (risky) investment

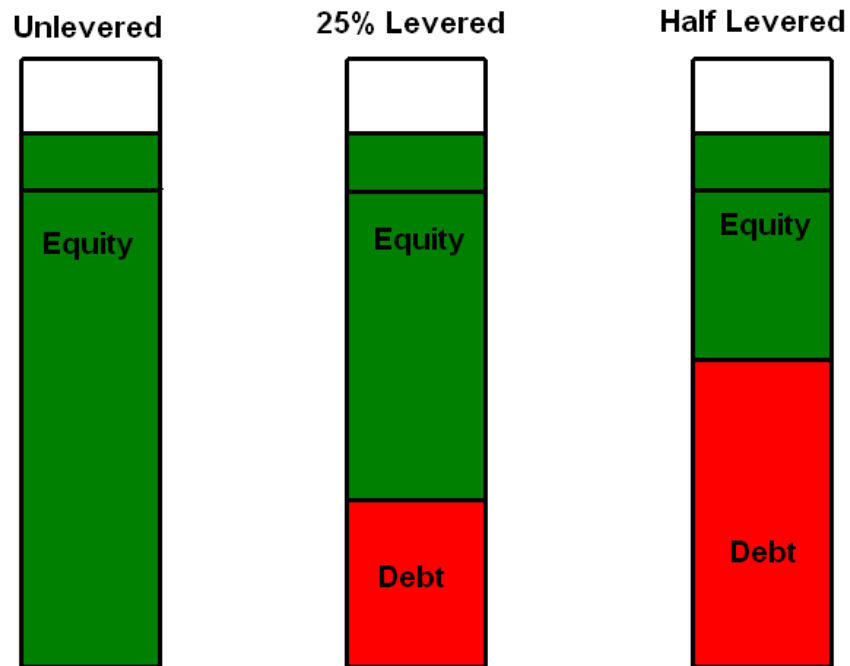
How do we get this discount rate?

Find an asset of comparable risk, and use the market to determine the risk (β) and then apply CAPM

$$\bar{R}_i = R_{rf} + (\bar{R}_M - R_{rf})\beta$$

Beta and risk of a firm (leverage)

Firms can change the beta of their equity by changing their Debt/Equity ratio:



Unlevered firm:

This firm has just equity issued; it carries no debt.

This firm's assets equals its value in equity (stock, market cap)

Thus, the beta on this firm is:

$$\beta_{\text{assets}} = \beta_{\text{equity}}$$

Levered firms

These firms have both equity (stock) and debt (bonds). The firm's total value is the sum of the value of the stocks and bonds.

$$\beta_{\text{assets}} = \frac{\text{Equity}}{\text{Debt} + \text{Equity}} \beta_{\text{equity}} + \frac{\text{Debt}}{\text{Debt} + \text{Equity}} \beta_{\text{debt}}$$

How can we use this?

$$\begin{aligned}\beta_{\text{assets}} &= \frac{E}{D+E} \beta_{\text{equity}} + \frac{D}{D+E} \beta_{\text{debt}} \\ &= \frac{E}{D+E} \beta_{\text{equity}} + \frac{D}{D+E} \cdot 0 \\ &= \frac{E}{D+E} \beta_{\text{equity}}\end{aligned}$$

Rearranging,

$$\begin{aligned}\beta_{\text{equity}} &= \beta_{\text{assets}} \frac{D+E}{E} \\ &= \beta_{\text{assets}} \left(1 + \frac{D}{E} \right)\end{aligned}$$

Weighted Average Cost of Capital (WACC)

Now, let's look at a firm's cost of financing investments, for which it uses both debt and equity.

Notation:

B = Bonds (or debt)

S = Stock (or equity)

r_S = the return to equity (what the firm pays to its shareholders)

r_B = the cost of debt (what the firm pays to its creditors)

WACC=average of required returns

WACC is the weighted average of the required returns r_S and r_B : It is the overall cost of capital for a firm

$$r^{WACC} = \frac{S}{S+B} r_S + \frac{B}{S+B} r_B (1 - T_C)$$

Example:

Market value of Firm's debt: \$40 million

Market value of Firm's equity: \$60 million

15% interest paid on debt, $T_C = 34\%$

Firm's $\beta = 1.41$

Market risk premium = 9.5%, T-bill rate = 11%

What is the firm's r_{WACC} ?