Solutions to Problem Set 9

Corporate Finance, Sections 001 and 002

1. (a) Recall that the asset beta, β_A is the beta of the underlying assets of the firm. Since the firm is a portfolio of debt and equity,

$$\beta_A = \frac{D}{V}\beta_D + \frac{E}{V}\beta_E \tag{1}$$

where V is the total value of the firm,

$$V = E + D,$$

E is the market value of the equity, and D is the market value of the debt. Substituting in the numbers of the problem into (1),

$$\beta_A = \frac{100}{300}0 + \frac{200}{300}(1.2) = 0.8.$$

Note that β_A is lower than β_E, because β_A also takes into account that the firm is financed with 0-beta debt.

(b) For scale-expanding projects, Nero should use the discount rate given by the CAPM, with beta equal to β_A. This equals

$$\begin{aligned} r_A &= R_f + (\bar{R}_M - R_f)\beta_A \\ &= .05 + .8(.13 - .05) = 0.114 \end{aligned}$$

(c) By the Modigliani-Miller proposition I, the new-equity issue does not change the asset beta β_A. By proposition II, the equity beta must equal

$$\beta_E = \beta_A + \frac{D}{E}(\beta_A - \beta_D)$$

After the repurchase, $D = 0$, so

$$\beta_E = \beta_A = 0.8,$$

which makes sense, because the firm is now all-equity.

2. In this no-tax environment, The WACC for Juniper is given by

$$r_{\text{WACC}} = \frac{D}{D+E} r_D + \frac{E}{D+E} r_E$$

Note that $r_{\text{WACC}} = r_A$, the rate of return on the assets. The problem gives $D = \$300,000$. The market value of equity E is the stock price multiplied by the number of shares outstanding, which equals \$500,000. Therefore,

$$r_{\text{WACC}} = \frac{300}{800}(.08) + \frac{500}{800}(.15) = .124$$

3. We will use the superscript L to refer to Longbourn and teh superscript N to refer to Netherfield.

   (a) If Netherfield is investing in the same business that Longbourn is engaged, in then, it should use the discount rate for Longbourn's assets. To compute this discount rate, we need to find Longbourn's asset β,

$$\beta_A^L = \frac{D^L}{D^L + E^L} \beta_D^L + \frac{E^L}{D^L + E^L} \beta_E^L.$$

   To compute the percent of debt and the percent of equity in the capital structure, we need to use the debt-equity ratio for Longbourn:

$$\frac{D^L}{D^L + E^L} = \frac{D^L/E^L}{D^L/E^L + 1} = \frac{.5}{.5+1} = 1/3$$

   We must have

$$\frac{E^L}{D^L + E^L} = 1 - \frac{D^L}{D^L + E^L} = 2/3.$$

   Therefore,

$$\beta_A^L = \frac{1}{3}(0) + \frac{2}{3}2 = \frac{4}{3}$$

   The discount rate for the project is then Longborn's discount rate on its assets. This is given by the CAPM:

$$\begin{aligned} r_A &= R_f + \beta_A(\bar{R}_M - R_f) \\ &= .08 + \frac{4}{3}(.19 - .08) = .226 \end{aligned}$$

(b) When Netherfield invests in Longbourn's industry, its mix of assets changes. Therefore its asset β will change. When the asset β changes, the equity β will also change. Before the investment, Netherfield's asset β was:

$$\begin{aligned} \text{Pre-investment } \beta_A^N &= \frac{D^N}{D^N + E^N}\beta_D^N + \frac{E^N}{D^N + E^N}\beta_E^N \\ &= \frac{3}{13}(.2) + \frac{10}{13}(1.4) = 1.123 \end{aligned}$$

because

$$\frac{D^N}{D^N + E^N} = \frac{D^N/E^N}{D^N/E^N + 1} = \frac{.3}{.3 + 1} = \frac{.3}{.13} = \frac{3}{13}$$

After the investment, the asset beta will be a weighted-average of the pre-investment beta and the beta on the new assets:

$$\text{Post-investment } \beta_A^N = .9(1.123) + .1(4/3) = 1.144$$

Finally, we use MM propition II to back out the new equity beta. Note that we need the information that the debt β has not changed

$$\text{Post-investment } \beta_E^N = 1.144 + .3(1.144 - .2) = 1.427$$

The equity beta has increased because the asset beta has increased, and the debt beta has remained the same.