Lecture 8 - Team Activity

Formulas:

- CAPM Security Market Line (SML) equation:
  $r_e = r_f + B_e(r_m - r_f)$
- Gordon's Growth Model, also called the Dividend Discount Model (DDM) or Perpetuity equation:
  $$P_0 = \frac{D_1}{r_e - g}$$
  Re-arranging:
  $$r_e = \frac{D_1}{P_0} + g$$
- $V = D + E$
- $WACC_{before-tax} = r_d . \frac{D}{V} + r_e . \frac{E}{V}$
- $WACC_{after-tax} = r_d . (1 - t_c) . \frac{D}{V} + r_e . \frac{E}{V}$

Q1) A firm's stock price is $10,
Beta of equity is 0.5,
Market return is 10% p.a.,
Treasury bonds yield 5% p.a.,
The stock just paid its annual dividend of $0.50,
which grows at a rate of 1% p.a..
Find the cost of equity of the firm using
(i) the DDM and
(ii) the CAPM or SML.
In theory, should the two answers be the same?
Which one is more correct?

Answer:
Using the Dividend Discount Model (DDM):

$$r_{E,DDM} = \frac{D_1}{P_0} + g$$

$$= \frac{D_0(1+g)}{P_0} + g$$

$$= \frac{0.50 \times (1 + 0.01)}{10} + 0.01$$
$$= 0.0605$$

Using the Capital Asset Pricing Model (CAPM):

$$r_{E,CAPM} = r_f + B_E(r_M - r_f)$$
$$= 0.05 + 0.5 \times (0.1 - 0.05)$$
$$= 0.075$$

In theory, they should both be the same. They are only different because our input numbers are inaccurate, and/or because the assumptions of the models are violated.
In practice, an arbitrary weighted average of the two might be used, weighted according to which one you think is more accurate and suitable for the project being valued.

Q2) A firm has a **debt-to-equity** ratio of 50%,
Cost of debt is 5% p.a.,
Cost of equity is 10% p.a.,
Corporate tax rate is 30%.
Find:
(i) the WACC of the firm before tax,
(ii) the WACC of the firm after tax.

Answer:
Since $\frac{D}{E} = 0.5$, then

$$\frac{D}{E} = \frac{0.5}{1}$$

So D could be 0.5 and E could be 1. Because $V = D + E$, V could be 1.5 (=0.5+1). So,

$$\frac{D}{V} = \frac{0.5}{1.5} = \frac{1}{3} \quad \text{and} \quad \frac{E}{V} = \frac{1}{1.5} = \frac{2}{3}$$

$$\begin{aligned} WACC_{before-tax} &= r_d.\frac{D}{V} + r_e.\frac{E}{V} \\ &= 0.05 \times \frac{1}{3} + 0.1 \times \frac{2}{3} \\ &= 0.083333 \end{aligned}$$

$$\begin{aligned} WACC_{after-tax} &= r_d.(1 - t_c).\frac{D}{V} + r_e.\frac{E}{V} \\ &= 0.05 \times (1 - 0.3) \times \frac{1}{3} + 0.1 \times \frac{2}{3} \\ &= 0.078333 \end{aligned}$$

Q3) A firm has a target **debt-to-assets** ratio of 0.6 which it sticks to. Its bonds yield 5% pa. It's beta of equity is 1, the market return is 10% pa, and treasury bonds yield 5% pa. The corporate tax rate is 30%. Calculate its after-tax WACC.

Answer:
The cost of equity (r_e) according to the SML will be 10%, same as the market, since the stock's beta is 1, just like the market.

$$\begin{aligned} WACC_{after-tax} &= r_d.(1 - t_c).\frac{D}{V} + r_e.\frac{E}{V} \\ &= 0.05 \times (1 - 0.3) \times 0.6 + 0.1 \times 0.4 \\ &= 0.061 \end{aligned}$$