M339W: November 29th, 2021.

The Effect of Taxes on Capital Structure.

Let τ_c be the corporate tax rate;

i the interest rate on the debt;

D the amount of debt.

Let X denote the company's earnings.

- If there were no debt, the company would distribute

$$\boxed{X(1-\tau_c)} \checkmark$$

to the shareholders (in total).

- With the debt, the interest needs to be paid first. The amount of interest is $\boxed{Di}$

The taxes are paid on the remainder.
So, the amount left over to distribute to the shareholders is

$$(X-Di)(1-\tau_c) = \boxed{X(1-\tau_c) + Di\tau_c} - Di$$

+

$\Rightarrow$ The total to be distributed is:

$$\boxed{X(1-\tau_c)} + \boxed{\underline{D}i \cdot \underline{\tau_c}}$$

interest tax shield (ITS)

Since the two amounts are different, MM does not hold.

In fact:

$$\boxed{\text{Value(levered)} = \text{Value(unlevered)} + PV(ITS)}$$

i may be used here

$\Rightarrow$ If the debt is held perpetually, $\boxed{PV(ITS) = D \cdot \tau_c}$

The after-tax weighted-average cost of capital is:

$$r_{wacc} = \frac{E}{E+D} \cdot r_E + \frac{D}{E+D} \cdot r_D (1 - \tau_c)$$ ✓

Recall:

$$r_U = \frac{E}{E+D} r_E + \frac{D}{E+D} r_D$$

$$\Rightarrow \quad r_{wacc} = r_U - \frac{D}{E+D} \cdot r_D \cdot \tau_c$$

22. A company invests 20,000 in a project. The project is expected to have cash flows of 3000 at the end of each year for 15 years, with the first cash flow expected one year after the initial investment. Using the project's after-tax weighted average cost of capital, the project has a net present value of 2496.27 .

The following gives additional information about the company:

(i) The company is financed with 40% equity and 60% debt.

(ii) The company's marginal tax rate is 25%

(iii) $r_E = 2r_D$, where r_E is the cost of equity and r_D is the cost of debt.

Calculate r_E .

(A) 10.25%

(B) 12.40%

(C) 13.25%

(D) 14.60%

(E) 16.40%

Investment = 20,000 (money out @ time 0)

Cashflows = level annuity immediate w/ pmt = 3000 and term = 15

Temporarily: $y = r_{wacc}$

I'm given that:

$$-20{,}000 + 3{,}000\, a_{\overline{15}|y} = 2496.27$$

Q: How do you get y?

Using IRR on the calculator or uniroot in R, $y = 0.1025 = r_{wacc}$

$$r_{wacc} = \frac{E}{E+D} \cdot r_E + \frac{D}{E+D} \cdot r_D (1 - T_c)$$

$$0.1025 = 0.4 \cdot r_E + 0.6\left(\frac{1}{2}\right) r_E (1 - 0.25)$$

$$= \underline{\left(0.4 + 0.3(0.75)\right)} r_E = 0.625 r_E$$

$$r_E = \frac{0.1025}{0.625} = 0.164$$

43. A company has a debt-to-equity ratio of 0.4. Its common stock is currently selling for 23. Its next dividend is expected to be 1.20 and the expected long-term growth rate for dividends is 4%. Its bonds currently yield 6%, and it has a marginal tax rate of 35%.

Div = 1.20 $g = 0.04$ $r_D = 0.06$ $\tau_c = 0.35$

What is the weighted average cost of capital for the company?

(A) 7.09%

(B) 7.20%

(C) 7.70%

(D) 8.30%

(E) 9.22%

$$\frac{D}{E} = 0.4 = \frac{2}{5} \Rightarrow \frac{D}{E+D} = \frac{2}{7}$$

and $\frac{E}{E+D} = \frac{5}{7}$

Implicitly, the problem requires of us to use the dividend-discount model, i.e.,

$$S = PV(\text{Dividends}) = \frac{Div}{r_E - g}$$

S: current stock price; PV: using r_E

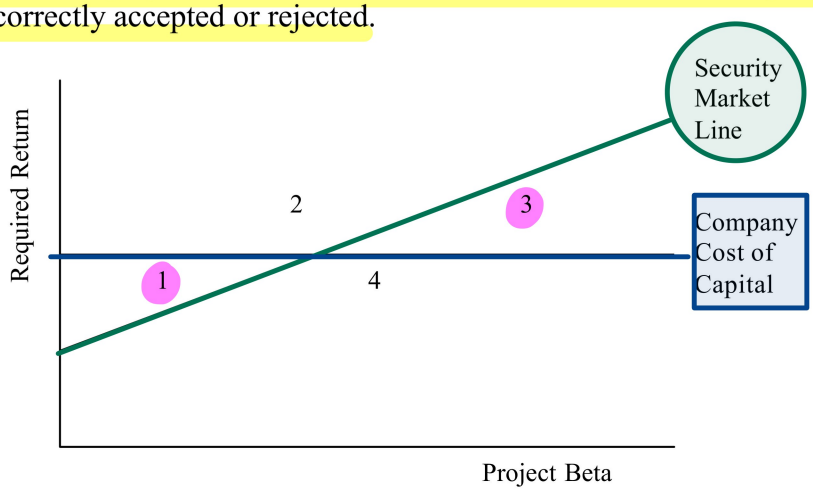
$$23 = \frac{1.20}{r_E - 0.04}$$

$$23(r_E - 0.04) = 1.20$$

$$r_E = 0.04 + \frac{1.20}{23} = 0.09217$$

$$r_{wacc} = \frac{5}{7} \cdot r_E + \frac{2}{7}(0.06)(1-0.35) = 0.07698$$

53. If a firm uses the company cost of capital to determine which projects to accept, a number of projects that do not have the same beta as the average beta of the firm may be incorrectly accepted or rejected.



Which sections of the graph above would contain projects that would be incorrectly accepted or rejected using the company cost of capital?

A. 1 and 3 only
B. 1 and 4 only
C. 2 and 3 only
D. 2 and 4 only
E. 3 and 4 only

54. The value of a currently all-equity firm is 700. The firm converts some of its equity to debt at 6%, changing the debt-to-equity ratio of the firm to 0.25. The corporate income tax rate is 35%.

If you ignore personal taxes and any costs of financial distress, what is the new value of the firm after the conversion?

A. 741
B. 745
C. 749
D. 753
E. 757

$$\text{Value (levered)} = \underbrace{\text{value(unlevered)}}_{700} + \boxed{\text{PV(ITS)}}$$

$$\text{PV(ITS)} = D \cdot T_c = D \cdot 0.35$$

$$\underbrace{\text{Value (levered)}}_{V} = D + E = D + 4D = 5D$$

$$V = 700 + \frac{1}{5} \cdot V \cdot 0.35 = 700 + V \cdot 0.07 \Rightarrow V = \frac{700}{0.93}$$

$$\Rightarrow V = 752.688$$