# MGT-482 Principles of Finance
# Assignment 7


Prof. Erwan Morellec

Team:
Grégoire Clément - gregoire.clement@epfl.ch
Senri Tatara - senri.tatara@epfl.ch
Timothée-Florian Bronner - timothee-florian.bronner@epfl.ch


February 16, 2019

## 1 Exercice 1

a) We compute the IRR by solving the equation NPV=0:

- *A*

$$NPV = -17 + \frac{3}{r} = 0 \tag{1}$$

Then:

$$IRR = r = \frac{3}{17} = 0.176 \tag{2}$$

- *B*

$$NPV = -17 + \frac{1.5}{r - 0.08} = 0 \tag{3}$$

Then:

$$IRR = r = 0.08 + \frac{1.5}{17} = 0.168 \tag{4}$$

Hence investment A has the higher IRR.
b) We compute NPV where r=9%:

- *A*

$$NPV = -17 + \frac{3}{0.09} = 16.333 \tag{5}$$

- *B*

$$NPV = -17 + \frac{1.5}{0.09 - 0.08} = 133 \tag{6}$$

Hence investment B has the higher NPV.

c) If the cost of capital is less than 16%, NPV of the investment B gets higher than that of investment A. Under this situation, investment B should be undertaken even though investment A has the higher IRR. On the contrary, investment A is better when the cost of capital is more than 16%.

## 2 Exercice 2

a) Since RC is currently an all-equity firm, the earnings are equal its EBIT. Hence we computed EPS:

$$EPS = \frac{EBIT}{Number\ of\ shares} = \frac{3M}{8M} = \$0.375 \tag{7}$$

b) Since RC is currently an all-equity firm, the equity cost of capital equals the return on assets.

$$R_E = R_U = \frac{3M}{8M \times 2.5} = 15\% \tag{8}$$

c) First, we computed the number of repurchase shares:

$$Number\ of\ repurchasing\ shares = \frac{1.5M}{2.5} = 0.6M\ shares \tag{9}$$

Hence the number of outstanding shares after repurchasing:

$$Number\ of\ shares\ after\ repurchasing = 8M - 0.6M = 7.4M\ shares \tag{10}$$

d) First we comupted earnings after repurchasing:

$$Earnings = EBIT - Interest = 3M - 1.5M \times 0.05 = 2.925M \tag{11}$$

Hence EPS can be obtained:

$$EPS = \frac{2.925M}{7.4M} = \$0.395 \tag{12}$$

We also need $R_E$:

$$\begin{aligned} R_E &= R_U + (R_U - R_D) \cdot \frac{D}{E} \\ &= 15.81\% \end{aligned} \tag{13}$$

$$P = \frac{EPS}{R_E} = \$2.5 \tag{14}$$

## 3 Exercice 3

a) By definition of the perfect market it won't change.
b) How did the equity evolved:

$$E = 270 - 55 \cdot (1 - \tau) = 233.15 \qquad [\ \$M\ ] \tag{15}$$

Now, given the remaining number of shares:

$$N = 18 - \frac{55}{15} = 14.33 \qquad [\ M\ ] \tag{16}$$

The price per share can be computed as:

$$\frac{E}{N} = 16.27 \qquad [\ \$\ ] \tag{17}$$

c) Distress cost have canceled the gain from the tax shield

$$\frac{E - V_{distress}}{N} = 15 \tag{18}$$

Hence:

$$\begin{aligned} V_{distress} &= E - N \cdot 15 \\ &= 18.2 \end{aligned} \qquad [\text{ M }] \tag{19}$$

# 4 Exercice 4

a) To compute the unlevered cost of capital of Blue we need the unlevered beta. we can compute it using a weighted average of $\beta_U$ from Red, Black and Yellow. Those $\beta_U$ can be computed using the following equations:

$$\beta_U = \frac{\beta_E}{1 + (1-\tau) \cdot \frac{D}{E}} \tag{20}$$

$$\frac{D}{E} = \frac{\frac{D}{D+E}}{1 - \frac{D}{D+E}} \tag{21}$$

Hence:

$$\begin{aligned} \beta_{U_{red}} &= \frac{1.1}{1 + (1-0.33) \cdot \frac{0.3}{0.7}} \\ &= 0.855 \end{aligned} \tag{22}$$

$$\beta_{U_{black}} = 1.258 \tag{23}$$

$$\beta_{U_{yellow}} = 0.539 \tag{24}$$

Finally:

$$\begin{aligned} \beta_{U_{blue}} &= \frac{350 \cdot \beta_{U_{red}} + 200 \cdot \beta_{U_{black}} + 100 \cdot \beta_{U_{yellow}}}{350 + 200 + 100} \\ &= 0.939 \end{aligned} \tag{25}$$

And the unlevered cost of capital can be computed so:

$$\begin{aligned} UCC &= \beta_{U_{blue}} \cdot (r_{market} - r_f) + r_f \\ &= 0.939 \cdot (0.09 - 0.03) + 0.03 \\ &= 8.63\% \end{aligned} \tag{26}$$

b) First we need to compute the NPV and then we can add the tax shield to it to get the APV.

$$\begin{aligned} NPV &= \frac{FCF}{UCC} + \tau * D \\ &= \frac{450}{8.63\%} + 0.33 * 3000 \\ &= 6200 \end{aligned} \tag{27}$$

And equity value would be:

$$E = NPV - D = 3200 \quad [\,\$\,] \tag{28}$$

c) Using the unlevered cost of capital with fixed dept schedule equation we can compute $r_E$:

$$\begin{aligned} r_E &= r_A \cdot \frac{E + D \cdot (1-\tau)}{E} - r_D \cdot \frac{D \cdot (1-\tau)}{E} \\ &= r_A + (r_A - r_D) \cdot \frac{D \cdot (1-\tau)}{E} \\ &= 12.17\% \end{aligned} \tag{29}$$

Using $r_E$ and $r_D$ we can compute $r_{WACC}$:

$$\begin{aligned} r_{WACC} &= r_E \cdot \frac{E}{E+D} + r_D \cdot (1-\tau) \cdot \frac{D}{E+D} \\ &= 7.25\% \end{aligned} \tag{30}$$

Finally, we can show that using $r_WACC$ or APV results in the same firm value:

$$\frac{450}{7.25\%} = 6200 \quad [\,\$\,] \tag{31}$$

## 5 Exercice 5

a) Using dept, equity and number of shares:

$$\begin{aligned} N &= 4000 \\ D &= 45000 \end{aligned} \tag{32}$$

$$E = \frac{D}{0.4} = \$112500 \tag{33}$$

$$share\ price = \frac{E}{N} = \$28.125 \tag{34}$$

$$V^L = D + E = D + \frac{D}{0.4} = \$157500 \tag{35}$$

Hence the firm value is \$157500 and the price of a share is \$28.125.
b)

$$\begin{aligned} r_E &= r_A \cdot \frac{E + D \cdot (1-\tau)}{E} - r_D \cdot \frac{D \cdot (1-\tau)}{E} \\ &= r_A + (r_A - r_D) \cdot \frac{D \cdot (1-\tau)}{E} \\ &= 12.82\% \end{aligned} \tag{36}$$

c)

$$\begin{aligned} r_{WACC} &= r_E \cdot \frac{E}{E+D} + r_D \cdot (1-\tau) \cdot \frac{D}{E+D} \\ &= 9.9\% \end{aligned} \tag{37}$$

d) For dept-holders:

$$D \cdot r_D = \$1800 \tag{38}$$

For share-holders:

$$E \cdot r_E = \$14423 \tag{39}$$

e)

$$EBT = EBT + Taxes = \frac{E \cdot r_E}{1-\tau} = \frac{14423}{1-0.35} = \$22200 \tag{40}$$

$$EBIT = EBT + Interest = EBT + D \cdot r_D = \$24000 \tag{41}$$

(rounded)
f) Adding the tax shield of \$22'500

$$V_p^L = V^L + D \cdot \tau_c = \$165375 \tag{42}$$

Equity increase by the value of the tax shield and Dept stays the same because it has not been issued yet:

$$E_2 = E + D \cdot \tau_c = \$120375 \tag{43}$$

g)

$$share\ price = \frac{E_2}{N} = \$30.09 \tag{44}$$

$$num\ repurchasing\ shares = \frac{22500}{share\ price} = 747\ shares \tag{45}$$

h)Now the debt has been issued then:

$$D_{2'} = 45000 + 22500 = \$67500 \tag{46}$$

$$E_{2'} = V_p^L - D_{2'} = \$97875 \tag{47}$$

and

$$\begin{aligned} r_{E_{2'}} &= r_A + (r_A - r_D) \cdot \frac{D_{2'} \cdot (1-\tau)}{E_{2'}} \\ &= 14.14\% \end{aligned} \tag{48}$$

Hence:

$$E_{2'} \cdot r_{E_{2'}} = \$13840 \tag{49}$$

i)

$$\frac{D_{2'}}{E_{2'}} = 69\% \tag{50}$$

$$\begin{aligned} r_{WACC} &= r_{E_{2'}} \cdot \frac{E_{2'}}{E_{2'} + D_{2'}} + r_{D_{2'}} \cdot (1-\tau) \cdot \frac{D_{2'}}{E_{2'} + D_{2'}} \\ &= 9.43\% \end{aligned} \tag{51}$$

Though the ratio is higher, the WACC is lower which should be reflected by a growing firm value, hence it was a good decision.

# 6 Exercice 6

a) Given:

$$E = 4 \cdot D \tag{52}$$

$$V_L = E + D = D + 4 \cdot D = 5D = 250M \tag{53}$$

Hence:

$$D = 50 \tag{54}$$

$$E = 200 \tag{55}$$

b) We just need to remove tax shield and add bankruptcy costs from levered firm value.

$$V_U = V_L - \tau \cdot D + K(D) = 242.5 \qquad [\ \$\text{M}\ ] \tag{56}$$

c) We need to find the amount of dept which maximizes the levered firm value

$$\begin{aligned} D_{best} &= argmax_{D \in [0, +\inf]}(V_L) \\ &= argmax_{D \in [0, +\inf]}(V_U + \tau \cdot D - K(D)) \\ &= argmax_{D \in [0, +\inf]}(\tau \cdot D - K(D)) \\ &= argmax_{D \in [0, +\inf]}((\tau - \frac{1}{10}) \cdot D - \frac{D^2}{500}) \\ &= argmax_{D \in [0, +\inf]}(\frac{D}{4} - \frac{D^2}{500}) \end{aligned} \tag{57}$$

Derivating w.r.t D and equaling to zero gives:

$$\frac{1}{4} - \frac{D_{best}}{250} = 0 \tag{58}$$

$$D_{best} = \frac{250}{4} = 62.5 \qquad [\ \$\text{M}\ ] \tag{59}$$

(One can verify that it is a maximal value (not miminal) by derivating one more time and see that we have a negative value (concave))

d) Replacing the value in previous formulas:

$$V_L = V_U + \tau \cdot D_{best} - K(D_{best}) = 250.3M \tag{60}$$

$$E = V_L - D_{best} = 187.8 \tag{61}$$

$$\frac{D_{best}}{E} = 33\% \tag{62}$$