ÉCOLE POLYTECHNIQUE
FÉDÉRALE DE LAUSANNE

MGT-482 Principles of Finance
Assignment 1

Prof. Erwan Morellec

Team:
Joachim Muth - joachim.muth@epfl.ch
Andreas Bill - andreas.bill@epfl.ch
Nicolas Roth - nicolas.roth@epfl.ch

November 28, 2016

1 Capital structure in s perfect market

Exercice 1

a)

Expected value of Acort equity:

$$E[V_{equity}] = \$50 \cdot 0.8 + \$20 \cdot 0.2 = \$44 million$$

Discount the value to have the present value by the cost of capital

$$PV = \frac{E[V]}{1 + r_E} = \frac{\$44}{1.1} = \$40 million$$

b)

Present value of the debt according to risk-free rate:

$$PV_{debt} = \frac{\$20}{1 + r_E} = \frac{\$20}{1.05} = \$19.05 million$$

Then,

$$PV_{equity} = PV_{\text{unlevered equity}} - PV_{debt} = \$40 - \$19.05 = \$20.95 million$$

c) Without leverage

$$E[R_E] = p_1 \cdot R_{E1} + p_2 \cdot R_{E2} = p_1 \cdot \frac{\$50 - \$40}{\$40} + p_2 \cdot \frac{\$20 - \$40}{\$40} = 0.8 \cdot 0.25 + 0.2 \cdot -0.5 = 0.1 = 10\% \quad (1)$$

c) With leverage

$$r_e = r_u + \frac{D}{E} \cdot (r_U - r_D) = 10\% + \frac{19.05}{20.95} \cdot (10\% - 5\%) = 14.54\%$$

d)

In unlevered case, the worst case is to obtain an equity value of \$20 million after on year (then a return of -50%).
The same situation can occurs in the levered case, but with an additional debt to pay back which decrease the value of the equity to \$0. We then have a return of -100%.

Exercice 2

a)

$$EPS = \frac{\$5 million}{10 million} = \$0.5$$

b)

RC's equity cost of capital

$$P_{current} = \frac{EPS}{R_A} \rightarrow R_A = \frac{EPS}{P_{current}} = \frac{\$0.5}{\$5} = 10\%$$

c)

RC can repurshase:

$$N_{shares} = \frac{\$3 milion}{P_{current}} = \frac{\$3 milion}{\$5} = 600'000$$

$$N_{\text{shares NEW}} = 10 million - 600'000 = \$9.4 million$$

d)

The calcul is the same as in section a), but with a debt interest to pay back. Then:

$$EPS = \frac{EBIT - interest}{N_{shares}} = \frac{\$5\text{million} - \$3\text{million} \cdot 0.05}{9.4\text{million}} = 0.516$$

And new price of RC shares are

$$P = \frac{EPS}{R_E} = \frac{0.516}{10.52\%} = \$5$$

With $R_E = R_A + \frac{D}{E} \cdot (R_A - R_D) = 10\% + \frac{3}{47} \cdot (10\% - 5\%) = 10.52\%$

Exercice 3

Debt D_0 is the unknown initial debt. Debt D_1 is the debt after borrowing \$30 million (and using \$10 million cash). The relation between both is: $D_1 = D_0 + 40$.
The current market value of the entreprise does not change, thus $V_{L0} = 120 + D_0 = V_{L1}$.

$$\rho = \frac{\beta_{E1}}{\beta_{E0}} = \frac{\beta_A + \frac{D1}{E1}(\beta_A - \beta_d)}{\beta_A + \frac{D0}{E0}(\beta_A - \beta_d)} = \frac{\beta_A + \frac{D1}{E1}\beta_A}{\beta_A + \frac{D0}{E0}\beta_A} = \frac{1 + \frac{D1}{E1}}{1 + \frac{D0}{E0}} = \frac{1 + \frac{D0+40}{80}}{1 + \frac{D0}{120}} = \frac{\frac{80+D0+40}{80}}{\frac{120+D0}{120}} = \frac{120}{80} = 1.5 \quad (2)$$

Therefore, $\beta_{E1} = \beta_{E0} \cdot \rho = 1.5 \cdot 1.5 = 2.25$

2 Capital structure with frictions

Exercice 4

a)

The share price of BBB will not change in perfect market. Indeed, the new equity value of BBB will be

$$E_{new} = E_{old} - \text{value repurchased} = \$20 \cdot 30million - \$81million = \$519million$$

And the number of shared purchased

$$n_{shares} = \frac{\$81million}{\$20} = 4.05millions$$

Then the new price is

$$P = \frac{519million}{30million - 4.05million} = \$20$$

b)

The equity value take now into account the corporate taxes of 35%

$$E_{new} = E_{old} - \text{value repurchased} + \text{corporate taxe} = \$20 \cdot 30million - \$81million + \$81million \cdot 35\% = \$547.19 \text{ million} \quad (3)$$

The number of purchased shares is the same, we then have a price of

$$P = \frac{547.19million}{30 - 4.05million} = \$21.09$$

c)

We now take into account corporate taxes and financial distress costs.

$$E_{new} = E_{old} - \text{value repurchased} + \text{corporate taxe} - \text{financial distress costs} = \$20 \cdot 30million - \$81million + \$81million \cdot 35\% - \text{financial distress costs} \quad (4)$$

We know that share price is \$20.5 then,

$$E_{new} = P \cdot n_{sharesnew} = 20.5 \cdot 25.95 million = \\ \$20 \cdot 30 million - \$81 million + \$81 million \cdot 35\% - \text{financial distress costs} \quad (5)$$

So financial distress costs = \$15.215 million.

Exercice 5

a)

Unlevered cost of capital of Blue Ltd:

$$\text{Unlevered Cost of Capital} = R_f + \beta_U(R_{mkt} - R_f) = 0.04 + \beta_U(0.11 - 0.4)$$

β_U is calculated with the equation

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

We calculate the β_U for firms Red, Black and Yellow and then do a weighted average that leads to:

$$\beta_U = 0.25 \cdot 0.94 + 0.40 \cdot 0.85 + 0.35 \cdot 0.56 = 0.77$$

(cf: table below)

	Red	Black	Yellow
β_E	1.20	1.40	1.10
β_D	0.00	0.00	0.00
$D/(D+E)$	0.30	0.50	0.60
D/E	0.43	1.00	1.50
Market cap.	250	400	350
Ratio	0.25	0.40	0.35
β_U	0.94	0.85	0.56

Then

$$\text{Unlevered Cost of Capital} = 0.04 + 0.77(0.11 - 0.4) = 9.39\%$$

b)

Firm value, using APV approach, is

$$APV = \frac{FCF_U}{R_U} + PV(taxshield) = \frac{300}{9.39\%} - 2000 \cdot 35\% = \$3194.88$$

Exercice 6

a)

Value of equity: $E = \frac{D}{E/D} = 20'000/0.5 = \$40'000$
Share price: $P = \frac{E}{n_{shares}} = \frac{40'00}{10'000} = \$4$

b)

Expected return: $E[R] = R_A + \frac{D}{E} \cdot (R_A R_D) = 10\% + 0.5(10\% - 5\%) = 12.5\%$

c)

Weighted average cost of company:

$$R_{WACC} = \frac{E}{E+D}R_E + \frac{D}{E+D}(1-\tau)R_D = \frac{40'000}{60'000} \cdot 12.5\% + \frac{20'000}{60'000}\dagger \cdot 0.7 \cdot 5\% = 9.5\%$$

d)

Distributed amount to debtholders: $D \cdot R_D = 20'000 \cdot 5\% = \$1'000$
Distributed amount to shareholders: $E \cdot R_E \cdot (1-\tau) = 40'000 \cdot 12.5\% \cdot 0.7 = \$3'500$

e)

EBIT: $Assets \cdot R_A = (V_L - \tau D) \cdot R_A = 60'000 - 0.3 \cdot 20'000 = 54'000 \cdot 10\% = \$5'400$
EBIT before taxes: $5'400 - 20'000 \cdot 5\% = \$4'400$

f)

Debt: $20'000 + 10'000 = \$30'000$
Tax shield: $30'000 \cdot 0.3 = \$9'000$
Value of the firm: $V_L = V_U + \tau \cdot D = 54'000 + 9'000 = \$63'000$
Equity value: $E = V_L - D = 63'000 - 30'000 = \$33'000$

g)

Using the borrowed $\$10'000$ the company can purchased $\frac{10'000}{4} = 2'500$ shares.
The new price is then $P = \frac{E}{n_{shares}} = \frac{33'000}{7'500} = \$4.4$

h)

EBIT: $Assets \cdot R_A = (V_L - \tau D) \cdot R_A = 63'000 - 0.3 \cdot 30'000 = 54'000 \cdot 10\% = \$5'400$
Net income $= (EBIT - \text{interest})(1-\tau) = (5'400 - 30'000 \cdot 5\%) \cdot 0.7 = \$2'730$

i)

Debt to equity ratio: $\frac{D}{E} = \frac{30'000}{33'000} = 0.91$
WAAC : $R_{WACC} = \frac{E}{E+D}R_E + \frac{D}{E+D}(1-\tau)R_D = \frac{33'000}{63'000} \cdot 14.54\% + \frac{30'000}{63'000} \cdot 0.7 \cdot 5\% = 9.286\%$
As the WAAC of the company is smaller thant before the share purchase, the company increased its value and it was, indeed, a good decision.

Exercice 7

a)

From $D/E = 1/3$ we have equation $V_L = E + D = 3D + D = 4D = 160$
Debt : $D = 160/4 = \$40$
Equity: $E = 160 - D = \$120$

b)

If it was not levered, the value would have been:

$$V_L = K(D) = V_U + \tau \cdot D \rightarrow V_U = V_L + K(D) - \tau \cdot D = 160 + \frac{40}{10} + \frac{40^2}{500} - 0.3 \cdot 40 = \$155.2$$

c)

Optimal capital structure, maximize V_L with respect to D:

$$\max V_U + \tau \cdot D - K(D) = \max V_U + \tau \cdot D - \frac{D}{10} - \frac{D^2}{500}$$

To find optimum, we search D^* such as $\frac{\delta V_L}{\delta D}(D^*) = 0$

$$\frac{\delta V_L}{\delta D} = \tau - {}^1/_{10} - {}^1/_{250} \cdot D \rightarrow D^* = 250 \cdot (\tau - {}^1/_{10}) = 50$$

d)

If company restructures with $D = 50$ then,

$$V_L = V_U + \tau \cdot D - K(D) = 155.2 + 0.3 \cdot 50 - K(50) = \$160.2$$

and the debt to equity ratio,

$$\frac{D}{E} = \frac{D}{V_L - D} = \frac{50}{160.2 - 50} = 0.454$$