Unit 6. Investment-Financing Relationship

6.1. Business Risk and Financial Risk
6.2. Weighted Average Cost of Capital
6.3. Adjusted Present Value (APV)
6.4. The Effects of Leverage on Expected Cash Flows and Discount Rates

Basic bibliography:
ROSS, S; WESTERFIELD, R; JAFFE, J. (2010)
Chapters 3.2 (formulas 3.15 and 3.16), 16.3-5, 17.1, 17.4, 18.1, 18.3-4

6.4 The Effects of Leverage on Expected Cash Flows and Discount Rates

Remember: So far in Unit 6 we have seen that ↑ B/S =>↑financial risk => ↑Rs

Additionally, given the corporate tax design in western countries:
↑ B/S => ↑interest payments => ↓corporate tax and therefore ↓ cash **out**flows,
which ↑ NFC due to a financing side effect called tax subsidy
and thus ↑ present value:

↑B/S =>↑**firm's value** =↑APV = -init. investment + $\sum_{k=1}^{n} \frac{NCF_K}{(1+Rwacc)^k}$ +PV $_{\text{Tax subsidy}}$

Let's introduce now the effects that corporate tax has on discount rates, and therefore on the firm's value:

Problem 5. Adjusted Present Value. Weighted Average Cost of Capital

ALFA Company is considering a €10 million project. The company's chief financial officer has evaluated the project and determined that the project's unlevered cash flows will be €2 million per year in perpetuity. The required return on the company's unlevered equity is 9.91 percent, the cost of equity for the company's target debt-to-value ratio (B/V = 40 percent) is 13.71 percent, and ALFA's pre-tax cost of debt is 4 percent. The project has the same risk as ALFA's existing business, and it will support the same amount of perpetual debt. ALFA is in the 30% tax bracket.

a) *Should ALFA accept the project? Calculate the adjusted present value by adjusting net cash flows. Re-calculate the adjusted present value by adjusting the weighted average cost of capital.*

b) *Calculate the net present value of this project for an unlevered firm. Is it lower than the net present value of the same project for the levered firm? Why?*

c) *Calculate the Rwacc for the levered firm (target debt) and the Rwacc for the unlevered firm. Which one is lower? Why?*

$Rs_{\text{all-equity}} = 9{,}91\% = Ro = Rwacc_{\text{all-equity}}$
$Rs_{B/V} = 40\%$ $R_B = 4\%$

a) APV= NPV $_{\text{all-equity firm}}$ + PV $_{\text{financing side effects}}$

NPV $_{\text{all-equity firm}}$ = -€10,000,000 + €2,000,000/0,0991 = €10,181,634.71

PV $_{\text{financing side effects}}$ = PV $_{\text{tax subsidy to interest payments}}$ (in this problem)

- **Cash flows from this loan:**

+4,000,000 _____ -112,000 ____ -112,000 _____ -112,000 _____ -112,000 _____ -112,000..
0 1 2 3 4 5…∞

Project's debt (40%) = €4,000,000
Interest payments = €4,000,000*0.04 = €160,000
-Tax shield = €160,000*0.30 = €48,000
€112,000

PV $_{\text{interest tax shield}}$ = €4,000,000- €112,000/0.04 = €1,200,000

- **Let's see now the present value of the tax shield alone:**

_____ 48,000 ____ 48,000 _____ 48,000 _____ 48,000 _____ 48,000 ……
0 1 2 3 4 5 ……∞

PV $_{\text{interest tax shield}}$ = €48,000/ 0.04 = €1,200,000

Adjusted present value (APV) = NPV $_{\text{all-equity firm}}$ + PV $_{\text{financing side effects}}$ =
€10,181,634.71+ €1,200,000 = €11,381,634.71

Re-calculate the adjusted present value by adjusting the weighted average cost of capital.

$$\text{Rwacc}_t = \frac{Rb\,(1-t)B + Rs\,S}{(B+S)}$$

Rwacc $_t$ = Rb (1-t) B/V + Rs S/V = 0.04 (1-0.3) 0.4 + 0.1371*0.6 = 0.09346 = 9.346%

APV = -10,000,000 + 2,000,000/0.09346 = €11,399,529

b) *Calculate the net present value of this project for an unlevered firm. Is it lower than the net present value of the same project for the levered firm? Why?*

NPV $_{\text{all-equity firm}}$ = -€10,000,000 + €2,000,000/0,0991 = €10,181,634.71

APV = NPV $_{\text{all-equity firm}}$ + PV $_{\text{financing side effects}}$ = €11,381,634.71

NPV $_{\text{all-equity firm}}$ < APV **Why?**

Given the corporate tax design in western countries:
↑ B/S => ↑interest payments => ↓corporate tax and therefore ↓ cash **out**flows, which ↑ NFC due to a financing side effect called tax subsidy
and thus ↑ present value, called APV in **€1,200,000 of tax subsidy in this example.**
Therefore, the design of corporate tax incentives ↑ B/S

c) Calculate the Rwacc for the levered firm (target debt) and the Rwacc for the unlevered firm. Which one is lower? Why?

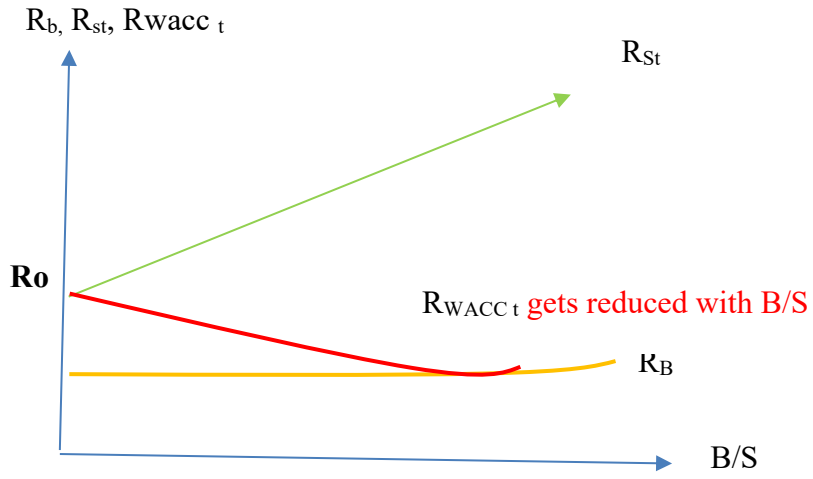
Rwacc = 9.91%

Rwacc $_t$ = Rb (1-t) B/V + Rs S/V = 0.04 (1-0.3) 0.4 + 0.1371*0.6 = 0.09346 = 9.346%

Rwacc > Rwacc t **Why?**

The leveraged firm is getting a reduction in tax due to interest payments. This reduction is called tax shield or tax subsidy. Each time the company pays 10 to the lender (bank), the government says: "do not worry, firm, the whole country will pay you 3 out of those 10 (subsidy), so finally you pay only 7"; that is to say, instead of paying 4% due to debt, the firm pays only = 0.4(1-t) = Rb (1-t).
This means a reduction in the average cost of capital Rwacc

Under this corporate tax design

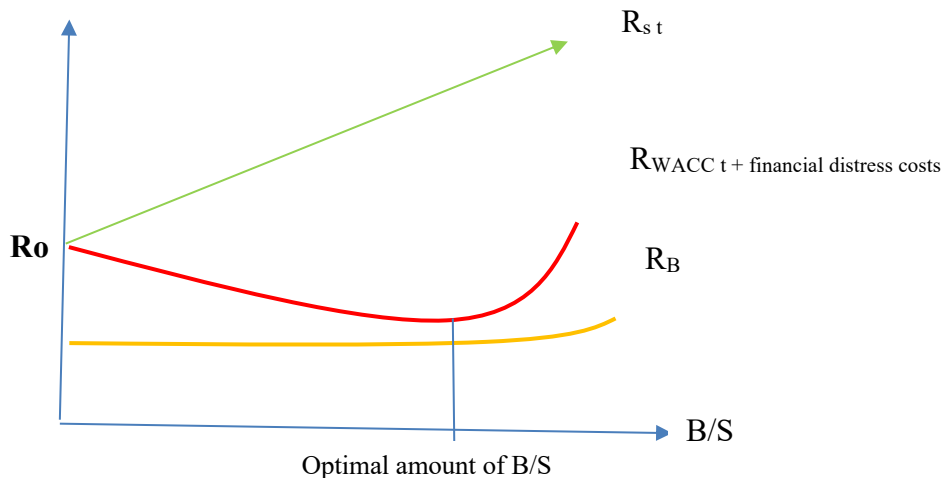


Limits to the use of debt: Introducing costs of financial distress

(See pdf RWJ Costs of Financial Distress)

Under this corporate tax design and costs of financial distress

Rb, Rst, Rwacc t



6.3 and 6.4 self-assessment questions

1. A government reducing corporate tax rate from 30% to 18%:
   a) Reduces tax subsidy to debt financing.
   b) Helps business projects to reach positive NPV.
   c) Reduces firms' incentives to increase B/S.
   d) All of the above.

2. The western countries corporate tax design:
   a) Increases corporate tax payments when increasing leverage.
   b) Pushes companies to increase the proportion of equity funds.
   c) Gives different treatment to business debt and equity costs.
   d) All of the above.

3. Increasing depreciation:
   a) Reduces corporate tax.
   b) Increases firms' payments.
   c) Increases financial risk.
   d) None of the above.

4. In order to increase the NPV, would you recommend depreciating:
   a) With residual value >0?
   b) The sooner the better?
   c) Smaller amounts at the beginning in order to increase EBIT?
   d) Using the straight-line depreciation method?

5. Financing side effects that may change the adjusted present value include:
   a) The tax subsidy to debt.
   b) The costs of issuing new debt, such as flotation fees.
   c) The costs of financial distress.
   d) All of the above.

6. Given a tax rate of 30%, a new 3-year €100 loan with a cost of debt of R_B = 5% means:
   a) A reduction in the company's Rwacc t.
   b) An after-tax cost of debt of 0.05(1-0.3) = 0.035 = 3.5%.
   c) An annual tax subsidy of 0.3*0.05*100 = €1.5 during 3 years.
   d) All of the above.

7. Under the current corporate tax design and costs of financial distress:
   a) Keeping a low B/S ratio allows firms to get some tax subsidy while not incurring in financial distress costs.
   b) As B/S increases, financial distress costs tend to offset the advantages of tax subsidy on debt.
   c) There is an optimum B/S ratio.
   d) All of the above.

8. The costs of financial distress include:
   a) Clients' loss of confidence in the firm's capacity to honor its warranties.
   b) Employees' loss of confidence in the firm's capacity to pay salaries on time.
   c) Suppliers' loss of confidence in the firm's capacity to pay supplies.
   d) All of the above.