1. Valuation and leverage (10=2+5+3 / 100)

Firm A is expected to generate Earnings before interest and taxes (EBIT) of 100 per year in perpetuity, no growth (ΔNA=0). The firm has outstanding debt of 500, an amount it intends to keep constant. This debt is riskless. Firm B operates in the same industry as A. It is all equity financed and its cost of equity is equal to 10%. Firm B is expected to generate Earnings before interest and taxes (EBIT) of 450 per year in perpetuity, no growth (ΔNA=0). Finally, the risk-free rate is 5% and, unless otherwise specified, the corporate tax rate is 0%, no personal taxes.

a. Find the value of firms A and B.

$$r^{e,B} = r^{a,B} = r^{a,A} = r^{wacc,A} = 10\%$$

$$V^B = \frac{450}{10\%} = 4500, \qquad V^A = \frac{100}{10\%} = 1000$$

b. Use a valuation ratio of your choice to find the value of firm A relative to the value of firm B. Show why P/E ratio can/cannot be applied.

Because there are no tax shields we can use the firm value to FCF ratio

$$V^A = \frac{4500}{450} \times 100 = 1000$$

We cannot use the P/E ratio: firm A equity is levered and more risky

$$P/E^A = \frac{1000 - 500}{100 - 5\% \times 500} = 6.67 = \frac{1}{15\%}$$

$$P/E^B = \frac{4500}{450} = 10 = \frac{1}{10\%}$$

c. Find the value of the firm A assuming the corporate tax rate is 35% (instead of 0%).

$$V^A = \frac{100 \times (1 - 35\%)}{10\%} + 35\% \times 500 = 825$$

2. Real options (15=7+8 / 100)

The (book) value of net assets of an all-equity firm is 1000. Starting from next year the firm will generate either 150 or 40 in Earnings before interest and taxes (EBIT) in perpetuity, both possibilities are equally likely. No growth ($\Delta NA=0$). The risk free rate is equal to 10%, the corporate tax rate is equal to 0% and we will always assume that $\beta^a = 0$.

Hint: a good way to approach this exercise is to first compute EVAs and use EVA valuation formula.

a. Assume that the firm can choose to sell its assets at their book value. Find the value of the firm.

$$if\ EBIT = 150:\ EVA^A = 150 - 10\% \times 1000 = 50$$

$$if\ EBIT = 40:\ EVA^A = 40 - 10\% \times 1000 = -60$$

$$V = 1000 > 1000 + \frac{1}{2} \times \frac{50}{10\%} + \frac{1}{2} \times \frac{-60}{10\%} = 900$$

b. Assume the firm also has the possibility to operate for one year, observe the market conditions (i.e. if next year' as well as future EBIT is 150 or 40) and then decide to continue operations or liquidate by selling the assets at their book value. Find the current market value of the firm.

$$V = \frac{1}{1 + 10\%} \times \left(\frac{1}{2} \times \left(1000 + \frac{50}{10\%}\right) + \frac{1}{2} \times 1000\right) = 1136.36$$

3. Cost of capital and risk management (5=2+3 / 100)

We want to find the cost of capital for a firm operating in a certain industry. The firm has a constant 60% debt-to-value ratio and its debt is risk-free. For the industry: the debt-to-value ratio is constant and equal to 20%, the cost of equity is 11.25% and debt is risk-free. Finally, the risk-free rate is 5% and corporate tax rate is 35%, no personal taxes.

a. Find the weighted average cost of capital if the firm, unlike all the other firms in the industry, was hedging all its risks so that its cash flow was effectively risk-free.

$$r^{wacc} = 5\% - 35\% \times 5\% \times 60\% = 3.95\%$$

b. Find the weighted average cost of capital when the firm does not hedge.

$$r^{a} = (1 - 20\%) \times 11.25\% + 20\% \times 5\% = 10\%$$

$$r^{wacc} = 10\% - 35\% \times 5\% \times 60\% = 8.95\%$$

4. Forward rates (10=4+6 / 100)

The 3-year spot rate is 3% and the 5-year spot rate is 4%. Compounding is annual.

a. Find the forward rate that can be agreed upon today for a two year investment that will start in three years.

$$f_{0;3,5} = \sqrt{\frac{(1+4\%)^5}{(1+3\%)^3}} - 1 = 5.25\%$$

b. The two year in three years forward rate offered by your investment bank is 6%. Show how you can take advantage of this situation.

	Today	Year 5
Borrow	1	$-(1+4\%)^5 \approx -1.22$
Invest	-1	$(1+3\%)^3 \times (1+6\%)^2 \approx 1.23$
Total	$= 0$	> 0

5. Put-call parity (15=10+5 / 100)

You observe the following securities traded on the market: a European call option on some stock, the option expires in one year, its exercise price is 100 and its premium is 10; a European put option on the same stock, the option expires in one year, its exercise price is 100 and its premium is 7; the underlying stock trading at 100; a one year zero-coupon bond with face value equal to 100 and current price 95.24.

a. Check if the put-call parity holds and show how you can exploit an arbitrage opportunity if there is one. *Hint:* draw a table of the cash flow from a 'buy cheap, sell expensive' strategy.

$$10 + 95.24 < 100 + 7$$

	Today	$S_T < 100$	$S_T \geq 100$
Long call	-10	0	$S_T - 100$
Buy ZCB	-95.24	100	100
Short stock	100	$-S_T$	$-S_T$
Short put	7	$-(100 - S_T)$	0
Total	$= 1.76 > 0$	$= 0$	$= 0$

b. Assume now that in six month time a highly contested shareholder meeting will take place. The right to vote at this meeting, which comes with owning shares, can be very valuable. In addition, a dividend will be paid at that time and the present value of this dividend is 1. Can these facts explain your answer to (a)? Give an estimate of the value of the voting right.

$$PV(right\ to\ vote) = 107 - 105.24 - 1 = 0.76$$

6. Interest rate swaps (10 / 100)

Outstanding debt of a firm consists of a bond with face value equal to 100, semi-annual coupon payments and 12% fixed annual coupon rate. The bond has 15 months left to maturity. The firm has also entered a swap agreement on the notional value of 100 where every six months it receives the fixed rate and pays the floating rate equal to the six month spot rate. The swap has 15 months left to maturity: there are three payments left, next one due in three months. The fixed swap rate is 12% and the next floating rate payment is equal to 4. Currently all spot interest rates are equal to 10%. Compounding is semi-annual.

What is the value of firm's outstanding debt if we take into account the swap contract?

Given that coupon payments on the fixed rate bond and the fixed rate leg of the swap match and cancel each other you are left with a floating rate note that will pay its next coupon of 4 in three months:

$$D = \frac{100 + 4}{(1 + \frac{10\%}{2})^{\frac{1}{2}}} = 101.49$$

7. Equity vs debt (10 / 100)

The government of Greece intends to inject capital into its ailing banks. Banks will issue securities that will be purchased by the government. This additional financing has to satisfy some conditions. First, it has to contribute to the minimal equity capital requirements set by the regulators. In other words, the failure by the bank to make payments on the new securities should not trigger bankruptcy. Second, the government wants the control rights to remain fully in the hands of equity holders representing the private sector. For the government to have some voting rights will amount to a partial nationalisation and it is believed that the private sector will be more efficient in managing banks. Also, this will help to attract private investors. Third, the government wants the private sector investors to retain all the participation in the potential upside of bank's performance.

Explain briefly what type of securities (from the ones we have seen in the lectures) will be best suited for the recapitalisation plan.

Preferred shares. See lecture notes or read about it in the press.

8. Payout (15=12+3 / 100)

In this exercise assume for simplicity that $r^f = r^a = T = 0\%$: in other words the present value of a security is equal to its expected cash flow. A firm has two projects: project 1 will generate a cash flow of either 150 or 50 next year with equal probability, project 2 will generate a cash flow of 50 next year. The firm has 100 shares and one zero coupon bond with face value equal to 70 outstanding.

a. Assume that the firm unexpectedly announces that it has agreed to sell the second project for 60 and will use all the proceeds from the sale to pay an exceptional dividend to shareholders. Compare the share price before and after this announcement. Show using explicit calculations all the factors that account for the change in the stock price.

$$Before: S = \frac{\frac{1}{2} \times (150 + 50 - 70) + \frac{1}{2} \times (50 + 50 - 70)}{100} = 0.80, \;\; B = 70$$

$$After: S = \frac{\frac{1}{2} \times (150 - 70) + \frac{1}{2} \times 0 + 60}{100} = 1.00, \;\; B = \frac{1}{2} \times 70 + \frac{1}{2} \times 50 = 60$$

The stock price goes up for 2 reasons: positive NPV from selling the project 2 and transfer of value from debt holders through 'asset stripping':

$$1.00 - 0.80 = \frac{(60 - 50) + (70 - 60)}{100}$$

b. Can you think of a real world example of financial transactions that would lead to the same value effects for the investors?

LBOs.

9. Leveraged buyouts (10 / 100)

Comment on the following statement:

During the 80s wave of LBOs private equity funds replaced the utterly incompetent management of acquired firms and, once performance improved, benefited from their increased market value.

There are two issues with the statement above: 1) improved performance was not due to replacing managers, in fact in LBOs old managers often stayed, however they received a high equity stake in a highly levered company and therefore had incentives to improve performance 2) LBOs generated large gains for target shareholders (who captured the future value gains by asking for a high takeover price), not always for the acquirer.

Formulae

Free cash flow

$$FCF = EBIT \times (1 - T) - \Delta NA$$

Weighted average cost of capital

$$r^{wacc} = r^e \times \frac{E}{D + E} + r^d \times (1 - T) \times \frac{D}{D + E}$$

Economic value added

$$EVA = EBIT \times (1 - T) - r^{wacc} \times NA_{-1}$$

Un-levering/re-levering

Constant D:

$$r^{wacc} = r^a \times \frac{D \times (1 - T) + E}{D + E}$$

$$r^e = r^a + \frac{D}{E} \times (1 - T) \times \left(r^a - r^d\right)$$

$$PV(TS) = T \times D$$

Constant D/(D+E):

$$r^{wacc} = r^a - r^d \times T \times \frac{D}{D + E}$$

$$r^e = r^a + \frac{D}{E} \times \left(r^a - r^d\right)$$

$$PV(TS) = \frac{r^d \times D \times T}{r^a - g}$$

Valuation formulae

WACC :

$$V_0 = \frac{FCF_1}{r^{wacc} - g}$$

APV :

$$V_0 = \frac{FCF_1}{r^a - g} + PV(TS)$$

EVA :

$$V_0 = NA_0 + \frac{EVA_1}{r^{wacc} - g}$$

Put-call parity

$$\frac{K}{(1 + r_T)^T} + C = S + P - PV(DPS)$$

Note: formulae with parameter g apply to firms in the Gordon growth model setting