

# Final Exam “Finance for AEO” (SOLUTIONS)

**Course:** Finance for AEO

**SubjectCode:** 226P05

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**Length:** 2 hours

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**Students are expected to conduct themselves properly during examinations and to obey any instructions given to them by examiners and invigilators. Firm action will be taken in the event that academic fraud is discovered.**

## Instructions

- There are choices:
  - Choose five out the six questions. Each question is worth 10 points, the maximum score on the exam is 50 points.
  - On question 6, there are five sub-questions: choose four.
- Answer each question on a separate sheet, clearly marking each sheet with your name and ID number.
- The exam is closed book, no translation computers are allowed. You may use a Dutch/English dictionary.
- You are allowed to use a non-graphical calculator.
- Explain your answers and show your calculations. Partial credit is given for incomplete answers. No credit is given for answers without explanation.
- Write clearly.
- Note: billion = “miljard” =  $10^9$

## Question 1

On its market value balance sheet, KLM has 500 million euro of equity and 700 million euro of debt, as well as 200 million euro cash. KLM's debt cost of capital ( $r_D$ ) is 4% and the equity cost of capital ( $r_E$ ) is 14%. The corporate tax rate is 35% and KLM maintains a fixed D/E ratio.

KLM is considering the acquisition of another airline of similar risk. The acquisition is expected to increase KLM's free cash flow by 10 million euro in the first year, and this contribution is expected to grow at 2% per year from then on. KLM negotiated a purchase price of 120 million euro.

- (a) Calculate KLM's pre-tax WACC ( $r_U$ ) and KLM's after-tax WACC ( $r_{wacc}$ ).

NOTE:  $E = 500$ , we use net debt ( $D = 700 - 200 = 500$ ) for this calculation.

$$r_U = \frac{E}{D+E}r_E + \frac{D}{E+D}r_D = 9\%$$

$$r_{wacc} = \frac{E}{D+E}r_E + \frac{D}{E+D}r_D(1 - \tau_c) = 8.3\%$$

- (b) Calculate the unlevered value of the acquisition ( $V^U$ ).

$$V_U = \frac{10}{9\% - 2\%} = 142.86 \text{ million}$$

- (c) Calculate the levered value ( $V^L$ ) and the NPV of the acquisition.

$$V_L = \frac{10}{8.3\% - 2\%} = 158.74 \text{ million. NPV} = 158.74 - 120 = 38.74$$

- (d) If KLM uses cash for the acquisition, by how much will the amount of debt on its balance sheet change?

Before the transaction, the value of the firms assets (excluding cash) was 1 billion. After the transaction it will be 1 billion plus 158.74 million, i.e. 1.159 billion. The firm maintains a fixed D/E ratio, therefore half of this sum, 579.37 has to be net debt. The firm initially had 200 million in cash, after the acquisition it will have  $200 - 120 = 80$  million in cash leftover. Therefore the new amount of (gross) debt on the balance sheet will be  $579.37 + 80 = 659.37$ . Thus (gross) debt actually declines.

- (e) If KLM decides against the takeover and uses all of its cash to repurchase shares, what would happen to its equity cost of capital?

Equity would decline from 500 to 300, net debt would increase from 500 to 700. The new fixed D/E ratio would be 7/3. Using MM proposition 2, the fact that  $r_U = 9\%$ , and assuming that the debt cost of capital does not change, we get  $\tilde{r}_E = r_U + \frac{D}{E}(r_U - r_D) = 9\% + \frac{7}{3}(9\% - 4\%) = 20.67\%$ . The repurchase increases leverage and therefore the equity cost of capital.

## Question 2

DEF Inc. is an all-equity financed producer of luxury headphones located in a country without corporate taxes and perfect capital markets. Its equity cost of capital is 20%. DEF plans to introduce a new type of “Super-DEF” headphones. Based on extensive marketing surveys, the sales forecast for Super-DEF is 900 units per year. Given how quickly tastes change, DEF expects the product will have a two-year life (i.e. sales only in year 1 and 2). It will be sold for 1000 euro each at DEF’s stores and will cost 700 euro per unit to manufacture. The only up-front expenses required for this project are a training session for the sales personnel (10,000 euro) and a new office building (300,000 euro, depreciated linearly over three years). Furthermore, only half of the customers will pay at the time of purchase, the other half delays their payment for one year.

Assume that the project is of average risk.

- (a) Calculate the unlevered net income of the project in years 0, 1, 2, and 3.

(in thousands)	t=0	t=1	t=2	t=3
Sales	0	900	900	0
COGS	0	630	630	0
Gross Profit	0	270	270	0
Selling & Admin Exp.	10	0	0	0
Depreciation	0	100	100	100
EBIT	-10	170	170	-100
Income tax	0	0	0	0
Unlevered NI	-10	170	170	-100
-Capital Exp.	-300	0	0	0
-Change in Accts. rec.	0	-450	0	450
+Depreciation	0	-100	-100	-100
=FCF	-310	-180	270	450

- (b) Calculate the free cash flows of the the project in each of the years.

See last line of previous table. The difficult part of the answer to this question are Accounts Receivables: only half of the sales of 900,000 are a cash flow in the same year. In the first year accounts receivable increase to 450,000 and decrease back to zero in year three.

- (c) Calculate the NPV of the project. Should the company invest? Explain.

First, note that since the company is all-equity financed, the equity cost of capital is equal to the WACC. We can discount using WACC since the project is of average risk.  $NPV = -310 + \frac{-180}{1.2} + \frac{270}{1.2^2} + \frac{450}{1.2^3} = -12.1$ . The company should not do the project.

(all figures in thousands of euro).

- (d) How would your answer change if the firm was offered a loan with an annual interest rate of 5% to finance the project? Explain.

Nothing would change about the decision not to invest. According to the theorem by Modigliani and Miller, in a world with perfect capital markets and no corporate taxes, the cost of capital does not depend on the capital structure. The free cash flows still have to be discounted at 20% per year!

### Question 3

Suppose ABM AMRO's stock has an expected return of 20% and a volatility of 40%, while Unilever's has an expected return of 10% and a volatility of 10%. If these two stocks were perfectly negatively correlated,

- (a) What is the portfolio risk if we invest 20% of our portfolio in ABN-AMRO and 80 % in Unilever? Why?

Using the standard formula for the variance of a risky portfolio of two stocks:

$$\text{Var}(R_p) = 0.16 \times 0.04 + 0.01 \times 0.64 + 2 \times 0.2 \times 0.8 \times 0.1 \times 0.4 \times (-1) = 0$$

With these portfolio weights, the risks of these two stocks cancel each other out.

- (b) What is the risk-free rate of interest in this economy? Why?

The portfolio of the two stocks shown above is risk free. By arbitrage, the return of this portfolio has to be equal to the risk free rate of return. Therefore  $r_f = 0.2 \times 20\% + 0.8 \times 10\% = 12\%$

- (c) Suppose the market portfolio has an expected return of 15%, a volatility of 20% and a correlation with ABM AMRO of 0.75, what is ABN-AMRO's market beta?

The definition of beta: 
$$\beta_{ABN} = \frac{\text{Cov}(R_m, R_{ABN})}{\text{Var}(R_m)} = \frac{\text{Corr}(R_m, R_{ABN}) \times \sigma_{ABN} \times \sigma_m}{\sigma_m^2} = \frac{0.75 \times 0.4}{0.2} = 1.5$$

- (d) What is the alpha of ABN-AMRO?

According to the CAPM, ABN should have a return of  $r_{ABN} = 0.12 + 1.5 \times (0.15 - 0.12) = 16.5\%$ . This is 3.5% lower than its actual expected return of 20%. In other words,  $\alpha_{ABN} = 3.5\%$ .

- (e) In what direction should the price of ABN AMRO move for CAPM to be in equilibrium again?

Since the stock has a positive alpha, investors will try to buy ABN. In the process, they bid up the price and thereby reduce its expected return. The price of ABN-AMRO will increase.

## Question 4

The following are the current prices (in euro) of zero-coupon bonds with face a value of 1000 euro.

	Bond A	Bond B	Bond C
Maturity	1 year	2 years	3 years
Price	961.54	907.03	827.85

- (a) Calculate the yield to maturity (YTM) for 1 year, 2 years, and 3 years on the basis of the information given in the table.

$$ytm_1 = \frac{1000}{961.54} - 1 = 4\%, ytm_2 = \left(\frac{1000}{907.03}\right)^{\frac{1}{2}} - 1 = 5\%, ytm_3 = \left(\frac{1000}{827.85}\right)^{\frac{1}{3}} - 1 = 6.5\%$$

- (b) Draw the yield curve based on the results from (a). Is it upward-sloping, downward-sloping, or constant?

The yield curve is upward sloping.

- (c) Calculate the price of a 3-year annual coupon paying bond with coupon rate of 6%, and a face value of € 1000.

$$P = \frac{60}{1.04} + \frac{60}{1.05^2} + \frac{1060}{1.065^3} = 989.63$$

- (d) Suppose the yield curve in (b) experiences an upward parallel shift by 100 basis points today, by how many percent will the price of the coupon paying bond in (c) change?

Due to the upward parallel shift of the yield curve by 100 bp, we have:  $ytm_1 = 5\%$ ,  $ytm_2 = 6\%$ ,  $ytm_3 = 7.5\%$ . Therefore:

$$P = \frac{60}{1.05} + \frac{60}{1.06^2} + \frac{1060}{1.075^3} = 963.8. \text{ The bond price drops by } 2.61\%. \left(\frac{963.8-989.63}{989.63} = -2.61\%\right)$$

## Question 5

As of December 2005, Google (ticker: GOOG) had no debt. Suppose the firm's managers consider recapitalizing the firm at the start of the new year by issuing zero-coupon debt with a face value of \$90 billion due in January of 2008, and using the proceeds to repurchase stock. Suppose Google currently has 300 million shares outstanding trading at \$405.85 per share, implying a market value of \$121.8 billion. The two-year risk-free rate is 4.5%. Using the option market data in the table below (Figure 1), estimate the credit spread Google will have to pay on the debt.

GOOG		405.85 – 11.85	
Dec 05, 2005 (Closing)		Vol 10311740	
Calls	Bid	Ask	Open Int
08 Jan 300.0 (YVC AT-E)	157.60	160.20	353
08 Jan 310.0 (YVC AB-E)	151.10	153.90	201
08 Jan 320.0 (YVC AD-E)	144.80	147.80	220
08 Jan 330.0 (YVC AF-E)	138.70	141.90	214
08 Jan 340.0 (YVC AH-E)	132.90	136.10	166
08 Jan 350.0 (YVC AJ-E)	127.20	130.40	209
08 Jan 360.0 (YVC AL-E)	121.70	124.90	196
08 Jan 370.0 (YVC AN-E)	116.40	119.50	380
08 Jan 380.0 (YVC AU-E)	111.40	114.40	123
08 Jan 390.0 (YVC AV-E)	106.50	109.50	165
08 Jan 400.0 (YVC AW-E)	102.00	104.60	1131
08 Jan 410.0 (YVC AX-E)	97.30	100.00	214

Source: Chicago Board Options Exchange at [www.cboe.com](http://www.cboe.com).

Figure 1:

See answers in Berk/Demarzo on p. 674/675

## Question 6

Answer four of the following five questions:

- (a) Comment in two sentences on the following statement: "Investing in the stock market must have a positive NPV, otherwise no one would do it"

This statement is not correct. Even if the NPV is zero, investors get compensated for the time value of money (the risk free interest rate) and risk (the risk premium). An NPV of zero just means that there are no abnormal returns.

- (b) Explain in a few sentences why all securities lie on the Security Market Line.

If the expected return of a security lies *below* the SML, investors can get a higher return by holding an appropriate combination of the risk free asset and the market portfolio. Therefore investors do not want to hold this security, and its price will fall until its expected return lies on the SML. A similar argument applies if the expected return of a security lies *above* the SML.

- (c) Explain in a few sentences why the market portfolio is efficient according to the CAPM.

If all investors behave optimally, the risky part of their portfolio will be identical. Suppose the composition of the market portfolio was not identical to this optimal portfolio demanded by investors: in this case, demand would not be equal to supply and prices of stocks would have change until investors can hold exactly the portfolio of stocks being traded, i.e. the market portfolio.

- (d) Explain briefly why the yield curve may be upward sloping. Give at least two explanations.

- (a) Expectation that short term interest rates will increase. (For instance if the central bank is fighting inflation)
- (b) Investments over a longer time horizon may demand a higher risk premium, for instance because of higher inflation risk.

- (e) A one-year European call option on stock X (paying no dividend) with a strike price of \$40 currently trades for \$20. The current price of stock X is \$23.83 and the one-year risk-free rate is 3%. Calculate the price of the corresponding put option, i.e. the price of a put option with strike of \$40.

According to put-call parity:  $C + PV(K) = P + S$ . Therefore the price of the put must be

$$P = 20 + \frac{40}{1.03} - 23.83 = 35$$