TIØ4146 Corporate Finance

Fall Exam

Multiple-Choice

(1) A person's utility (U) as a function of its wealth (W) is given by $U(W) = 6W - 0.02W^2$. The person faces an investment with uncertain outcomes of either receiving W=40 or receiving W=100, each with a probability of 50%. The *certainty equivalent* for this investment is:

a. 70
b. 304
c. 64.6
d. 5.4
e. 34.0

The quadratic utility function gives:

$U(40) = 6 \times 40 - 0.02 \times 40^2 = 208$

$U(100) = 6 \times 100 - 0.02 \times 100^2 = 400$

So $E(U[W]) = 50\% \times 208 + 50\% \times 400 = 304$

The certain W that corresponds to a utility of 304 is found by running the utility function in reverse to find that W=64.6, which is called the *certainty equivalent*.

(2) Which of the following options is **TRUE**?

a. Market risk, or systematic risk, is diversifiable risk.
b. Risk increases with the number of assets in a portfolio.
c. The covariances between different assets returns are always positive.
d. The portfolio variance is the weighted average of assets variances.
e. An asset's Beta (β) is the sensitivity of the asset's returns for changes in portfolio returns.

(3) Which of the following is **FALSE**?

a. The Capital Market Line is given by combinations of the risk-free asset and the market portfolio.
b. The graphical representation of the Capital Asset Pricing Model is known as the Security Market Line.
c. The Security Market Line only prices the systematic risk and is therefore valid for all investment objects.
d. The Capital Asset Pricing Model gives an expression of the required equity return
e. The Sharpe ratio is a better performance measure than Treynor ratio when a portfolio is split into subportfolios (e.g., countries, portfolio manager).

(4) Regarding the capital structure of firms, select the alternative that is **FALSE**.
  a. Modigliani and Miller proved that capital structure choice is irrelevant in a perfect capital market.
  b. The formula for the cost of equity for a company under corporate tax regime that keeps a continuous balanced debt is identical to Modigliani and Miller's second proposition for a perfect capital market.
  c. The assumption that most closely resembles what is observed in practice by firms is the periodical rebalancing of the debt.
  d. Under the Pecking Theory assumptions, firms would prefer to have cash reserves, then use debt and only issue equity when they cannot contract more debt without risking bankruptcy.
  e. The company dividend decision is relevant in a perfect capital market.

(5) According to the efficient market hypothesis, select the option which is **TRUE**.
  a. The market price does not reflect expected future outcomes for a stock.
  b. Prices do not react to new information being available.
  c. Stock prices behave like random numbers.
  d. People that make money trading stock prove that the market is inefficient.
  e. Prices first underreact to new information, then overreact to compensate.

(6) Choose the correct statement. Using the risk neutral valuation approach, the value of a risky asset is given by:
  a. The expected payoff, calculated with real probabilities, discounted at a risk adjusted rate.
  b. The expected payoff, calculated with risk neutral probabilities, discounted at a risk adjusted rate.
  c. The expected payoff, calculated with real probabilities, discounted at a risk-free rate.
  d. The expected payoff, calculated with risk neutral probabilities, discounted at a risk-free rate.
  e. None of the above.

(7) Which one of following statements about the binomial pricing model is FALSE?
  a. The market is complete if two linearly independent securities are traded.
  b. The non-arbitrage condition is $d<r<u$.
  c. The market risk is embedded in the risk neutral probabilities.
  d. It is a discrete time model.
  e. It can only be used to price put options.

Statement b. was incorrectly shown during the exam: "The non-arbitrage condition is d". This statement is therefore incorrect as well.

(8) The holder of a put option has:
  a. the obligation to sell a security for a given price.
  b. the right to buy a security for a given price.
  c. the right to sell a security for a given price.
  d. the obligation to buy a security for a given price.
  e. None of the above.

Open-Questions

(1) Newpower Ltd produces power from offshore wind. Other companies producing offshore wind has and an equity beta of 1.2, Newpower Ltd has the same level of debt-to-equity ratio as other offshore wind power producers.

a. Determine the expected return on Newpower's shares if the expected return of the market is 8.0 per cent and the risk-free rate is 2.0 per cent.

The candidate should know that the expected return of the shares is the expected return on equity and show the ability to use the CAPM in order to calculate the proper cost (return) of equity:

$R_e = R_f + \beta * (R_m - R_f)$ = 2.0% + 1.2*(8.0%-2.0%) = **9.2%**

b. Newpower's shares are priced according to the net present value of the infinite streams of future dividend payments. The company expects at the end of 2023 to pay a dividend of 2.00 euros by end of 2024 and further expects its dividend growth rate to be 5.0 % in the future. What should be a fair price of Newpowers shares?

The candidate should here show the ability to apply Gordon's growth model (equation 2.6 in the textbook). A common error would be to multiply 2.00 by 1.05. But the question says that the dividend payment is 2.00 euros after one year so this is already taken account of.

$Gordon's\ growth\ formulae: p = \frac{2.00}{9.2\% - 5.0\%} = \mathbf{47.6}$ **euros**

c. Newpower consider investing in solar power. Solar power production is riskier, and the beta for firms operating in solar power is 1.8. Comparable solar power firms have a debt-to-equity (D/E) ratio of 1/3 which can be assumed to be the fixed D/E ratio target for such firms. Firms investing in solar power projects can issue debt at 3.0 per cent and they face a company tax rate of 25 %. Given these assumptions, what is the weighted average cost of capital for investing in solar power?

The candidate should here be able to use the information that more risky investments involve a higher beta (in this case 1.8 since the other industry peers in the new industry have the same capital structure). We need then to calculate a new cost of equity capital for the increased risk using CAPM as in question a). For constant debt-to-equity ratio the present value of the tax shield is not riskless but depends on the performance of the company. One should then deduct the present value of the tax shield by the return of the assets, not by the return on debt. Therefore, WACC calculation will be different, and not include the corporate tax. If they have fixed target for debt-to-equity ratio, then the WACC should be calculated by the formula presented in page 172 in the book (r is WACC). The explanation for this is also on the second paragraph of the same page, after the first table.

Cost of equity capital in solar power industry = $r_e = r_f + \beta_i(r_m - r_f)$ = 2.0% + 1.8*(8%-2%) = **12.8 %**

$$r_{WACC} = WACC = \left(\frac{E}{D+E}\right) \times r_e + \left(\frac{D}{D+E}\right) \times r_D$$

$$r_{WACC} = WACC = \left(\frac{3}{3+1}\right) \times 12.8\% + \left(\frac{1}{3+1}\right) \times 3.0\% \times = \mathbf{10.4}\%.$$

(2) The expected free cash flow of company A is $5 million each year. Company A also has $19.05 million in outstanding debt, which is expected to be maintained permanently. Company B is a similar company with the same expected cash flow as Company A, and no debt. The cost of capital of Company B is 15%.

a. Calculate the value of Company B.

b. Assuming that corporate tax rate is 21%, calculate the value of Company A's tax shield, the company value, and its capital cost.

Answer:

a.

$$V_U = \frac{FCF}{r^A} = \frac{5}{0.15} = 33.33$$

b.

Constant debt: $PV(tax\ shield) = \frac{D \times \tau \times r^D}{r^D} = D \times \tau = 19.05 \times 0.21 = 4$

$$V_L = V_U + PV(TS) = 37.33$$

$$V_L = \frac{FCF}{WACC}; WACC = \frac{5}{37.33} = 0.1339$$

(3) Consider a manufacturing plant that currently has discounted cash flows evaluated in 8 million Euros. According to the market conditions the discounted cashflows can go up by 25% or down by 20% with (real) probabilities 0.7 and 0.3, respectively, in one year. Assume that the yearly risk-free discount rate is 7%.

a. Assume that the plant can be sold at any time to a larger company for 7 million Euros. Present the evolution of the discounted cash flows in a two-period model, where each period corresponds to a one year. Calculate the value of the project when one considers the abandonment option.

The DCF evolve according the tree:

t=0	**t=1**	**t=2**
		12.5
	10	
8		**8**
	6.4	
		5.12

The ROA is based on the risk neutral probabilities:

p=(r-d)/(u-d)=0.6 and 1-p=0.4

t=0	t=1	t=2
		max(12.5 , 7) = 12.5
	max(10, 7) =10	
max(7, 8.3) = 8.3		**max(8, 7) = 8**
	Max(7.1, 7) = 7.1	
		Max(5.12, 7) = 7

Calculating the value of the project with the option we get:

In t=1, the discounted value in the first node is given by

$$\frac{12.5 * 0.6 + 8 * 0.4}{1.07} = 10$$

And for the second node

$$\frac{8 * 0.6 + 7 * 0.4}{1.07} = 7.1028$$

In t=0, we get

$$\frac{10 * 0.6 + 7.1028 * 0.4}{1.07} = 8.2627$$

The project value when considered the possibility to abandon the market is approximately 8.3.

b. Assume now that the plant can only be sold at time 2 at a price of 7 million euros. How does this impact on the project value calculated in point **a.**

We have now an abandonment option of "European style", because it can only be exercised at the maturity. The previous abandonment option was of "American style", because it could be exercised at any time. An American option has always a larger or equal value than the European option with similar characteristics.
Looking at the second tree with the backward calculation procedure, we can understand that the abandonment option is exercised only when the market goes down twice, i.e. in the last node of the second year. Then the additional flexibility of leaving the market at time 1 is never exercised. Consequently, the project value is the same in both cases.

(4) AAA Transcontinental's stock has a volatility of 25% and a current stock price of 40 Euros per share. AAA pays no dividends. The risk-free interest rate is 4%.

a. Calculate the Black-Scholes delta of a one-year, at-the-money European call and a put options on AAA stock. Interpret this value.

Solution: Since d1 is given by

$$d_1 = \frac{\ln(S_0/X) + (r + \frac{1}{2}\sigma^2)T}{\sigma\sqrt{T}}$$

We get that d1= .285 or .29
From tables N(d1) = 0.6141 -> call option delta
The option delta can be seen as the quantity of shares that have to be bought to replicate the call option. This value can also be seen as the variation in the option price when the stock price increases in one unit (assuming that the initial price is near 40 euros).

b. Calculate the Black-Scholes value of a one-year European put option on AAA stock with a strike price of 50 Euros.

Solution: In this case we have that d1 = -0.6075 or -0.61
From tables N(d1) = 0.2709
Note d2 = d1 - $\sigma\sqrt{T}$ = -0.6075 - .25$\sqrt{1}$ = -0.8575 or -0.86 From tables N(d2) = 0.1949
Note N(-0.86) = 1 - N(0.86) = 1 - 0.8051 = 0.1949
C = S × N(d1) - e^{-rT}X × N(d2) = 40 * (0.2709) - 50$e^{-0.4}$ (.1949) = 1.47
P = C - S + e^{-rT}X = 1.47 - 40 + 50$e^{-0.4}$ = 9.51 Euros

c. One of the determinants of the European call and put option prices is the strike price. Increasing the strike price leads to variations in the options price. How do both the European call and put option prices change with the strike price? Explain why.

Solution: It is known that

$$\frac{\partial O_c}{\partial X} = -e^{-rT}N(d_2) < 0 \quad and \quad \frac{\partial O_p}{\partial X} = e^{-rT}N(-d_2) > 0$$

The European call option gives to its owner the right to buy a stock at a fixed price (the strike price) at the maturity. The payoff of the option is then max(0, S-X). When increase the strike price, X, we decrease the payoff, and consequently its value must decrease. Similar justification can be given by the put option.