Exam SØK2005 V22 – Answer key
Trang

① 5 points

* Short sale strategy: You anticipate a price decline of an asset (stock ABC), so you borrow the stock for a time period of T and sell it to an investor at $S/share. In this scenario, you (1) now borrow N shares now, and (2) later at time T you close the short position: (2.1) buying N shares at the market price of $(S−X) per share to replace the borrowed shares, and (2.2) returning these N shares to the lender. ⇒ $\boxed{\text{True}}$

② 2 points

* Profit: Sell at $S/share ; Buy at $(S−X)/share

⇒ Total profit: $[S-(S-X)] \times N = \$NX$.

$X is only the profit per share ⇒ $\boxed{\text{False}}$

③ 3 points : The price of the stock would increase instead of decreasing. There's no limit of how high the price would go ⇒ potential loss is unlimited.

(while your gain is limited to $S/share if the stock becomes worthless!) ⇒ $\boxed{\text{False}}$

④

The expected return (in NOK) on the fund investment is $0.55(2300) + 0.45(-2500) = 140$; and on the safe asset investment is 100.

$\Rightarrow$ Expected risk premium $= 140 - 100 = $ NOK $\boxed{40.}$

⑤ $r_f = \frac{100}{5000} = 0.02$ (Return on T-bills)

$\Rightarrow$ Excess return $= 0.04 - 0.02 = 0.02 = \boxed{2}\%$

⑥ $r_{nom} = 4\%$ $\quad r_{real} = \frac{r_{nom} - i}{1+i} = \frac{4\% - 2\%}{1.02} = 1.96\%$

Approximation : $r_{real} \approx r_{nom} - i = 4\% - 2\% = 2\%$

$\Rightarrow r_{real} <$ approximation $\Rightarrow$ $\boxed{\text{lower than}}$

⑦ $r_f = 0.05$, $E(r_p) = 0.1$, $\sigma_p = 0.2$

and ⑧ $U = E(r) - \frac{1}{2}A\sigma^2 \Rightarrow U_f = r_f - \frac{1}{2}A(0)^2 = r_f = 0.05$ (T-bills)

$U_p = 0.1 - \frac{1}{2}A(0.2)^2 = 0.1 - 0.02A$ (risky)

To prefer T-bills to portfolio $\Rightarrow U_p < U_f \Rightarrow 0.1 - 0.02A < 0.05$

$\Rightarrow A > \boxed{2.5}$

$\Rightarrow$ We find $\boxed{\text{minimum}}$ A.

(9) $E(r_c) = 0.07$; $E(r_p) = 0.1$; $\sigma_p = 0.12$, $r_f = 0.04$

$$E(r_c) = y\,E(r_p) + (1-y)\,r_f = r_f + y\left[E(r_p) - r_f\right]$$

$$= 0.04 + y\,(0.1 - 0.04) = 0.04 + 0.06y$$

$$\Rightarrow 0.07 = 0.04 + 0.06\,y$$

$$\Rightarrow y = \frac{0.07 - 0.04}{0.06} = 0.5 = \boxed{50}\,\%.$$

(10) $\sigma_c = y \cdot \sigma_p = 0.5(0.12) = 0.06 = \boxed{6}\,\%$

(11) Jimmy prefers investment that has $\sigma_c = 6\%$.
Howard tolerates more risk ($\sigma_c \leq 8\%$) $\Rightarrow$ Howard is $\boxed{\text{less}}$ risk averse than your friend.

(12) y : proportion in the risky portfolio $\Rightarrow (1-y)$ in risk-free asset.

$$\sigma_c = y\,\sigma_p = y(0.25) = 0.2 \Rightarrow y = \frac{0.2}{0.25} = 0.8$$

$$\Rightarrow E(r_c) = r_f + y\left[E(r_p) - r_f\right] = 0.1 + 0.8(0.25 - 0.1) = 0.22 = \boxed{22}\,\%.$$

(13) $E(r_p) = w_D \cdot E(r_D) + w_E\,E(r_E) = 0.3030(0.2) + 0.6970\,(0.08)$
$= 0.11636$

$\sigma_p = 10\%$ (given)

$$\Rightarrow \text{Sharpe} = \frac{E(r_p) - r_f}{\sigma_p} = \frac{0.11636 - 0.05}{0.1} = \boxed{0.6636}$$

(14) $\sigma_i^2 = \beta_i^2 \sigma_M^2 + \sigma^2(e_i)$ (total risk)

$$\sigma_A^2 = 1.3^2 (0.2)^2 + 0.38^2 = 0.212$$

$$\sigma_B^2 = 0.6^2 (0.2)^2 + 0.4^2 = 0.1744$$

$\Rightarrow \sigma_A^2 > \sigma_B^2 \Rightarrow$ stock A is $\boxed{\text{more}}$ risky.

(15) $\beta_P = w_A \cdot \beta_A + w_B \cdot \beta_B + w_M \cdot \beta_M$

$$= 0.5(1.3) + 0.2(0.6) + 0.3(1)$$

$$= \boxed{1.07}$$

(16) CAPM: $E(r_A) = r_f + \beta_A (E(r_M) - r_f)$

$$= 0.05 + 0.3(0.15 - 0.05)$$

$= 0.08 \Rightarrow$ This is fair expected return!

The actual expected return is, however:

$$E(r_A) = \frac{S_1 + D_1}{S_0} - 1 = \frac{\$33 + \$2}{\$30} - 1 = 0.1667 > \text{fair expected return}$$

$\Rightarrow$ stock is $\boxed{\text{underpriced.}}$

(If the stock price was higher $\rightarrow$ the "actual" expected return would be lower $\rightarrow$ closer to the "fair" expected return).

(17) $\beta_B = 0 \Rightarrow r_f = E(r_B) = 5\%$

$$\left.\begin{aligned}\beta_D &= w_A \cdot \beta_A + w_f \cdot \beta_f \\ &= 0.5(1.2) + 0.5(0) \\ &= 0.6 \quad = \beta_C \\ E(r_D) &= w_A \cdot E(r_A) + w_f \cdot r_f \\ &= 0.5(0.1) + 0.5(0.05) \\ &= 0.075 > E(r_C)\end{aligned}\right\} \begin{aligned}&\beta_D = \beta_C \\ &\text{but } E(r_D) > E(r_C)\end{aligned}$$

$\Rightarrow$ Arbitrage opportunity exists! $\rightarrow$ $\boxed{\text{Yes}}$

(18) The estimated return for stock A is:

$$\left.\begin{aligned}&0.03 + 1.2(0.05) = 0.09 \\ &\text{But stock A's actual return is } 0.08\end{aligned}\right\} \Rightarrow \begin{aligned}\text{Abnormal return} &= 0.08 - 0.09 \\ &= -0.01. \\ &= \boxed{-1}\%.\end{aligned}$$

(19) Effective annual rate for the T-bill: $(T = 1)$

$$\left(\frac{1000}{925}\right) - 1 = 8.11\%$$

Effective annual rate for the coupon bond:

$$\frac{\underbrace{1000}_{FV} + \underbrace{80}_{\text{coupon pmt}}}{990} - 1 = 9.09\% > 8.11\%$$

$\Rightarrow$ $\boxed{\text{higher}}$ for the coupon bond.

(20) Using financial calculator with the following input :

Bond A : $N = 20$, $PV = -950$, $PMT = 50$, $FV = 1000$

$\Rightarrow I/Y = 5.415\%$ (YTM per 6-month period)

Bond equivalent yield = $5.415\% \times 2 = 10.83\%$ ✓

Bond B : Selling at par value $\Rightarrow$ YTM = coupon rate = 8%
= bond equivalent yield

$\Rightarrow$ Bond A has a $\boxed{\text{higher}}$ B.E.Y.

(21) ① The current price of the bond is :

10 periods (T) , \$50 (C per period) , Par = \$1000 , r = 3%

by hand

$$PV = C\left\{\frac{1}{r}\left[1-\frac{1}{(1+r)^T}\right]\right\} + Par\,\frac{1}{(1+r)^T}$$

$$= 50\left\{\frac{1}{0.03}\left[1-\frac{1}{1.03^{10}}\right]\right\} + \frac{1000}{1.03^{10}}$$

$$= 1170.60$$

or with financial calculator : $N = 10$, $I/Y = 3\%$, $PMT = 50$, $FV = 1000$

$\Rightarrow \boxed{PV = -1170.60}$

② The price of bond 6 months from now is : (9 6-month periods to maturity).

$N = 9$, $I/Y = 3\%$, $PMT = 50$, $FV = 1000$

$\Rightarrow \boxed{PV = -1155.72}$

$$\Rightarrow \text{Rate of return} = \frac{50 + 1155.72 - 1170.60}{1170.60} = \boxed{3}\%$$

(22) $y_1 = 0.085$, $y_2 = 0.09$

$$1 + f_2 = \frac{(1+y_2)^2}{1+y_1} = \frac{(1.09)^2}{1.085} \Rightarrow f_2 = 9.5\%$$

Liquidity Preference Theory:

$$E(r_2) = f_2 - \text{liquidity premium}$$
$$= 9.5\% - 2\% = \boxed{7.5}\%$$

(23) PV of your obligation $= \frac{\$2000}{0.1} = \$20,000$. $\left(V_0 = \frac{D_1}{k-g} \text{ and } g = 0 \right)$

Duration of the perpetual bond: $\frac{1+y}{y} = \frac{1.01}{0.1} = 11$ years (Rule 5 slide 7 Lecture 9)

Let w = weight on the 5-year maturity bond

$\Rightarrow (1-w)$ = ______ 30-year ______

$$\Rightarrow w \times 3 + (1-w) \times 19 = 11$$

$\Rightarrow$ $w = 0.5$ $\Rightarrow$ 50% in 5-year maturity bond.

Amount in 5-year bond:

$$w.\,PV(\text{obligation}) = 0.5(20,000) = \$\boxed{10,000}$$

(24) The market capitalization rate is:

$$k = r_f + \beta[E(r_M) - r_f] = 0.05 + 1.2(0.12 - 0.05) = 0.134$$

Growth rate: $g = b.\,ROE \Rightarrow 0.4(0.15) = 0.06$

$$\Rightarrow D_1 = \overbrace{E_0(1+g)}^{E_1}(1-b) = 5(1.06)(0.6) = 3.18$$

$$\Rightarrow V_0 = \frac{D_1}{k-g} = \frac{3.18}{0.134 - 0.06} = \boxed{42.97}$$

(25) From put-call parity theorem:

and (26) $C = P + S_0 - \frac{X}{(1-r_f)^T} = 5 + 20 - \frac{20}{1.05} = \$5.95.$

$\Rightarrow$ If you $\boxed{\text{sell}}$ a straddle (selling a put and a call), you have a premium income today of $P + C = 5 + 5.95 = \$10.95.$

If $S_1 = \$20 \Rightarrow$ options expire worthless $\Rightarrow$ profit $= \boxed{\$10.95}$

maximum possible.

(27)

- Scenarios:

$S_0 = 130 \begin{cases} S_u = 164 \\ S_d = 104 \end{cases} \xrightarrow{X = 104} C \begin{cases} 60 \\ 0 \end{cases}$

- Alternative portfolio:
  - Buy 1 share of stock at $S_0 = 130$
  - Borrow NOK 100 at 4% rate (pay NOK 104 in one year)

$\Rightarrow CF_0 = -130 + 100 = -\text{NOK } 30.$

	S_u	S_d
Value of stock S_1	164	104
− (Loan + interest)	104	104
Payoff	60	0

$\Rightarrow -30 \begin{cases} 60 \\ 0 \end{cases}$

Same final payoff

$\Rightarrow C = 30$

$\Rightarrow$ Price of call option is NOK $\boxed{30}$

(28) S_T : Spot price at maturity = 102

F_0 : Futures price = 100

S_0 : Current price = (?)

D : Dividend = \$3 × 2 = \$6/year

r_f : Risk-free rate = 6%

T : Maturity = 1 year

A) Establish a portfolio : 1) buy a stock at S_0 and in one year receive dividends \$6 ⇒ Value of stock in 1 year = $S_T + D =$ \$108.

2) Take a loan of $\frac{F_0 + D}{(1+r_f)^T} = \frac{100+6}{1.06} = 100$ (pay \$106 in one-year)

B) Enter a long futures : No CF now and profit $= S_T - F_0 =$ \$2 in one year.

	0	1
A) Stock:	$-S_0$	+108
Loan :	+ 100	−106
CF :	$100 - S_0$	2
	‖	‖
B) Futures	0	2

$$\Rightarrow 100 - S_0 = 0 \Rightarrow \boxed{S_0 = 100}. \left(= \frac{F_0 + D}{1 + r_f} = \frac{100+6}{1.06} \right)$$

(29) - (38) : Multiple choice questions.