INV2601 SELF ASSESSMENT QUESTIONS - SUGGESTED SOLUTIONS

Question 1: option 1

$$Annual\ HPR = HPR^{1/N}$$

$$1.0574 = HPR^{1/4}$$

$$HPR = 1.0574^4$$

$$HPR = 1.2501$$

$$HPR = \frac{Ending\ value}{Beginning\ value}$$

$$1.2501 = \frac{1\ 000}{Beginning\ value}$$

$$Beginning\ value = \frac{1\ 000}{1.2501}$$

$$= R799.94$$

Refer Marx 2013: 7

Question 2: option 1

To predict past market movements

Refer Marx 2013: 28-29

Question 3: option 2

Equal

A risk-free asset is an asset with zero variance which has zero correlation with all other risky assets and produces a risk-free rate of return. It is an asset with a standard deviation of zero because its expected return will equal its actual return.

Refer Marx 2013: 35

Question 4: option 3

(i) Systematic (ii) unsystematic

Refer Marx 2013: 6, 36

Question 5: option 4

$$\beta = \frac{Corr_{i,m} \times \sigma_i \times \sigma_m}{{\sigma_m}^2}$$

$$= \frac{0.45 \times 0.14 \times 0.06}{0.06^2}$$

$$= \frac{0.0038}{0.0036}$$

$$= 1.06$$

Refer to Marx 2013: 38

Question 6: option 2

The required rate of return of Brainchild Limited using the capital asset pricing model (CAPM):

$$k = r_f + \beta(r_m - r_f)$$

$$= 8 + 1.1(12 - 8)$$

$$= 12.40\%$$

The intrinsic value of Brainchild Limited using the constant growth model:

$$V_0 = \frac{D_1}{k - g}$$

$$= \frac{D_0(1 + g)}{k - g}$$

$$= \frac{2.00(1.05)}{0.124 - 0.05}$$

$$= \frac{2.10}{0.074}$$

$$= R28.38$$

Refer to Marx 2013: 38, 65-66

Question 7: option 2

$D_0 = 1.00$

$D_1 = 1.00(1.15) = 1.15$

$D_2 = 1.15(1.15) = 1.3225$

$D_3 = 1.3225(1.08) = 1.4283$

$D_4 = 1.4283(1.04) = 1.4854$

$$P_3 = \frac{D_4}{k - g}$$

$$= \frac{1.4854}{0.18 - 0.04}$$

$$= R10.6102$$

Calculate the intrinsic value:

$$V_0 = \frac{D_1}{(1 + k)^1} + \frac{D_2}{(1 + k)^2} + \frac{D_3}{(1 + k)^3} + \frac{P_3}{(1 + k)^3}$$

$$= \frac{1.15}{(1.18)^1} + \frac{1.3225}{(1.18)^2} + \frac{1.4283}{(1.18)^3} + \frac{10.6102}{(1.18)^3}$$

$$= 0.9746 + 0.9498 + 0.8693 + 6.4577$$

$$= R9.25$$

OR

HP 10BII	
Input	**Function**
End mode	□ BEG/END
0	CF_0
1.15	CF_1
1.3225	CF_2
12.0385 (=1.4823 +10.6102) $NB: CF_3 = D_3 + P_3$	CF_3
18%	I/YR
	NPV
	R9.25

Refer to Marx 2013: 67-68

<u>Question 8: option 3</u>

$$g = Return\ on\ equity\ (ROE) \times Retention\ rate(RR)$$

$$ROE = net\ profit\ margin \times total\ asset\ turnover \times financial\ leverage$$

$$= 15 \times 2.0 \times 0.9$$

$$= 27\%$$

$$Retention\ rate\ (RR) = 1 - dividend\ payout\ ({}^{D}/_{E})$$

$$= 1 - 0.30$$

$$= 0.70$$

$$g = ROE\ \times RR$$

$$= 27\% \times 0.70$$

$$= 18.90\%$$

Refer Marx 2013: 62, 135

<u>Question 9: option 4</u>

(i) Defensive (ii) speculative

Refer to Marx 2013: 145-146

<u>Question 10: option 4</u>

Alternative 2 and 3

Refer to Marx 2013: 185-187, 191-193

<u>Question 11:option 4</u>

$$Total\ effect = \ -D(\Delta y) + c\ (\frac{\Delta y}{100})^2\ \times 100]$$

$$= 21.2 + [210(0.02^2) \times 100]$$

$$= 21.2 + 8.4$$

$$= 29.60\%$$

Refer to Marx 2013: 225-228

Question 12: option 4

HP 10BII	
Input	**Function**
End mode	□ BEG/END
1 000	FV
-967.59	PV
80 (=1 000× 0.08)	PMT
4	N
	I/YR
	9.00%

Refer to Marx 2013: 219

Question 13: option 2

$$CY = \frac{coupon\ payment}{bond\ price}$$

$$= \frac{80}{967.59}$$

$$= 0.0827 \times 100$$

$$= 8.27\%$$

Refer to Marx 2013: 218-219

Question 14: option 3

	$\boldsymbol{V_-}$	$\boldsymbol{V_0}$	$\boldsymbol{V_+}$
FV	1000	1000	1000
PMT	90	90 [(1000 × 0.18)÷2]	90
I/YR	3 [(7-1)÷2]	3.5 [7÷2]	4 [(7+1)÷2]
N	30	30	30
PV	2176.0265	2011.5625	1864.6017

$$Duration = \frac{V_- - V_+}{2V_0(\Delta y/100)}$$

$$= \frac{2\,176.0265 - 1\,864.6017}{2 \times 2011.5625 \times (1/100)}$$

$$= \frac{311.4248}{40.2313}$$

$$= 7.74$$

Refer to Marx 2013: 225-226

Question 15: option 2

Call option

Refer to Marx 2013: 245

Question 16:option 2

Interest rate swap

Refer to Marx 2013: 256-257

Question 17: option 1

$X = 35 - 3 = 32$

Refer to Marx 2013: 248

Question 18: option 3

$$delta = \frac{f^+ - f^-}{S^+ - S^-}$$

$$= \frac{12 - 2}{85 - 75}$$

$$= 1.0$$

$$f^+ = S^+ - X$$

$$= 85 - 73$$

$$= 12$$

$$f^- = S^- - X; MAX\ 0$$

$$= 75 - 73 = 2$$

$$S^+ = 80 + 5 = 85$$

$$S^- = 80 - 5 = 75$$

Refer to Marx 2013: 248-249

Question 19: option 4

$$Forward\ rate = \left(\frac{1.08^2}{1.06^1} - 1\right) \times 100$$

$$= \left(\frac{1.1664}{1.06} - 1\right) \times 100$$

$$= 10.04\%$$

Refer to Marx 2013: 223

Question 20: option 4

$$Expected\ rate\ of\ return = \bar{k} = \sum_{i=1}^{n} P_i \times k_i$$

$$\bar{k}_A = 0.5(12) + 0.25(10) + 0.25(8)$$

$$= 6 + 2.5 + 2$$

$$= 10.5\%$$

$$Standard\ deviation\ (\sigma) = \sqrt{\sum_{n=1}^{n} P_{ki} \times (k_i - \bar{k}_i)^2}$$

$$\sigma_A = \sqrt{0.5(12 - 10.5)^2 + 0.25(10 - 10.5)^2 + 0.25(8 - 10.5)^2}$$

$$= \sqrt{1.1250 + 0.0625 + 1.5625}$$

$$= \sqrt{2.75}$$

$$= 1.66\%$$

Refer to Marx 2013: 8-9

Question 21: option 2

$$Correlation = \frac{Covariance}{\sigma_A \times \sigma_B}$$

$$= \frac{1.3}{1.66 \times 1.23}$$

$$= 0.64$$

Refer to Marx 2013: 276-277

Question 22: option 2

$$Portfolio\ standard\ deviation\ (\ \sigma_P):$$

$$= \sqrt{\mathrm{w}_1{}^2 \sigma_1{}^2 \ + \ (1 - \mathrm{w}_1)^2 \sigma_2{}^2 \ + \ 2\ \mathrm{w}_1\ (1 - \mathrm{w}_1)\ \rho_{1,2}\ \sigma_1\ \sigma_2}$$

$$= \sqrt{(0.5^2 \times 1.66^2) + (0.5^2 \times 1.23^2) + (2 \times 0.5 \times 0.5 \times 0.64 \times 1.66 \times 1.23)}$$

$$= \sqrt{(0.6889) + (0.3782) + (0.6534)}$$

$$= \sqrt{1.7205}$$

$$= 1.31\%$$

Refer to Marx 2013: 278

Question 23: option 3

$$Sharpe = \frac{r_p - r_f}{\sigma_p}$$

$$= \frac{8 - 3}{3}$$

$$= 1.67$$

Refer to Marx 2013: 295

Question 24: option 1

$$Jensen\ (\alpha) = r_p - [r_f + \beta_p(r_m - r_f)]$$

$$= 11 - [3 + 1(9 - 3)]$$

$$= 2.00$$

Refer to Marx 2013: 295-296

Question 25: option 2

$$Treynor = \frac{r_p - r_f}{\beta_p}$$

$$= \frac{14 - 3}{1.1}$$

$$= 10.00$$

Refer to Marx 2013: 294

Question 26: option 1

Zero-coupon bonds pay a minimum interest. This statement is incorrect because zero-coupon bonds do not make any interest (coupon) payment.

Refer to Marx 2013: 210-213

Question 27: option 3

Step 1: Calculate the future value of the coupon payments reinvested.

$$FV\ OF\ COUPONS\ = \sum COUPON\ PMT\ (1 + r)^n$$

$$= [140(1.10)] + 140$$

$$= 154 + 140$$

$$= R294$$

Step 2: Add the face value of the bond to the future value of the coupon payment.

$= 1000 + 294$

$= R1\ 294$

Step 3: Calculate the realized yield.

HP 10BII	
Input	**Function**
End mode	□ BEG/END
1 294	FV
-1 069.42	PV
2	N
	I/YR
	10.00%

Refer to Marx 2013: 220-222

<u>Question 28: option 1</u>

The expectations theory proposes the forward rates are solely a function of current spot rates.

Refer to Marx 2013: 224-225

Question 29: option 1

	$\boldsymbol{V_-}$	$\boldsymbol{V_0}$	$\boldsymbol{V_+}$
FV	1000	1000	1000
PMT	50	50 [(1000×0.10)÷2]	90
I/YR	3.5 [(8-1)÷2]	4 (8÷2)	4.5 [(8+1)÷2]
N	40	40 (20×2)	40
PV	R1 320.3261	R1 197.9277	R1 092.0079

$$Duration = \frac{(\mathrm{V}_-) - (\mathrm{V}_+)}{2\mathrm{V}_0(\Delta \mathrm{y}/100)}$$

$$= \frac{1\ 320.3261 - 1\ 092.0079}{2 \times 1\ 197.9277 \times (1/100)}$$

$$= \frac{228.3182}{23.9586}$$

$$= 9.53$$

$$Convexity = \frac{(\mathrm{V}_-) + (\mathrm{V}_+) - 2\,\mathrm{V}_0}{2\,\mathrm{V}_0(\Delta \mathrm{y}/100)^2}$$

$$= \frac{1\ 320.3261 + 1\ 092.0079 - (2 \times 1\ 197.9277)}{2 \times 1\ 197.9277 \times (1/100)^2}$$

$$= \frac{16.4786}{0.2396}$$

$$= 68.78$$

Refer to Marx 2013: 225-229

Question 30: option 2

$Duration\ effect$

$$\%\Delta \mathbf{P}_{\mathbf{D}(-\mathbf{1})} = -\mathrm{D}(\Delta \mathrm{y})$$

$$= -9.53(-1)$$

$$= 9.53\%$$

$$\%\Delta \mathbf{P}_{\mathbf{D}(+\mathbf{1})} = -\mathrm{D}(\ \Delta \mathrm{y})$$

$$= -9.53(+1)$$

$$= -9.53\%$$

Refer to Marx 2013: 226

Question 31: option 1

$$Convexity\ effect\ = C\left(\frac{\Delta y}{100}\right)^2 \times 100$$

$$= 68.78\left(\frac{1}{100}\right)^2 \times 100$$

$$= 0.69\%$$

Refer to Marx 2013: 227-228

Question 32: option 2

$$Total\ effect = Duration\ effect\ + Convexity\ effect$$

$$\%\Delta \mathrm{P_T} = [-\mathrm{D}(\Delta \mathrm{y})] + \left[\mathrm{C}\left(\frac{\Delta \mathrm{y}}{100}\right)^2 \times 100\right]$$

$$\%\Delta\mathbf{P}_{\mathbf{T}(-\mathbf{1})} = [-9.53(-1)] + \left[68.78\left(\frac{1}{100}\right)^2 \times 100\right]$$

$$= 9.53 + 0.6878$$

$$= 10.22\%$$

$$\%\Delta\mathbf{P}_{\mathbf{T}(+\mathbf{1})} = [-9.53(1)] + \left[68.78\left(\frac{1}{100}\right)^2 \times 100\right]$$

$$= -9.53 + 0.6878$$

$$= -8.84\%$$

Refer to Marx 2013: 228

<u>Question 33: option 1</u>

$$Loss\ to\ put\ writer = S - (X - p)$$

$$= 94 - (100 - 2)$$

$$= 94 - 98$$

$$= -R4$$

$$Maximum\ profit\ to\ put\ holder = X - p$$

$$= Breakeven\ amount$$

$$= 100 - 2$$

$$= R98$$

Refer to Marx 2013: 247-248

Question 34: option 4

The call holder has the right to require the writer to sell the optioned securities at a preset price.

Refer to Marx 2013: 245

Question 35: option 4

Speculation

Refer to Marx 2013: 237-241

Question 36: option 3

$$\begin{aligned} Breakeven\ for\ a\ call\ holder\ &= X + p \\ &= 100 + 5 \\ &= R105 \end{aligned}$$

$$\begin{aligned} Profit\ for\ call\ holder &= S - (X + p) \\ &= 120 - 105 \\ &= R15 \end{aligned}$$

Refer to Marx 2013: 247-248

Question 37: option 4

$Lower\ bound$: $p \geq X(1+r)^{-t} - S$

$\geq 55(1.08)^{-0.25} - 50$

$\geq 53.9519 - 50$

$\geq R3.95$

$Upper\ bound$: $p \leq X(1+r)^{-t}$

$\leq 55(1.08)^{-0.25}$

$\leq R53.95$

NB: Ensure that you also know the lower and upper bounds for a call option.

Refer to Marx 2013: 250

Option 38: option 4

All of the above.

Refer to Marx 2013: 245, 247-248

Option 39: option 1

Decrease in the yield to maturity causes an increase in value of the bond while an increase in the yield to maturity causes a decrease in the value of the bond.

Refer to Marx 2013: 217

Option 40: option 3

The portfolio with the lowest risk is one that is equally invested in shares A and Y.

Correlation of share returns is between -1 and +1. The closer to -1 the correlation is the more the returns of the two shares tend to move exactly opposite to each other. Therefore the highly diversified the portfolio will be resulting in lower risk.

Refer to Marx 2013: 276-277

Question 41: Option 3

Step 1: Calculate the present value of the bond if it not provided in the question. If the present value is provided, move on to step 2.

HP 10BII	
Input	**Function**
End mode	□ BEG/END
100	FV
10 =[(100×0.20)÷2]	PMT
10 =(5×2)	N
5.97 =(11.94÷2)	I/YR
	PV
	R129.7034

Step 2: Calculate the yield to call of the bond:

HP 10BII	
Input	**Function**
End mode	□ BEG/END
105	FV
-129.7034	PV
10 =[(100×0.20)÷2]	PMT
4 =(2×2)	N
	I/YR
	3.1688×2 **6.34%**

NB: In calculating the yield to call you replace the par value (R100) with the call price (R105) at the beginning of year three which is the end of year 2. The time to maturity (5 years) is replaced with the call date (2 years).

Refer to Marx 2013: 220

Question 42: Option 4

The yield to put of the bond:

HP 10BII	
Input	**Function**
End mode	□ BEG/END
93.25	FV
-82.25	PV
3	PMT
12 =(3×4)	N
	I/YR
	4.5117×4 **18.05%**

Refer to Marx 2013: 220

Question 43: option 2

	V_-	V_0	V_+
FV	100	100	100
PMT	6	6	6
I/YR	7.5 (8.5-1)	8.5	9.5 (8.5+1)
N	6	6	6
COMP PV	92.9592	88.6160	84.5306

$$Effective\ Duration = \frac{(V_-) - (V_+)}{2V_0(\Delta y/100)}$$

$$= \frac{92.9592 - 84.5306}{2 \times 88.6160 \times (1/100)}$$

$$= \frac{8.4286}{1.7723}$$

$$= 4.76$$

NB: 100 basis points = 1%

Refer to Marx 2013: 225-226

Question 44: option 2

$$Convexity = \frac{(V_-) + (V_+) - 2\,V_0}{2\,V_0(\Delta y/100)^2}$$

$$= \frac{92.9592 + 84.5306 - (2 \times 88.6160)}{2 \times 88.6160 \times (1/100)^2}$$

$$= \frac{0.2578}{0.0177}$$

$$= 14.57$$

Refer to Marx 2013: 227-228

<u>Question 45: option 4</u>

Total effect on price from changes in interest rates:

$$Total\ effect\ =\ duration\ effect\ +\ convexity\ effect$$

$$\%\Delta P_T = -D(\Delta y) + [C\left(\frac{\Delta y}{100}\right)^2 \times 100]$$

% $\boldsymbol{price\ increase}$ $\left[\%\Delta \mathbf{P}_{\mathbf{T(-1)}}\right]$**:**

$$\%\Delta P_{T(-1)} = -D(-\Delta y) + [C\left(\frac{\Delta y}{100}\right)^2 \times 100]$$

$$=\ -4.76(-1)\ +\ [14.57\ (0.01)^2 \times\ 100]$$

$$=\ 4.76\ +\ 0.1457$$

$$= 4.91\%$$

% $\boldsymbol{price\ decrease}$ $\left[\%\Delta \mathbf{P}_{\mathbf{T(+1)}}\right]$**:**

$$\%\Delta P_{T(+1)} = -D(+\Delta y) + [C\left(\frac{\Delta y}{100}\right)^2 \times 100]$$

$$= -4.76(1) + [14.57\,(0.01)^2 \times 100]$$

$$= -4.76 + 0.1457$$

$$= -4.61\%$$

Refer to Marx 2013: 228

<u>Question 46: option 3</u>

Calculate the change in price due to duration and convexity.

$$\mathbf{P_T} = \mathbf{V_0} \times (\mathbf{1} \pm \%\Delta\mathbf{P_T})$$

$$\mathrm{P}_{(\mathrm{T}-1)} = 88.62 \times (1 + 0.0491)$$

$$\mathbf{P_{(T-1)}} = \mathrm{R}92.97$$

$$\mathrm{P}_{(\mathrm{T}+1)} = 88.62 \times (1 - 0.0461)$$

$$\mathbf{P_{(T+1)}} = \mathrm{R}84.53$$

Refer to Marx 2013: 228

Question 47: option 1

Calculate the market price of the bond.

HP 10BII	
Input	**Function**
End mode	□ BEG/END
1 000	FV
90 =(1 000×0.09)	PMT
4	N
10	I/YR
	PV
	=R968.3013

Refer to Marx 2013: 217

Question 48: option 4

Step 1: Calculate the future value of the coupon payments reinvested

$$FV\ OF\ COUPONS\ =\ \sum COUPON\ PMT\ (1+r)^n$$

$$=\ 90(1.08)\ (1.06)\ (1.07)\ +\ 90(1.06)\ (1.07)\ +\ 90(1.07)\ +90$$

$$= 110.2442\ +\ 102.0780\ +\ 96.3\ +90$$

$$= R398.6222$$

Step 2: Add the face value of the bond to the future value of the coupon pay

$= 1\ 000\ +\ 398.6222$

$=\ R1\ 398.3222$

Step 3: Calculate the actual yield received:

HP 10BII	
Input	**Function**
End mode	□ BEG/END
1 398.6222	FV
-968.30	PV
4	N
	I/YR
	9.63%

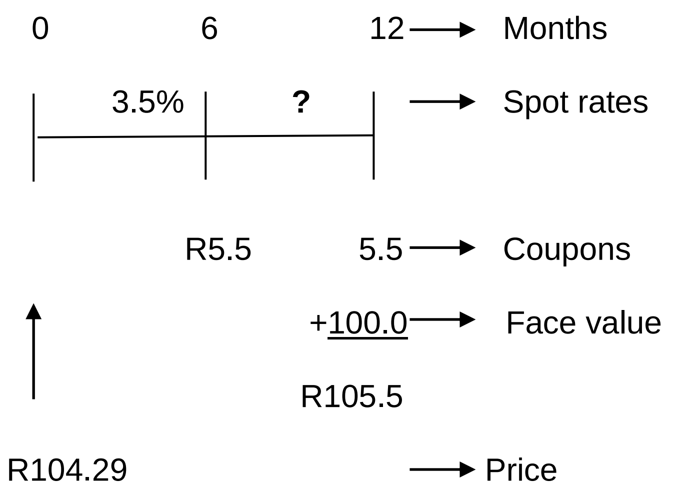
Refer to Marx 2013: 220-222

Question 49: option 3

6 months spot rate

Since the annual coupon rate (7%) is equal to the yield to maturity (7%) therefore the 6-months spot rate will be equals to the yield to maturity. Therefore the **6-months spot rate = 7%.** However if the annual coupon rate is not equals to the yield to maturity, you should calculate the 6-months spot rate.

12 months spot rate



$$\frac{5.5}{1.035} + \frac{105.5}{(1+r)^2} = 104.29$$

$$5.3140 + \frac{105.5}{(1+r)^2} = 104.29$$

$$\frac{105.5}{(1+r)^2} = 104.29 - 5.3140$$

$$\frac{105.5}{(1+r)^2} = 98.9760$$

$$(1+r)^2 = \frac{105.5}{98.9760}$$

$$(1+r)^2 = 1.0659$$

$$1+r = (1.0659)^{1/2}$$

$$1+r = 1.0324$$

$$r = 1.0324 - 1$$

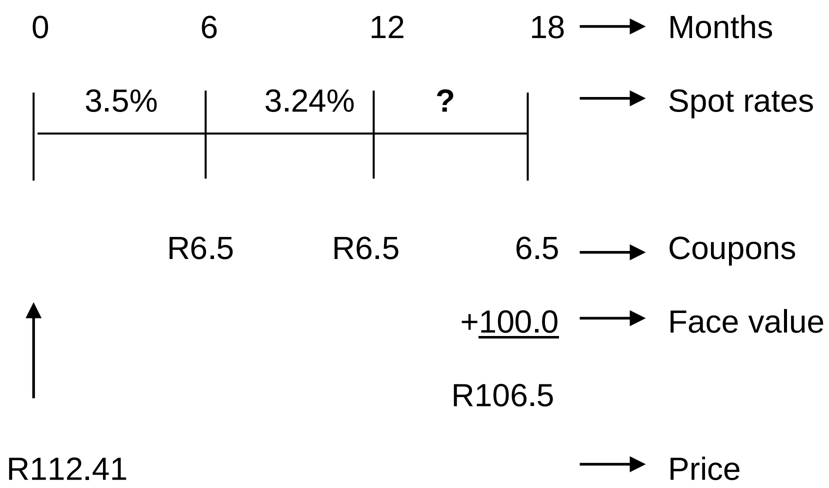
$$r = 0.0324 \times 100 = 3.24$$

12 month spot rate = 3.24 × 2 = 6.48%

Refer to Marx 2013: 222-223

<u>Question 50: option 3</u>

18 month spot rate



$$\frac{6.5}{1.035} + \frac{6.5}{(1.0324)^2} + \frac{106.5}{(1+r)^3} = 112.41$$

$$6.2802 + 6.0984 + \frac{106.5}{(1+r)^3} = 112.41$$

$$\frac{106.5}{(1+r)^3} = 112.41 - 6.2802 - 6.0984$$

$$\frac{106.5}{(1+r)^3} = 100.0314$$

$$(1+r)^3 = \frac{106.5}{100.0314}$$

$$(1+r)^3 = 1.0647$$

$$1 + r = (1.0647)^{1/3}$$

$$1 + r = 1.0211$$

$$r = 1.0211 - 1$$

$$r = 0.0211 \times 100 = 2.11$$

18 month spot rate = 2.11 × 2 = 4.22%

Refer to Marx 2013: 222-223

Question 51: Option 4

Option 4 applies to hedging. It is the practise of offsetting the price risk inherent in any spot market position by taking an equal but opposite position in the futures market.

The following statements are incorrect:

Option 1 applies to arbitrage.

Option 2 applies to short selling.

Option 3 applies to marking to market.

Refer to Marx 2013: 237-241

Question 52: Option 4

The short seller must pay the dividends that are due to the lender of the shares.

Refer to Marx 2013:25-26, 238

The risk of the holder of the long put contract is limited to the premium paid however his profit potential is unlimited.

Refer to Marx 2013: 245-247

Question 53: Option 2

$$Profit = (R70 - R50) - R6 - R5$$

$$= R20 - R11$$

$$= R9$$

Refer to Marx 2013: 247-248

Question 54: Option 2

$\boldsymbol{Put - call\ parity}$:

$$S + p = c + X(1 + r)^{-t}$$

$42 + p = 5 + 40(1.08)^{-0.5}$

$p = 5 + 38.49 - 42$

$p = R1.49$

Refer to Marx 2013: 249-250

Question 55: Option 3

$E(R_P) = w_1 E(R)_1) + (1 - w_1) E(R_2)$

$= (0.711 \times 7) + (0.289 \times 20)$

$= 4.9770 + 5.78$

$= 10.76\%$

Refer to Marx 2013: 278

Question 56: Option 3

Portfolio standard deviation (σ_P)

$\sigma_P = \sqrt{w_1{}^2 \sigma_1{}^2 + (1 - w_1)^2 \sigma_2{}^2 + 2 \ w_1 \ (1 - w_1) \ \rho_{1,2} \ \sigma_1 \ \sigma_2}$

$= \sqrt{[0.4^2 \times 0.24^2] + [0.6^2 \times 0.11^2] + [2 \times 0.4 \times 0.6 \times 0.7 \times 0.24 \times 0.11]}$

$= \sqrt{[0.16 \times 0.0576] + [0.36 \times 0.0121] \times [2 \times 0.0044]}$

$= \sqrt{[0.0092 + 0.0044 + 0.0088]}$

$= \sqrt{0.0224}$

$= 0.1497 \times 100$

$= 14.97\%$

Refer to Marx 2013: 278

Question 57: Option 1

Long futures, short spot and invest proceeds.

The theoretical or fair value (R240) exceeds the actual market price (R200). Therefore, it is a reverse cash and carry arbitrage. The appropriate strategy is to long futures, short spot and invest proceeds.

Refer to Marx 2013: 243-244

Question 58: Option 3

Consolidation phase.

Refer to Marx 2013: 269-270

Question 59: Option 4

Delta measures an option’s sensitivity to changes in the spot price of the underlying.

Refer to Marx 2013: 252-253

Question 60: Option 1

Strangle.

Refer to Marx 2013: 253-255