International Financial Markets

SECTION A

Question 1

a) i) Arithmetic and Logarithmic Returns

The arithmetic return formula shows the percentage change in the value of a stock from an initial value. It is given by getting the difference between the beginning price and the ending price (Ending price – Beginning price), then dividing it by the beginning price. The formula is given by:

$R = \frac{P_1 - P_0}{P_0}$

On the other hand, a logarithmic return is given by the formula:

$R = \log \frac{P_1}{P_0}$

The result would be different since arithmetic returns are not symmetrical, while logarithmic returns are symmetrical. This implies that if an arithmetic return is -30% (which is a 30% loss), a 30% gain would not return the investor to the initial position before the loss. On the other hand, a similar gain would return the investor to the initial position if it were a logarithmic return. Besides, logarithmic returns of sub-period can be added since they are continuously compounded between the periods, unlike arithmetic returns which lack time additivity.

ii) Diversification Implications

The table suggests that a portfolio of the four international stock indices is not well-diversified. They all have negative arithmetic averages, implying that they moved in the same direction. A well-diversified portfolio should consist of securities from different sectors or types to ensure that they are not affected in a similar way by the same risks. The table further suggests that gold must be incorporated into a portfolio of any of the international stock indices to diversify risk. Gold has a positive arithmetic return, while the stock indices have negative returns. Adverse changes in the stock indices would be set-off by the positive returns on gold.

I would need standard deviations of the returns on each stock to make more reliable judgments. Creating a diversified portfolio involves a trade-off between minimizing risk and maximizing returns. A well-diversified portfolio should optimize or maximize the risk-adjusted return.

b) The expected returns, standard deviations and correlation coefficients

i) Expected Return and Risk

(I) 'UK' and 'European'

Expected return = (Weight of UK × Return on UK) + (Weight of European × Return on European)

= (50% × 11%) + (50% × 20%)

= 5.5% + 10%

= **15.5%**

Expected Risk = $\sqrt{w_{UK}^2\sigma_{UK}^2 + w_{EU}^2\sigma_{EU}^2 + 2w_{UK}w_{Eu}\rho_{U,EU}\sigma_{UK}\sigma_{EU}}$

Where w is weight, σ is standard deviation, $\rho_{UK,EU}$ is the correlation coefficient

$= \sqrt{(0.5^2 \times 0.19^2) + (0.5^2 \times 0.26^2) + (2 \times 0.5 \times 0.5 \times 0.34 \times 0.19 \times 0.26)}$

$= \sqrt{0.009025 + 0.016900 + 0.008398}$

$= \sqrt{0.034323}$

= 0.185264676

= 18.53%

(II) 'UK' and 'Asia-Pacific

Expected return = $(W_{UK} \times R_{UK}) + (W_{AP} \times R_{AP})$

= (50% × 11%) + (50% × 14%)

= 5.5% + 7%

= **12.5%**

Expected Risk = $\sqrt{w_{UK}^2\sigma_{UK}^2 + w_{AP}^2\sigma_{AP}^2 + 2w_{UK}w_{AP}\rho_{UK,AP}\sigma_{UK}\sigma_{AP}}$

$= \sqrt{(0.5^2 \times 0.19^2) + (0.5^2 \times 0.21^2) + (2 \times 0.5 \times 0.5 \times 0.82 \times 0.19 \times 0.21)}$

$= \sqrt{0.009025 + 0.011025 + 0.016359}$

$= \sqrt{0.036409}$

= 0.190811425

= 19.08%

(III) 'European' and 'Asia-Pacific'

Expected return = $(W_{EU} \times R_{EU}) + (W_{AP} \times R_{AP})$

= (50% × 20%) + (50% × 14%)

= 10% + 7%

= **17%**

Expected Risk = $\sqrt{w_{EU}^2\sigma_{EU}^2 + w_{AP}^2\sigma_{AP}^2 + 2w_{EU}w_{AP}\rho_{UK,AP}\sigma_{EU}\sigma_{AP}}$

$= \sqrt{(0.5^2 \times 0.26^2) + (0.5^2 \times 0.21^2) + (2 \times 0.5 \times 0.5 \times 0.08 \times 0.19 \times 0.21)}$

$= \sqrt{0.0169 + 0.011025 + 0.002184}$

$= \sqrt{0.030109}$

= 0.173519451

= 17.35%

ii) Most Attractive Portfolio

The 'European' and 'Asia-Pacific' might be the most attractive to the client since the three portfolios have the highest expected return and the lowest risk. This is true, assuming that the investors are rational. It implies that the investor minimizes risk and maximizes return. Therefore, an investor would look for a portfolio with the highest return per unit of risk or the lowest risk per unit of return.

A portfolio's expected return and risk depend on the returns and risk of the individual stocks (indices) making up the portfolio. The expected return will be high if a portfolio consists of assets with higher returns. The 'European' and 'Asia-Pacific portfolio has the highest expected return since the European Growth fund has the highest return of the three funds, and the Asia-Pacific Value fund has the second highest return. On the other hand, the 'UK' and 'Asia-Pacific has the lowest expected return since the UK Alpha fund has the lowest return of the three funds.

The portfolio's expected risk depends on the individual funds' standard deviations and the correlation coefficient. As shown in the above calculations, the 'UK' and 'Asia-Pacific portfolio has the highest expected risk due to the high correlation between the UK Alpha and Asia-Pacific Growth funds, while the 'European' and 'Asia-Pacific' has the lowest expected risk due to the low correlation between the two funds making the portfolio.

iii) Investment advisor's recommendations

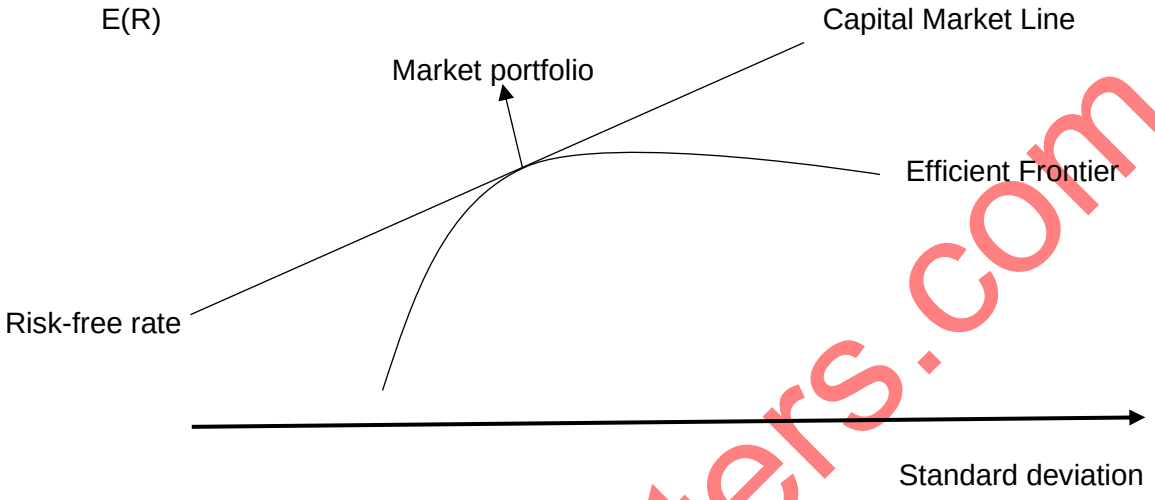
The investment advisor's recommendations are not valid. If the client has not imposed restrictions on portfolio choice, an equally weighted portfolio is not appropriate. Instead, an optimal portfolio should be constructed. It is a portfolio that minimizes the variance or standard deviation per unit of return. An optimal portfolio balances the desire to minimize risk and maximize returns. The optimal portfolio may include all three funds to ensure the diversification of risks. The weights of each fund in the optimal portfolio may not be equal.

Question 2

a) relevance of 'risk aversion' and 'efficient portfolios' for the capital market line (CML) of the capital asset pricing model (CAPM)

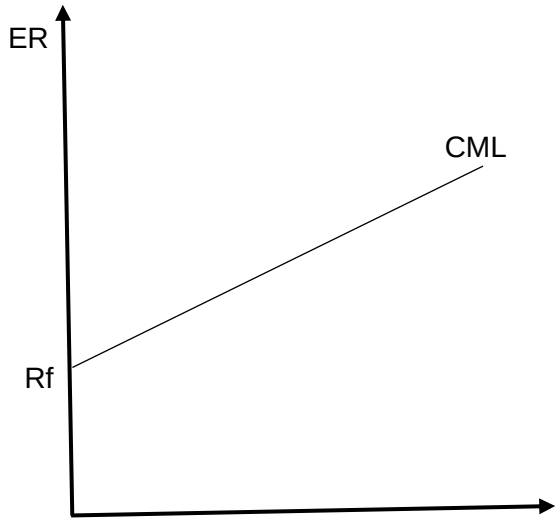
The capital market line shows a combination of risk-free and risky assets that optimize the risk-return relationship. The intercept of the CML is the risk-free rate. Risk aversion is relevant in the CML since it influences the choice of portfolios. Risk-averse investors are likely to select

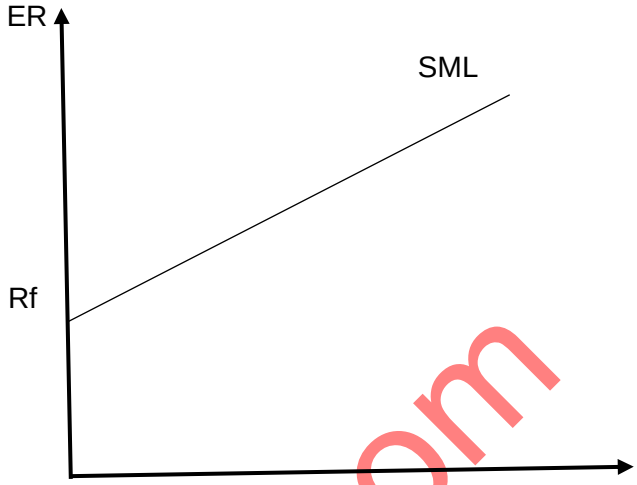
portfolios that are close to the risk-free asset. They prefer portfolios with low variance (low standard deviation) to those with high returns. The efficient frontier shows a set of optimal portfolios that earn the highest return per unit of standard deviation (risk) or minimizes risk (standard deviation) per unit of return. The portfolio (combination) at the point where the efficient frontier meets the CML is the most efficient portfolio.



b) Security Market Line (SML) and the Capital Market Line (CML)

The CML shows the relationship between expected return and standard deviation (total risk), while the SML shows the relationship between expected return and systematic risk (beta). Thus, the SML is a graphical representation of the CAPM. The slope of the CML is the Sharpe ratio, while the slope of the SML is the Treynor ratio. The SML only shows the association between return and systematic risk, while the CML shows the association between return and total risk, which includes both systematic and unsystematic risk.





c) Annual expected returns and standard deviations

i) CAPM Equilibrium

CAPM equilibrium implies that the required return on an asset or portfolio is equal to the expected return. The implication of this for quantitative analysis is that the expected returns on the three stocks given will be directly plugged into the CAPM equation.

ii) Beta values for the three stocks

Since the stock market is in CAPM equilibrium, the expected returns can be used in the CAPM equation as follows:

Expected return(RR) = Risk-free rate(Rf) + Beta(Market return, Rm – Risk-free rate, Rf)

Beta = $\frac{RR-Rf}{Rm-Rf}$

Rf = 2%

Rm = 17%

Rm – Rf = 17% - 2% = 15%

Stock	**Expected Return**	**Beta Value**
Xavier plc	8%	β = $\frac{0.08-0.02}{0.17-0.02}$ = **0.4**
Yello plc	14%	β = $\frac{0.14-0.02}{0.17-0.02}$ = **0.8**
Zebra plc	19%	β = $\frac{0.19-0.02}{0.17-0.02}$ **= 1.133**

The beta value of Xavier plc stock implies that the stock's systematic risk is 60% lower than the market's. A 1% change in the stock market index is associated with a 0.4% (less than proportionate) change in Xavier plc stock.

The beta value of Yello plc stock shows that the stock's systematic risk is 20% lower than that of the market. A 1% change in the stock market index is associated with a 0.8% (less than proportionate) change in Yellow plc stock.

The beta value of Zebra plc stock implies that the stock's systematic risk is 13.3% higher than the market's. A 1% change in the stock market index is associated with a 1.13% (more than proportionate) change in Zebra plc stock.

The above values indicate that Zebra stock has the highest systematic risk, followed by Yellow plc stock, and Xavier plc stock has the highest systematic risk.

iii) Identify whether the stocks plot on the CML

Stock	Expected Return	Standard Deviation	Sharpe ratio = (ER-Rf)/SD
Xavier plc	8%	9%	$= \frac{(8\%-2\%)}{9\%} = 0.67$
Yello plc	14%	15%	$= \frac{(14\%-2\%)}{15\%} = 0.80$
Zebra plc	19%	21%	$= \frac{(19\%-2\%)}{21\%} = 0.81$
Market index	17%	16%	$= \frac{(17\%-2\%)}{16\%} = 0.94$

The assumption under CML is that the risky portfolio is the market portfolio. Therefore, the slope of the CML should be equal to the Sharpe ratio of the market portfolio. As shown in the table above, the Sharpe ratio of the market portfolio is higher than the ratios of all three stocks. This implies that the three stocks do not plot on the CML. They all plot below the CML. It suggests that the three stocks are generating too low returns for the level of risk, indicating that they are overpriced.

iv) New stock

It is plausible for a new stock to be underpriced. In some IPO cases, underwriters underprice stocks to increase the demand for the new stock. Underpricing may also result from the fact that the market does not have much information about the stock (risk levels, and expected returns, among other information).

The demand for Willow plc is expected to increase once the market realizes that it is underpriced. The increase in demand will cause a rise in the market price, thereby lowering its return. This will continue until the stock is correctly priced and it plots on the SML.

d) Classify the following scenarios according to systematic and unsystematic risk

Event	Classification	Assumptions & Explanation
A petroleum company reveals the discovery of new oil reserves	Systematic risk	The discovery of new oil reserves will affect global oil prices (assuming most sectors rely on oil as an energy source). Oil price changes are a market factor and affect nearly all sectors of the economy. It is impossible to completely eliminate the risk of changes in oil prices, even through diversification.
A company unexpectedly wins a large government contract	Unsystematic risk	Winning a large government contract only affects the profitability of the company and not the entire market. This classification assumes that the large government contract would have been given to another company regardless. Government spending (through a large contract) is a systematic risk, but a company winning the contract is an unsystematic risk.
A large company's chief executive unexpectedly announces her resignation	Unsystematic risk	Resignation of a company's CEO, whether large or not, affects the company and can also affect the sector but not the entire market. Besides, strong corporate governance mechanisms ensure that a company's success is not largely dependent on an individual.

Question 3

a) Beta values

i) Estimation method

The global equity fund is a fund that comprises stocks from around the globe. The estimation method used the global equity fund as the market index. Returns on the global equity fund and the returns of the individual stocks were collected during the period under consideration. The covariance method was used where beta is given by the covariance between the global equity funds and the individual stock returns, divided by the variance of the global equity fund's returns.

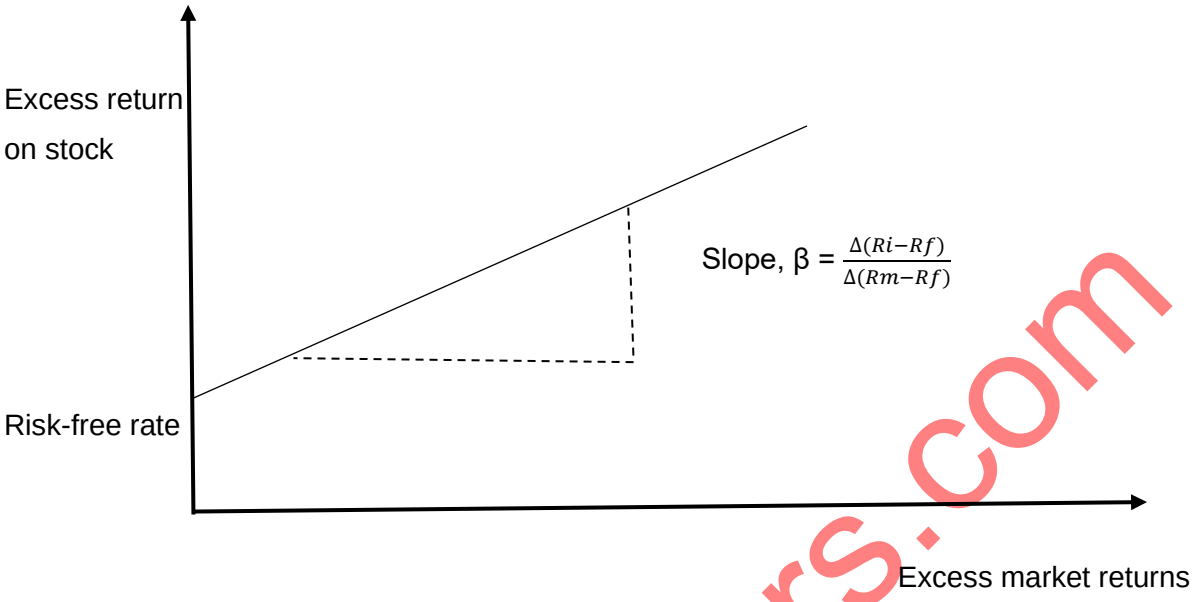
Beta, $\beta = \frac{COV(R_m, R_i)}{VAR(R_m)}$

Where R_m is the return on the market portfolio (global equity fund), and R_i is the return on the asset

Alternatively, the beta was obtained by regressing the individual stock's excess returns on the market index excess returns. Excess return is given by the actual return less the risk-free rate on the respective date. The slope of the equitation is the beta value for the stock. The regression equation is given by:

$R_i - R_f$ = α + β(Rm-Rf)

The slope of the above gives the beta value of the stock or portfolio.



ii) Calculating beta values

Portfolio one:

Stock	Amount (£)	Weight in the portfolio
Aron plc	300	$\frac{300}{2,000}$ = **0.150**
Carw NV	650	$\frac{650}{2,000}$ = **0.325**
Evon JSC	800	$\frac{800}{2,000}$ = **0.400**
Hyppia SpA	250	$\frac{250}{2,000}$ = **0.125**
Total	**2,000**	$\frac{2,000}{2,000}$ = **1.000**

Beta of the portfolio = (0.15 × 0.1) + (0.325 × -0.2) + (0.4 × 1.6) + (0.125 × 0.8)

= 0.015 + -0.065 + 0.64 + 0.1

= 0.69

Portfolio two:

Stock	Amount (£)	Weight in the portfolio
Brynie SA	2200	$\frac{2,200}{5,000}$ = 0.440
Deiva Ag	700	$\frac{700}{5,000}$ = 0.140
Ghia LLC	500	$\frac{500}{5,000}$ = 0.100
Rf	1600	$\frac{1,600}{5,000}$ = 0.320
	5,000	$\frac{5,000}{5,000}$ = 1.000

Beta of the portfolio = (0.44 × 0.5) + (0.14 × 1.1) + (0.1 × 0.4) + (0.32 × 0)

= 0.22 + 0.154 + 0.04 + 0

= 0.414

***The risk-free asset is considered to have zero risk; hence the beta is zero.

iii) Portfolio with the same beta as the market

The twin objectives can be achieved by forming a portfolio of the Fled SA de CV and the risk-free asset. The composition of the portfolio will be as follows:

Portfolio beta = (W_{Fled} × Beta of Fled) + (W_{Rf} × Beta of Rf)

1 = W_{Fled} × 1.3 + (W_{Rf} × 0)

1 = W_{Fled} × 1.3

W_{Fled} = 1/1.3

W_{Fled} = 0.7692

The objective will be achieved by investing 76.92% of the investor's funds in Fled SA de CV and 23.08% of the funds in risk-free asset.

iv) Anticipated sharp recession

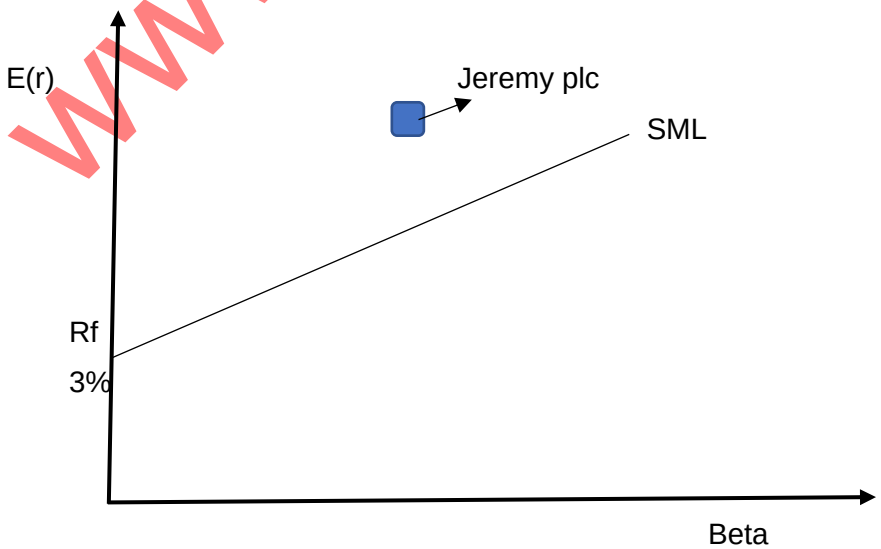
If an investor is anticipating a recession, he/she invests in stocks with low or negative beta. A negative beta implies that the stocks will rise when a recession occurs and the market index falls. For instance, Carw NV (negative beta) would be most appropriate. Other suitable stocks would include Aron plc, which has a low beta. Investment in risk-free assets would also be appropriate since they have zero beta.

v) Emerging economies stocks

Additional factors to consider include regulatory changes (stability of the regulatory framework), liquidity of the market, restrictions on foreign accessibility, and political stability, among other factors.

b) Jeremy plc

i) Explain why Jeremy plc is mispriced according to the CAPM



Jeremy's required return = Rf + Beta(Rm – Rf)

= 3% + 1.7(12% - 3%)

= 3% + 15.3%

= 18.3%

As shown above, the CAPM required return of Jeremy's plc. is lower than its expected return for the next year. As shown in the figure above, Jeremy's plc plots above the SML, implying that it is expected to generate a higher return than the return consistent with the risk level as per CAPM. The above diagram shows that Jeremy plc is underpriced.

ii) Strategy to exploit the mispricing

The strategy is to borrow at risk-free rate and then purchase shares of Jeremy plc. The cash flows are as follows:

Step1 : borrow at the risk-free rate by selling 1000 units of risk-free asset

Cash inflow = £10.5 × 1000 = £10,500

Step 2: Purchase 350 shares of Jeremy plc using the amount borrowed

Cash outflow = -(350 × £350) = -£10,500

Step 3: Sell the shares of Jeremy plc at the end of next year (earn the expected return)

Cash inflow = £10,500 + (£10,500 × 24%) = £13,020

Step 4: Use the cash received from the sale of Jeremy's shares to repay the amount borrowed at risk-free rate

Amount payable = £10,500 + (£10,500 × 3%) = -£10,815

Net payoff = £13,020 - £10,815 = **£2,205**

Return = $\frac{2,205}{10,500}$ = **21%**

iii) If Jeremy plc was correctly priced according to the CAPM

Expected return would be 18.3%

Investment = £10,500

Net payoff = £10,500 × (18.3% - 3%) = £1,606.50

% return = $\frac{1,606.50}{10,500}$ = **15.3%**

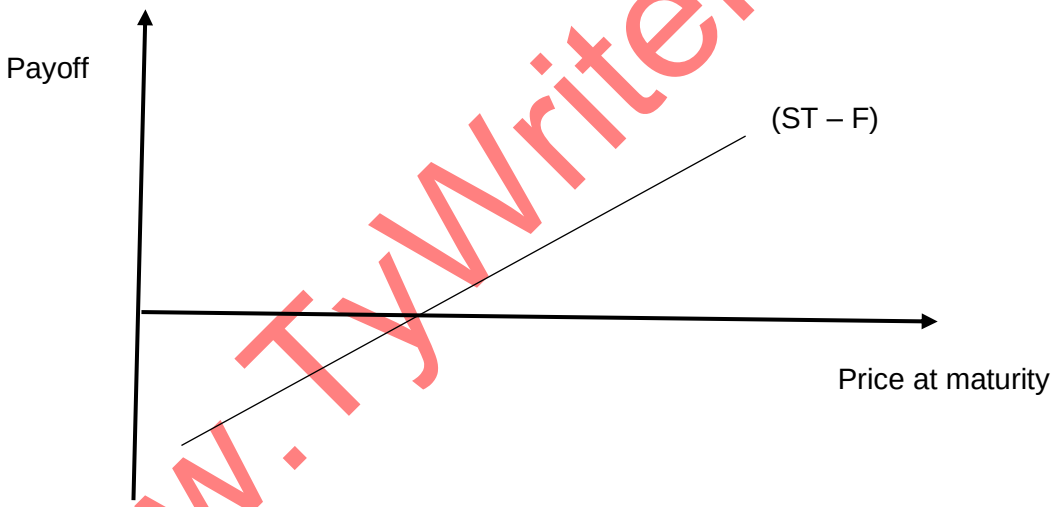
SECTION B

Question 5

a) Forward, Call option, and Put option buyers

Forward buyer: ST – F

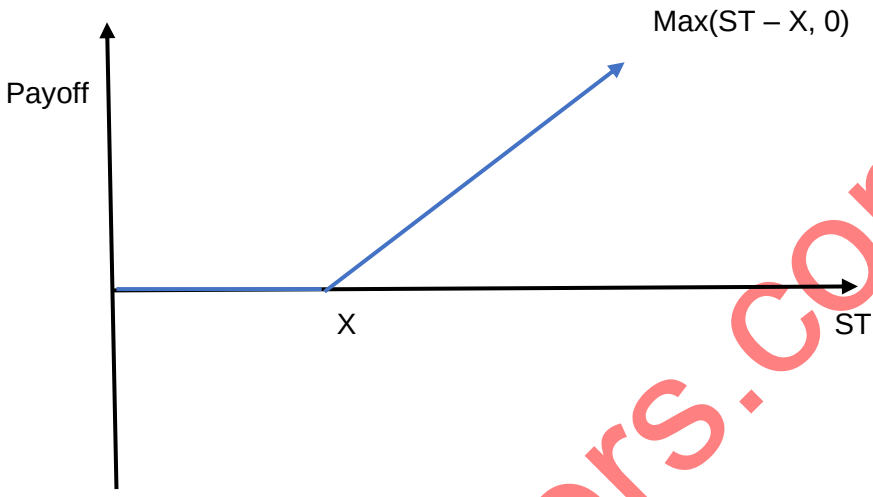
A forward contract is a contract between two parties to buy or sell an asset at a specified price on a future date. The above statement implies that the payoff to a forward contract buyer is the difference between the underlying spot price at the expiry of the contract (ST), and the forward price (F). if the spot price of the underlying asset at the expiry of the contract is higher than the forward contract's strike price, then the buyer gets a positive payoff. As shown in the figure below, the payoff to the forward buyer is not limited. It can be negative if ST is less than F.



Call option buyer: Max (ST – X, 0)

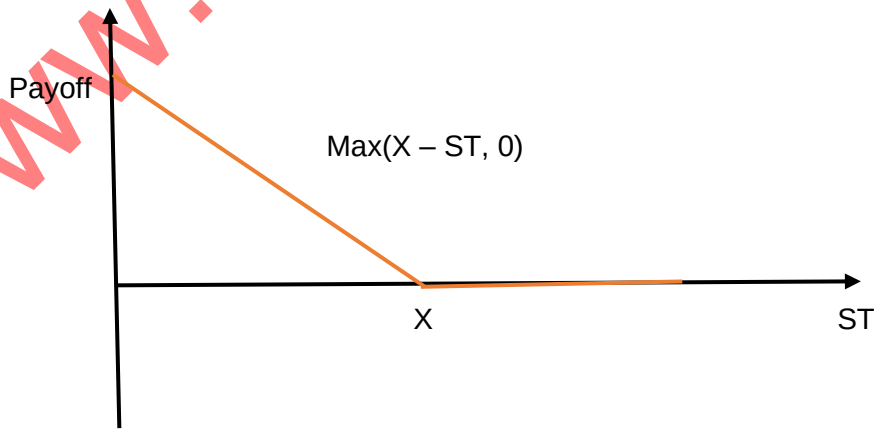
A call option is a contract that gives the option buyer the right to, but not an obligation to, buy an underlying asset at a specified price within a specific time. ST is the spot price of the underlying asset at the expiry of the contract, and X is the strike price of the call option contract. The above statement implies that the call option buyer's payoff is limited on the downward side to zero. However, the upward gains are not limited. If the spot price of the underlying asset at the maturity of the call option is greater than the strike price of option (X), the buyer will exercise the option since it is profitable. That is, he/she can buy the asset at the lower exercise price and immediately sell it at a higher market price at a profit. If the strike price is

higher than the spot price at the expiry of the option, the buyer will not exercise the option since it is not profitable to do so. The payoff will be £0.



Put option buyer: Max (X – ST, 0)

A put option contract gives the holder the right, but not the obligation, to sell an underlying asset at an agreed price at a future date. A holder of a put option benefits if the strike price is higher than the spot price of the underlying asset at the expiry of the option. This implies that the holder(buyer) can sell the asset at a higher price than the market price. Therefore, if X > ST, the buyer will exercise the option. However, if X < ST, the buyer will not exercise the option to sell since it will be more profitable to sell at the market price than exercise the option. Therefore, the payoff on the downward side is limited to zero, as shown in the diagram below.



As illustrated above, hedging using either a call or put option limits the downside risk (losses) to zero. This is because if the spot price at the time of expiry is not favourable, the holder of the option will not exercise the option. However, for forward contracts, the

downside risk is not limited. The holder (buyer) of a forward contract has to fulfill his obligation even if the spot price of the underlying asset is unfavourable.

For the buyer of a call option, it is profitable when the spot price at the expiry of the option is greater than the strike price. On the other hand, the holder of a put option benefits when the strike price is higher than the spot price at the expiry of the contract.

b) Relevance of arbitrage (or 'no arbitrage') in derivatives pricing

Arbitrage (no-arbitrage) is critical in derivatives pricing. Arbitrage occurs when there is mispricing such that a trader can make a risk-free profit by buying one security in one market and selling it in another market. Derivatives pricing is based on the concept of no-arbitrage. Derivative pricing uses a replicating portfolio and assumes that the value of a derivative should be equal to that of the replicating portfolio such that no trader can make risk-free profit by buying one security or portfolio and selling the other. The concept is based on the idea that if arbitrage opportunities arise, traders' responses will quickly clear the arbitrage opportunities and return the derivative or security to the fair value.

For forward contracts, it is assumed that a trader purchases a forward contract and sells it upon expiry of the contract. Alternatively (replicating portfolio), a trader can buy the underlying asset at the current spot price and earn the risk-free rate of interest. Derivative pricing posits that the value of the forward contract should be equal to the value of the replicating portfolio. Therefore, the value of the forward contract is given:

$F(T) = Se^{rt}$

Where: S = current underlying spot price, F = forward price, t = maturity of forward, and r = risk free interest rate.

c) Using stock index futures for hedging an underlying equity portfolio

Stock index futures are based on stock indices and not individual stocks. Since it is not possible to physically deliver stock indices, stock index futures are cash-settled at the expiry of the contract.

Suppose a trader has an equity portfolio with a current spot price of £500. The FTSE 100 index future is trading at £7 with a strike price of £7,350. The trader will purchase a FTSE index to hedge the equity portfolio against unfavourable price movements. Suppose on the contract expiry, the equity portfolio's value falls to £450, while the price of the FTSE 100 index falls to £7200. Since the FTSE 100 Index future is cash-settled, the trader will be given the difference between the strike price and the sport price. The payoff will be as follows:

Loss on equity portfolio = 450 – 500 = -£50

Gain on Index future = 7,350 – 7,200 = £150

Net payoff = 150 – 50 -7 = £93

In the above example, the cash paid to the trader for settling the index future (£150) will cover the loss on the equity portfolio.