

Assignment 2.2

Q1: Short Forward Contract

You've entered into a short forward contract to sell 1,000 ounces of gold in May 2024 at a fixed forward price of \$2,050 per ounce.

The profit or loss from this short forward position is calculated using the formula:

$$Profit or Loss = (ForwardPrice - SpotPrice) \times 1000$$

May-2024 Spot Price (\$)	Profit or Loss (\$)
1400	650,000
1500	550,000
1560	490,000
1600	450,000
1800	250,000
2050	0
2200	-150,000
2300	-250,000
2400	-350,000

Table 1: Profit or Loss from Short Forward Contract on Gold (1,000 ounces at \$2050)

Q5: Portfolio of Forward + Put Option

Define the instruments

- Long forward contract on an asset with maturity T and forward price F .
- Long European put option on the same asset with strike price $K = F$ and same maturity.

Terminal payoff of each component

- Long forward contract: $S_T - F$

- Long put option: $\max(F - S_T, 0)$

Total terminal value of the portfolio

$$PortfolioPayoff = (S_T - F) + \max(F - S_T, 0)$$

Cases

- Case 1: $S_T \leq F$

$$Payoff = (S_T - F) + (F - S_T) = 0$$

- Case 2: $S_T > F$

$$Payoff = (S_T - F) + 0 = S_T - F$$

This is exactly the payoff of a European call option with strike price F .

Hence, by no-arbitrage:

$$LongForward + LongPut = LongCall$$

This proves that the value of the European put option equals the value of a European call option with the same strike and maturity when combined with a forward.

Q6: Put-Call Parity – Risk-Free Rate

Using the Put-Call Parity formula

$$C - P = S_0 - Ke^{-rT}$$

Substitute the known values:

$$20 - 5 = 130 - 120e^{-r}$$

$$15 = 130 - 120e^{-r}$$

$$120e^{-r} = 130 - 15 = 115$$

$$e^{-r} = \frac{115}{120} = 0.9583$$

$$-r = \ln(0.9583) \Rightarrow r = -\ln(0.9583)$$

$$r \approx -(-0.0425) = 0.0425$$

$$r = 4.25\% \text{ per annum}$$