

LO.a: Describe and compare how equity, interest rate, fixed-income, and currency forward and futures contracts are priced and valued.

1. Which of the following statements is *most likely* accurate? In the carry arbitrage model,:
 - A. an instrument is bought or sold along with a forward position in that instrument.
 - B. the law of one price does not hold.
 - C. the portfolio is created with no liabilities and a net positive cash flow today.
2. At the forward or futures contract initiation date the price negotiated is such that the value of the contract is:
 - A. less than zero.
 - B. equal to zero.
 - C. more than zero.
3. The no-arbitrage forward price of an underlying which has no storage cost and no convenience yield is:
 - A. the future value of the spot price compounded by the risk free rate over time T.
 - B. the future value of the spot price using the discount rate which is relevant for the underlying instrument.
 - C. the same as the spot price.
4. If $F_0(T) > FV(S_0)$, an arbitrageur would:
 - A. conduct a reverse carry arbitrage strategy.
 - B. purchase the forward contract and sell the underlying short.
 - C. sell the forward contract and purchase the underlying.
5. The forward value at time t for a long forward contract initiated at time 0 is:
 - A. the future value of the difference in forward prices.
 - B. the present value of the difference in forward prices.
 - C. equal to the spot price at time t.
6. The one-year forward price of an underlying which pays a dividend in six months is given by:
 - A. the future value of the underlying less the future value of carry benefits.
 - B. the future value of the underlying plus the future value of carry benefits.
 - C. the future value of the underlying plus the future value of carry costs.
7. Suppose an investor buys a one-year equity *futures* contract and there are now three months to expiration. Today's futures price is 111.30. There are no other cash flows. The futures contract value after marking to market, will be *closest* to:
 - A. 100.
 - B. 0.00.
 - C. 111.30.
8. The unique issues influencing the pricing of forward and futures fixed-income contracts based on the carry arbitrage model are:

- A. accrued interest, conversion factor adjustment, choosing cheapest-to-deliver bonds.
 - B. quoted price, coupon frequency, choosing least expensive bonds.
 - C. dirty price, bond maturity, price of eligible bonds.
9. The spot rate and forward rate for the US Dollar-Chinese Yuan pair is expressed as number of CNY per unit of USD. The forward price for such a currency contract will be calculated as:
- A. Future price of the spot exchange rate using the CNY interest rate adjusted for the USD interest rate.
 - B. Future price of the spot exchange rate using the USD interest rate adjusted for the CNY interest rate.
 - C. Future price of the spot exchange rate using the average of the USD and CNY interest rate.

LO.b: Calculate and interpret the no-arbitrage value of equity, interest rate, fixed-income, and currency forward and futures contracts.

10. Assume an investor bought a one-year forward contract with price $F_0(T) = 110$. Six months later, at Time $t = 0.5$, the price of the stock is $S_{0.5} = 115$ and the interest rate is 4%. The value of the existing forward contract expiring in six months will be *closest* to:
- A. -7.
 - B. 5.
 - C. 7.
11. The continuously compounded dividend yield on a broad based stock index is 4.88%, and the current stock index level is 1,300. The continuously compounded annual interest rate is 5.8%. Based on the carry arbitrage model, the nine-month futures price will be *closest* to:
- A. 1,300.
 - B. 1,408.
 - C. 1,309.
12. A stock trading at €50, pays a €1.00 dividend in three months. The price of the forward contract on this stock expiring in six months will *most likely* decrease if there is a(n):
- A. increase in dividend.
 - B. increase in expected future stock price.
 - C. increase in risk-free interest rate.
13. The three-month GBP Libor and the six-month GBP Libor based on the current market quotes is 0.39% and 0.52% respectively. Assume a 30/360-day count convention. The 3×6 FRA fixed rate will be *closest* to:
- A. 0.65%.
 - B. 0.52%.
 - C. 0.78%.

14. Suppose an investor entered a receive-floating 6×9 FRA at a rate of 0.85%, with notional amount of GBP1,000,000 at Time 0. The 6×9 FRA rate is quoted in the market at 0.85%. After 90 days the three-month GBP Libor is 1.01% and the six-month GBP Libor is 1.11%, which is used as the discount rate to determine the value after 90 days. The new 3×6 FRA rate is found as 1.21%. Assuming the appropriate discount rate is GBP Libor, the value of the original receive-floating 6×9 FRA will be *closest* to:
- A. GBP1,200.
 - B. GBP895.
 - C. GBP600.
15. Suppose that a bond futures contract is based on an underlying French bond quoted at €106 that has accrued interest of €0.063. The euro-bond futures contract matures in three months. At contract expiration, the bond will have an accrued interest of €0.190. There are no coupon payments due until after the futures contract expires. The current risk-free rate is 0.20%. The conversion factor is 0.75. The equilibrium euro-bond futures price based on the carry arbitrage model will be *closest* to:
- A. €150.
 - B. €130.
 - C. €140.
16. AZ Corp. sold USD10,000,000 against GBP forward at a forward rate of £0.8200 for \$1 at Time 0. In the spot market at Time t, \$1 is worth £0.7600, and the annually compounded risk-free rates are 1.00% for the British pound and 3.00% for the USD. Assume at Time t the forward contract has one month to expiration. The forward price $F_t(\text{£}/\text{\$,T})$ at Time t will be *closest* to:
- A. 0.82.
 - B. 0.76.
 - C. 0.75.
- €
17. AZ Corp. sold USD10,000,000 against GBP forward at a forward rate of £0.8200 for \$1 at Time 0. The current spot market at Time t is such that \$1 is worth £0.7600, and the annually compounded risk-free rates are 1.00% for the British pound and 3.00% for the USD. Assume at Time t the forward contract has one month to expiration. The value of the foreign exchange forward contract in £ at Time t will *most likely* be:
- A. positive.
 - B. negative.
 - C. zero.

LO.c: Describe and compare how interest rate, currency, and equity swaps are priced and valued.

18. Which of the following is *least likely* a feature of currency swaps? Currency swaps:
- A. involve an exchange of notional amounts at the start and at the expiration of the swap.
 - B. involve payments that are in different currency units on each leg of the swap.
 - C. have payments which are netted at each leg.

19. You enter into a one-year equity swap with quarterly settlement. You pay the S&P500 return and the counter party pays fixed annualized rate of 4%. At the end of the first quarter the S&P500 index increases by 4%. Which of the following statements is *most likely* true about cash flow at the end of first quarter?
- You will need to make a payment to the counterparty.
 - You will receive a payment from the counterparty.
 - There will be no net cash flow.

LO.d: Calculate and interpret the no-arbitrage value of interest rate, currency, and equity swaps.

20. Suppose we are pricing a four-year Libor-based interest rate swap with annual resets (30/360 day count). The estimated present value factors, are given in Table 1 below:

Table 1

Maturity (years)	Present Value factors
1	0.9901
2	0.97787
3	0.9654
4	0.9385

The fixed rate of the swap is:

- 1.5%.
 - 1.6%.
 - 1.4%.
21. Suppose a year ago Company X entered a £10,000,000 five-year receive-fixed Libor-based interest rate swap with annual resets (30/360 day count). The fixed rate in the swap contract entered one year ago was 2.30%. The current discount factors are given in Table 1. The value (in thousands) for the party receiving the fixed rate will be *closest* to:
- £275.
 - £390.
 - £275.
22. Suppose an investor entered into a receive-equity index and pay-fixed swap with a quarterly reset, 30/360 day count. The notional amount is £10,000,000, pay-fixed (1.4% annualized, or 0.35% per quarter). Assuming an equity index return of -5.0% for the quarter (not annualized), the equity swap cash flow in thousands will be:
- £350.
 - £535.
 - £535.
23. Six months ago a party entered a receive-fixed, pay-equity three-year annual reset swap in which the fixed leg is based on a 30/360 day count. The fixed rate at the time of the swap was 2.2%, the equity was trading at 100, and the notional amount was £5,000,000. Now all spot interest rates have fallen to 2.0% (a flat term structure), and the equity is trading for 103. Calculate the fair value of this equity swap. The table below gives the present value factors based on the new spot rates of 2.0% applied to the fixed cash flow of (2.2% \times 5 mil) £110,000.

Date (in years)	PV Factors	Fixed Cash Flow	PV of Fixed Cash Flow
0.5	0.9901	110,000	108,911
1.5	0.9707	110,000	106,777
2.5	0.9517	5,110,000	4,863,187
		Total	5,078,875

- A. -£82,474.
- B. -£71,125.
- C. -£283,000.

Solutions

1. A is correct. In the carry arbitrage model, an instrument is bought or sold along with a forward position in that instrument. Section 2.
2. B is correct. The forward price or futures price is negotiated between parties such that market value of the forward or futures contract at the initiation date is zero. Section 3.1.
3. A is correct. $F_0(T)$ = Future value of underlying = $FV(S_0)$. Section 3.2.1.
4. C is correct. Unless $F_0(T) = FV(S_0)$, there is an arbitrage opportunity. If $F_0(T) > FV(S_0)$, then an arbitrage opportunity exists, forward contract is sold and the underlying is purchased. A & B are incorrect. “If $F_0(T) < FV(S_0)$, then forward contract would be purchased and underlying is sold short.” This is known as reverse carry arbitrage. Section 3.2.1
5. B is correct. $V_t(T)$ = Present value of difference in forward prices
 $= PV_{t,T}[F_t(T) - F_0(T)]$. Equation 2 Section 3.2.1.
6. A is correct. The forward price is the future value of the underlying plus the future value of the carry costs minus the future value of the carry benefits. In this case no carry costs are given and the carry benefit is the dividend payments in six months. Hence the no-arbitrage forward price is the future value of the underlying less the future value of the carry benefits. Section 3.2.2.
7. B is correct. Futures contracts are daily marked to market, such that the resulting profits and losses, are received or paid at each daily settlement. Hence, the equity futures contract value is zero after settlement. Section 3.3.
8. A is correct. Fixed-income forward and futures contracts have certain unique issues that are considered when applying the carry arbitrage model. First, fixed-income securities are quoted without accrued interest. But full price is paid when buying the bond so the accrued interest is included in forward/futures contracts’ pricing. Second a conversion factor adjustment is used to make all deliverable bonds roughly equal in price. Third, when multiple bonds can be delivered for a particular maturity of a futures contract, a cheapest-to-deliver bond is usually chosen after the conversion factor adjustment. Section 3.5.
9. A is correct. In this case the base currency is the USD and the price currency is the CNY. To calculate the forward price, we determine the future value of the spot exchange rate using the price currency interest rate and adjust for the base currency interest rate. Section 3.6.
10. C is correct. $F_0(T) = 110$, $S_{0.5} = 115$, $r = 4\%$, and $T - t = 0.5$, the six month forward price at Time t is equal to $F_t(T) = FV_{t,T}(S_t) = 115(1 + 0.04)^{0.5} = 117.2775$. Value of the existing forward entered at Time 0 valued at Time t using the difference method is:
 $V_t(T) = PV_{t,T}[F_t(T) - F_0(T)] = (117.2775 - 110)/(1 + 0.04)^{0.5} = 7.136$. Section 3.2.1.
11. C is correct. Based on the carry arbitrage model forward price is $F_0(T) = S_0 e^{(rc-\gamma)T}$.

Future value of the underlying adjusted for the dividend payments = $1,300e^{(0.0580-0.0488)(9/12)} = 1,309$. Section 3.3.

12. A is correct. Being a carry benefit, the increase in dividend will decrease the forward price. The expected stock price does not influence the forward price. An increase in the risk-free rate will increase the forward contract price. Section 3.3.

13. A is correct.
$$FRA(0,90,90) = \left\{ \left[\frac{1+0.0052\left(\frac{180}{360}\right)}{1+0.0039\left(\frac{90}{360}\right)} - 1 \right] \times 4 \right\} = 0.0064937 \cong 0.65\%.$$
 Section 3.4.

14. B is correct.
$$V_{90}(0,180,90) = 1,000,000 \times \frac{\left[(0.0121-0.0085)\left(\frac{90}{360}\right) \right]}{\left[1+0.0111\left(\frac{180}{360}\right) \right]} = GBP895.033.$$
 Section 3.4.

15. C is correct.
$$QF_0(T) = [1/CF(T)] \{ FV_{0,T}[B_0(T+Y) + AI_0] - AI_T - FVCI_{0,T} \} = [1/0.75] \{ (1.002)^{3/12} [106 + 0.063] - 0.19 - 0 \} = €141.2345.$$
 Section 3.5.

16. B is correct. The forward price at Time t is $F_t(\pounds/\$,T) = S_t(\pounds/\$)FV_{\pounds,t,T}(1)/FV_{\$,t,T}(1) = 0.76(1 + 0.01)^{1/12}/(1 + 0.03)^{1/12} = 0.7588$. Section 3.6.

17. A is correct. The value per US dollar to the seller of the foreign exchange futures contract at Time t is simply the present value of the difference between the initial forward price and the $\pounds/\$$ forward price at Time t or $V_t(T) = PV_{\pounds,t,T}[F_0(\pounds/\$,T) - F_t(\pounds/\$,T)] = (0.8200 - 0.7588)/(1 + 0.01)^{1/12} = \pounds 0.061149$ per US dollar. AZ has an initial short position, so the short position of a \$10,000,000 has a positive value of \$10,000,000($\pounds 0.06115/\$$) = $\pounds 611,500$ because the forward rate fell between Time 0 and Time t. Section 3.6.

18. C is correct. Options A and B represent features of currency swaps. Section 4.2.

19. A is correct. The 4% is an annualized rate. The quarterly rate is 1%. At end of the first quarter you need to pay 4% based on the S&P500 return and you should receive 1%. The net impact is that you need to pay 3%. Section 4.3.

20. B is correct. Sum of present value factors is $0.9901+0.97787+0.9654+0.9385 = 3.87187$.
Fixed swap rate = $r_{FIX} = \frac{1-d_4}{\text{sum of all present values}} = (1 - 0.9385)/3.87187 = 0.015884 = 1.588\%$.
Section 4.1.

21. A is correct. The sum of present values = 3.87187. $V = (FS_0 - FS_t)\Sigma PV_{t,ti} = (0.023 - 0.0159)(3.87187) = 0.02749 \times \pounds 10 \text{ mil} = \pounds 274,900$. Section 4.1.

22. B is correct. $\pounds 10,000,000(-0.05-0.0035) = -\pounds 535,000$. Section 4.3.

23. B is correct. The fair value of this equity swap is 5,078,875 less 5,150,000 [= (103/100) 5,000,000], or a loss of $\pounds 71,125$. Section 4.3.