



Subject: Introduction to Derivatives
& Financial Market

Chapter: Unit 2

Category: Practice Question

S 1)

What is the difference between a long forward position and a short forward position?

When a trader enters into a long forward contract, she is agreeing to *buy* the underlying asset for a certain price at a certain time in the future. When a trader enters into a short forward contract, she is agreeing to *sell* the underlying asset for a certain price at a certain time in the future.

S 2)

Explain carefully the difference between hedging, speculation, and arbitrage.

A trader is *hedging* when she has an exposure to the price of an asset and takes a position in a derivative to offset the exposure. In a *speculation* the trader has no exposure to offset. She is betting on the future movements in the price of the asset. *Arbitrage* involves taking a position in two or more different markets to lock in a profit.

S 3)

An investor enters into a short forward contract to sell 100,000 British pounds for US dollars at an exchange rate of 1.4000 US dollars per pound. How much does the investor gain or lose if the exchange rate at the end of the contract is

- (a) 1.3900 and
- (b) 1.4200?

(a) The investor is obligated to sell pounds for 1.4000 when they are worth 1.3900. The gain is $(1.4000 - 1.3900) \times 100,000 = \$1,000$.

(b) The investor is obligated to sell pounds for 1.4000 when they are worth 1.4200. The loss is $(1.4200 - 1.4000) \times 100,000 = \$2,000$

S 4)

What is the difference between the over-the-counter market and the exchange-traded market? What are the bid and offer quotes of a market maker in the over-the-counter market?

The over-the-counter market is a telephone- and computer-linked network of financial institutions, fund managers, and corporate treasurers where two participants can enter into any mutually acceptable contract. An exchange-traded market is a market organized by an exchange where traders either meet physically or communicate electronically and the contracts that can be traded have been defined by the exchange. When a market maker quotes a bid and an offer, the bid is the price at which the market maker is prepared to buy and the offer is the price at which the market maker is prepared to sell.

S 5)

Suppose that a June put option to sell a share for \$60 costs \$4 and is held until June. Under what circumstances will the seller of the option (i.e., the party with the short position) make a profit? Under what circumstances will the option be exercised? Draw a diagram illustrating how the profit from a short position in the option depends on the stock price at maturity of the option.

Suppose that a June put option to sell a share for \$60 costs \$4 and is held until June. Under what circumstances will the seller of the option (i.e., the party with a short position) make a profit? Under what circumstances will the option be exercised? Draw a diagram showing how the profit from a short position in the option depends on the stock price at the maturity of the option.

The seller of the option will lose money if the price of the stock is below \$56.00 in June. (This ignores the time value of money.) The option will be exercised if the price of the stock is below \$60.00 in June. The profit as a function of the stock price is shown in Figure S1.2.

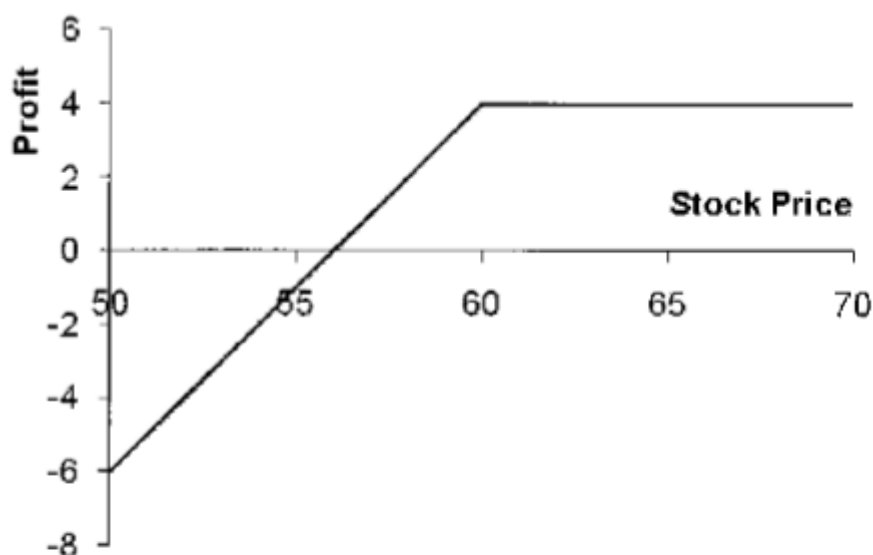


Figure S1.2 Profit from short position in Problem 1.14

S 6)

A company knows that it is due to receive a certain amount of a foreign currency in 4 months. What type of option contract is appropriate for hedging?

A long position in a four-month put option can provide insurance against the exchange rate falling below the strike price. It ensures that the foreign currency can be sold for at least the strike price.

S 7)

On July 1, 2011, a company enters into a forward contract to buy 10 million Japanese yen on January 1, 2012. On September 1, 2011, it enters into a forward contract to sell 10 million Japanese yen on January 1, 2012. Describe the payoff from this strategy.

Suppose that the forward price for the contract entered into on July 1, 2011 is F_1 and that the forward price for the contract entered into on September 1, 2011 is F_2 with both F_1 and F_2 being measured as dollars per yen. If the value of one Japanese yen (measured in US dollars) is S_T on January 1, 2012, then the value of the first contract (in millions of dollars) at that time is

$$10(S_T - F_1)$$

while the value of the second contract (per yen sold) at that time is:

$$10(F_2 - S_T)$$

The total payoff from the two contracts is therefore

$$10(S_T - F_1) + 10(F_2 - S_T) = 10(F_2 - F_1)$$

Thus if the forward price for delivery on January 1, 2012 increased between July 1, 2011 and September 1, 2011 the company will make a profit. (Note that the yen/USD exchange rate is usually expressed as the number of yen per USD not as the number of USD per yen)

S 8)

Explain why a futures contract can be used for either speculation or hedging.

If an investor has an exposure to the price of an asset, he or she can hedge with futures contracts. If the investor will gain when the price decreases and lose when the price increases, a long futures position will hedge the risk. If the investor will lose when the price decreases and gain when the price increases, a short futures position will hedge the risk. Thus either a long or a short futures position can be entered into for hedging purposes.

If the investor has no exposure to the price of the underlying asset, entering into a futures contract is speculation. If the investor takes a long position, he or she gains when the asset's price increases and loses when it decreases. If the investor takes a short position, he or she loses when the asset's price increases and gains when it decreases.

S 9)

A stock price is \$29. An investor buys one call option contract on the stock with a strike price of \$30 and sells a call option contract on the stock with a strike price of \$32.50. The market prices of the options are \$2.75 and \$1.50, respectively. The options have the same maturity date. Describe the investor's position.

S 10)

The price of gold is currently \$1,000 per ounce. The forward price for delivery in 1 year is \$1,200. An arbitrageur can borrow money at 10% per annum. What should the arbitrageur do? Assume that the cost of storing gold is zero and that gold provides no income.

S 11)

Suppose that you enter into a short futures contract to sell July silver for \$17.20 per ounce. The size of the contract is 5,000 ounces. The initial margin is \$4,000, and the maintenance margin is \$3,000. What change in the futures price will lead to a margin call? What happens if you do not meet the margin call?

There will be a margin call when \$1,000 has been lost from the margin account. This will occur when the price of silver increases by $1,000/5,000 = \$0.20$. The price of silver must therefore rise to \$17.40 per ounce for there to be a margin call. If the margin call is not met, your broker closes out your position.

S 12)

On July 1, 2012, a Japanese company enters into a forward contract to buy \$1 million with yen on January 1, 2013. On September 1, 2012, it enters into a forward contract to sell \$1 million on January 1, 2013. Describe the profit or loss the company will make in yen as a function of the forward exchange rates on July 1, 2012, and September 1, 2012.

Suppose F_1 and F_2 are the forward exchange rates for the contracts entered into July 1, 2012 and September 1, 2012, and S is the spot rate on January 1, 2013. (All exchange rates are measured as yen per dollar). The payoff from the first contract is $(S - F_1)$ million yen and the payoff from the second contract is $(F_2 - S)$ million yen. The total payoff is therefore $(S - F_1) + (F_2 - S) = (F_2 - F_1)$ million yen.

S 13)

The forward price of the Swiss franc for delivery in 45 days is quoted as 1.1000. The futures price for a contract that will be delivered in 45 days is 0.9000. Explain these two quotes. Which is more favourable for an investor wanting to sell Swiss francs?

The 1.1000 forward quote is the number of Swiss francs per dollar. The 0.9000 futures quote is the number of dollars per Swiss franc. When quoted in the same way as the futures price the forward price is $1 / 1.1000 = 0.9091$. The Swiss franc is therefore more valuable in the forward market than in the futures market. The forward market is therefore more attractive for an investor wanting to sell Swiss francs.

S 14)

What does a stop order to sell at \$2 mean? When might it be used? What does a limit order to sell at \$2 mean? When might it be used?

A *stop order* to sell at \$2 is an order to sell at the best available price once a price of \$2 or less is reached. It could be used to limit the losses from an existing long position. A *limit order* to sell at \$2 is an order to sell at a price of \$2 or more. It could be used to instruct a broker that a short position should be taken, providing it can be done at a price more favorable than \$2.

S 15)

What is the difference between the operation of the margin accounts administered by a clearing house and those administered by a broker?

The margin account administered by the clearinghouse is marked to market daily, and the clearinghouse member is required to bring the account back up to the prescribed level daily. The margin account administered by the broker is also marked to market daily. However, the account does not have to be brought up to the initial margin level on a daily basis. It has to be brought up to the initial margin level when the balance in the account falls below the maintenance margin level. The maintenance margin is usually about 75% of the initial margin.

S 16)

What are the most important aspects of the design of a new futures contract?

The most important aspects of the design of a new futures contract are the specification of the underlying asset, the size of the contract, the delivery arrangements, and the delivery months.

S 17)

Explain how margins protect investors against the possibility of default.

A margin is a sum of money deposited by an investor with his or her broker. It acts as a guarantee that the investor can cover any losses on the futures contract. The balance in the margin account is adjusted daily to reflect gains and losses on the futures contract. If losses are above a certain level, the investor is required to deposit a further margin. This system makes it unlikely that the investor will default. A similar system of margins makes it unlikely that the investor's broker will default on the contract it has with the clearinghouse member and unlikely that the clearinghouse member will default with the clearinghouse.

S 18)

A trader buys two July futures contracts on orange juice. Each contract is for the delivery of 15,000 pounds. The current futures price is 160 cents per pound, the initial margin is \$6,000 per contract, and the maintenance margin is \$4,500 per contract. What price change would lead to a margin call? Under what circumstances could \$2,000 be withdrawn from the margin account?

There is a margin call if more than \$1,500 is lost on one contract. This happens if the futures price of frozen orange juice falls by more than 10 cents to below 150 cents per pound. \$2,000 can be withdrawn from the margin account if there is a gain on one contract of \$1,000. This will happen if the futures price rises by 6.67 cents to 166.67 cents per pound.

S 19)

A cattle farmer expects to have 120,000 pounds of live cattle to sell in 3 months. The live cattle futures contract traded by the CME Group is for the delivery of 40,000 pounds of cattle. How can the farmer use the contract for hedging? From the farmer's viewpoint, what are the pros and cons of hedging?

The farmer can short 3 contracts that have 3 months to maturity. If the price of cattle falls, the gain on the futures contract will offset the loss on the sale of the cattle. If the price of cattle rises, the gain on the sale of the cattle will be offset by the loss on the futures contract. Using futures contracts to hedge has the advantage that it can at no cost reduce risk to almost zero. Its disadvantage is that the farmer no longer gains from favorable movements in cattle prices.

S 20)

Distinguish between the terms open interest and trading volume.

The *open interest* of a futures contract at a particular time is the total number of long positions outstanding. (Equivalently, it is the total number of short positions outstanding.) The *trading volume* during a certain period of time is the number of contracts traded during this period.

S 21)

What is the difference between a local and a futures commission merchant?

A *commission broker* trades on behalf of a client and charges a commission. A *local* trades on his or her own behalf.

S 22)

Under what circumstances are (a) a short hedge and (b) a long hedge appropriate?

A *short hedge* is appropriate when a company owns an asset and expects to sell that asset in the future. It can also be used when the company does not currently own the asset but expects to do so at some time in the future. A *long hedge* is appropriate when a company knows it will have to purchase an asset in the future. It can also be used to offset the risk from an existing short position.

S 23)

Explain what is meant by basis risk when futures contracts are used for hedging.

Basis risk arises from the hedger's uncertainty as to the difference between the spot price and futures price at the expiration of the hedge.

S 24)

Give three reasons why the treasurer of a company might not hedge the company's exposure to a particular risk.

(a) If the company's competitors are not hedging, the treasurer might feel that the company will experience less risk if it does not hedge. (See Table 3.1.) (b) The shareholders might not want the company to hedge. (c) If there is a loss on the hedge and a gain from the company's exposure to the underlying asset, the treasurer might feel that he or she will have difficulty justifying the hedging to other executives within the organization.

S 25)

Suppose that the standard deviation of quarterly changes in the prices of a commodity is \$0.65, the standard deviation of quarterly changes in a futures price on the commodity is \$0.81, and the coefficient of correlation between the two changes is 0.8. What is the optimal hedge ratio for a 3-month contract? What does it mean?

The optimal hedge ratio is

$$0.8 \times \frac{0.65}{0.81} = 0.642$$

This means that the size of the futures position should be 64.2% of the size of the company's exposure in a three-month hedge.

S 26)

A futures contract is used for hedging. Explain why the daily settlement of the contract can give rise to cash-flow problems.

Suppose that you enter into a short futures contract to hedge the sale of an asset in six months. If the price of the asset rises sharply during the six months, the futures price will also rise and you may get margin calls. The margin calls will lead to cash outflows. Eventually the cash outflows will be offset by the extra amount you get when you sell the asset, but there is a mismatch in the timing of the cash outflows and inflows. Your cash outflows occur earlier than your cash inflows. A similar situation could arise if you used a long position in a futures contract to hedge the purchase of an asset and the asset's price fell sharply. An extreme example of what we are talking about here is provided by Metallgesellschaft (see Business Snapshot 3.2).

S 27)

The expected return on the S&P 500 is 12% and the risk-free rate is 5%. What is the expected return on an investment with a beta of (a) 0.2, (b) 0.5, and (c) 1.4?

- a) $0.05 + 0.2 \times (0.12 - 0.05) = 0.064$ or 6.4%
- b) $0.05 + 0.5 \times (0.12 - 0.05) = 0.085$ or 8.5%
- c) $0.05 + 1.4 \times (0.12 - 0.05) = 0.148$ or 14.8%

S 28)

Explain what is meant by a perfect hedge. Does a perfect hedge always lead to a better outcome than an imperfect hedge? Explain your answer.

A *perfect hedge* is one that completely eliminates the hedger's risk. A perfect hedge does not always lead to a better outcome than an imperfect hedge. It just leads to a more certain outcome. Consider a company that hedges its exposure to the price of an asset. Suppose the asset's price movements prove to be favorable to the company. A perfect hedge totally neutralizes the company's gain from these favorable price movements. An imperfect hedge, which only partially neutralizes the gains, might well give a better outcome.

S 29)

A portfolio manager has maintained an actively managed portfolio with a beta of 0.2. During the last year, the risk-free rate was 5% and equities performed very badly providing a return of -30% . The portfolio manager produced a return of -10% and claims that in the circumstances it was a good performance. Discuss this claim

S 30)

An airline executive has argued: "There is no point in our using oil futures. There is just as much chance that the price of oil in the future will be less than the futures price as there is that it will be greater than this price." Discuss the executive's viewpoint.

It may well be true that there is just as much chance that the price of oil in the future will be above the futures price as that it will be below the futures price. This means that the use of a futures contract for speculation would be like betting on whether a coin comes up heads or tails. But it might make sense for the airline to use futures for hedging rather than speculation. The futures contract then has the effect of reducing risks. It can be argued that an airline should not expose its shareholders to risks associated with the future price of oil when there are contracts available to hedge the risks.

S 31)

Does a perfect hedge always succeed in locking in the current spot price of an asset for a future transaction? Explain your answer.

No. Consider, for example, the use of a forward contract to hedge a known cash inflow in a foreign currency. The forward contract locks in the forward exchange rate — which is in general different from the spot exchange rate.

S 32)

Under what circumstances does a minimum variance hedge portfolio lead to no hedging at all?

A minimum variance hedge leads to no hedging when the coefficient of correlation between the futures price changes and changes in the price of the asset being hedged is zero.

S 33)

Explain what happens when an investor shorts a certain share.

The investor's broker borrows the shares from another client's account and sells them in the usual way. To close out the position, the investor must purchase the shares. The broker then replaces them in the account of the client from whom they were borrowed. The party with the short position must remit to the broker dividends and other income paid on the shares. The broker transfers these funds to the account of the client from whom the shares were borrowed. Occasionally the broker runs out of places from which to borrow the shares. The investor is then short squeezed and has to close out the position immediately.

S 34)

What is the difference between the forward price and the value of a forward contract?

The forward price of an asset today is the price at which you would agree to buy or sell the asset at a future time. The value of a forward contract is zero when you first enter into it. As time passes the underlying asset price changes and the value of the contract may become positive or negative.

S 35)

Suppose that you enter into a 6-month forward contract on a non-dividend-paying stock when the stock price is \$30 and the risk-free interest rate (with continuous compounding) is 12% per annum. What is the forward price?

The forward price is

$$30e^{0.12 \times 0.5} = \$31.86$$

S 36)

Explain carefully the meaning of the terms convenience yield and cost of carry. What is the relationship between futures price, spot price, convenience yield, and cost of carry?

Convenience yield measures the extent to which there are benefits obtained from ownership of the physical asset that are not obtained by owners of long futures contracts. The *cost of carry* is the interest cost plus storage cost less the income earned. The futures price, F_0 , and spot price, S_0 , are related by

$$F_0 = S_0 e^{(c-y)T}$$

where c is the cost of carry, y is the convenience yield, and T is the time to maturity of the futures contract.

S 37)

The 2-month interest rates in Switzerland and the United States are, respectively, 2% and 5% per annum with continuous compounding. The spot price of the Swiss franc is \$0.8000. The futures price for a contract deliverable in 2 months is \$0.8100. What arbitrage opportunities does this create?

The theoretical futures price is

$$0.8000e^{(0.05-0.02) \times 2/12} = 0.8040$$

The actual futures price is too high. This suggests that an arbitrageur should buy Swiss francs and short Swiss francs futures.

S 38)

The risk-free rate of interest is 7% per annum with continuous compounding, and the dividend yield on a stock index is 3.2% per annum. The current value of the index is 150. What is the 6-month futures price?

The futures contract lasts for five months. The dividend yield is 2% for three of the months and 5% for two of the months. The average dividend yield is therefore

$$\frac{1}{5}(3 \times 2 + 2 \times 5) = 3.2\%$$

The futures price is therefore

$$150e^{(0.07-0.032) \times 0.4167} = 1,331.80$$

or \$1331.80.

S 39)

The spot price of silver is \$15 per ounce. The storage costs are \$0.24 per ounce per year payable quarterly in advance. Assuming that interest rates are 10% per annum for all maturities, calculate the futures price of silver for delivery in 9 months.

The present value of the storage costs for nine months are

$$0.06 + 0.06e^{-0.10 \times 0.25} + 0.06e^{-0.10 \times 0.5} = 0.176$$

or \$0.176. The futures price is from equation (5.11) given by F_0 where

$$F_0 = (15.000 + 0.176)e^{0.10 \times 0.75} = 16.36$$

i.e., it is \$16.36 per ounce.

S 40)

When a known future cash outflow in a foreign currency is hedged by a company using a forward contract, there is no foreign exchange risk. When it is hedged using futures contracts, the daily settlement process does leave the company exposed to some risk. Explain the nature of this risk. In particular, consider whether the company is better off using a futures contract or a forward contract when:

- (a) The value of the foreign currency falls rapidly during the life of the contract.
- (b) The value of the foreign currency rises rapidly during the life of the contract.
- (c) The value of the foreign currency first rises and then falls back to its initial value.
- (d) The value of the foreign currency first falls and then rises back to its initial value.

Assume that the forward price equals the futures price.

In total the gain or loss under a futures contract is equal to the gain or loss under the corresponding forward contract. However the timing of the cash flows is different. When the time value of money is taken into account a futures contract may prove to be more valuable or less valuable than a forward contract. Of course the company does not know in advance which will work out better. The long forward contract provides a perfect hedge. The long futures contract provides a slightly imperfect hedge.

- (a) In this case the forward contract would lead to a slightly better outcome. The company will make a loss on its hedge. If the hedge is with a forward contract the whole of

the loss will be realized at the end. If it is with a futures contract the loss will be realized day by day throughout the contract. On a present value basis the former is preferable.

- (b) In this case the futures contract would lead to a slightly better outcome. The company will make a gain on the hedge. If the hedge is with a forward contract the gain will be realized at the end. If it is with a futures contract the gain will be realized day by day throughout the life of the contract. On a present value basis the latter is preferable.
- (c) In this case the futures contract would lead to a slightly better outcome. This is because it would involve positive cash flows early and negative cash flows later.
- (d) In this case the forward contract would lead to a slightly better outcome. This is because, in the case of the futures contract, the early cash flows would be negative and the later cash flow would be positive.

S 41)

Explain why a foreign currency can be treated as an asset providing a known yield.

A foreign currency provides a known interest rate, but the interest is received in the foreign currency. The value in the domestic currency of the income provided by the foreign currency is therefore known as a percentage of the value of the foreign currency. This means that the income has the properties of a known yield.

S 42)

Is the futures price of a stock index greater than or less than the expected future value of the index? Explain your answer.

The futures price of a stock index is always less than the expected future value of the index. This follows from Section 5.14 and the fact that the index has positive systematic risk. For an alternative argument, let μ be the expected return required by investors on the index so that $E(S_T) = S_0 e^{(\mu - q)T}$. Because $\mu > r$ and $F_0 = S_0 e^{(r - q)T}$, it follows that $E(S_T) > F_0$.