

EC 247 Financial Instruments and Capital Markets

Class Exercise 7 Solutions

These questions reflect the topic on futures contracts, which is addressed in chapter 24 of the Frederic S. Mishkin and Stanley G. Eakins, *Financial Markets and Institutions*, 7th Edition, Pearson Prentice Hall, 2012.

Question 1

Explain the difference between (a) arbitrage (b) speculation and (c) hedging.

- (a) Arbitrageurs seek to exploit price differentials in order to make arbitrage profits. These are risk-free profits that require a zero initial outlay. Market equilibrium is usually defined so as arbitrage opportunities are absent. Related to the futures contracts, as the delivery month is getting closer, the price of the futures contracts converges to the spot price of the underlying asset. If this is not the case, arbitrage opportunities arise. Assume that during the delivery period the futures price is above the spot price. Then, traders could short a futures contract, buy the asset, and make delivery. This strategy will give a profit equal to the difference between the futures price and the spot price. As such opportunities are exploited, the futures price will fall. Next, suppose that the futures price is below the spot price during the delivery period. Companies interested in acquiring the asset will find it attractive to go long in futures contracts and wait for delivery to be made. This being so, the futures price will tend to rise.
- (b) Speculators try to secure profit from knowing better than the market what the future will bring forth. In other words, they seek to profit by trading according to their own expectations, which however may turn out to be wrong. Speculators in futures markets are highly specialized investors with a good knowledge of the market who seek to profit from their own beliefs about price patterns in the future.
- (c) Hedgers are trying to eliminate (reduce) risk. The hedging principle can be perceived as follows: *reduce the risk associated with holding one asset by holding a second asset so that, together, the payoffs cancel out across states of the world*. Hedging examples with interest rate futures, with foreign exchange futures contracts and with stock index futures have been discussed in the lecture and can be found in chapter 24 of the book. A hedging example in the forward market could come from a grain merchant who may wish to sell forward (take a short position) in order to protect himself against the possibility that the value of his stored grain will have fallen by the date at which it is sold. A miller on the other hand may wish to buy forward (take a

long position) in order to protect himself against a rise in the price of the grain before it is needed in the milling process¹.

Question 2

A silver futures contract requires the seller to deliver 5000 ounces of silver. An investor sells one June futures contract at a price of \$8 per ounce, posting a \$2025 initial margin. If the required maintenance margin is \$1500, what is the first price per ounce at which this investor would receive a maintenance margin call?

The purpose of this question is to illustrate how the margins work in the marking to market trading of futures contracts. When an investor adopts a position in a futures contract (short position in the specific example), his broker requires that he deposit funds in a *margin account*. The amount that the investor is required to deposit at the time that the contract is agreed is called the *initial margin*. At the end of each trading day, the margin account is adjusted, so as to reflect losses or gains from trading. In order to ensure that the balance of the margin account will not become negative, a *maintenance margin*, which is lower than the initial margin is set. If the margin account falls below the maintenance margin, the investor receives a margin call, according to which he has to top up the margin account to the initial margin. The extra funds that are deposited are known as *variation margin*².

In our example, the price per ounce is \$8, the initial margin is \$2025, and the maintenance margin is \$1500. What we are looking for, is the first price per ounce that the investor will receive a margin call. Each \$0.01 increase in price results in a loss of \$50.00. As the initial margin is \$2025, and the maintenance is \$1500, a \$525 loss or greater is necessary to trigger a margin call. Hence, the price would need to increase roughly by \$0.11. We can also work out a more detailed answer by completing the following table:

FC PRICE	DAILY GAIN (LOSS)	CUMULATIVE GAIN (LOSS)	MARGIN ACCOUNT BALANCE	MARGIN CALL
\$8	-	-	\$2025	-
\$8.01	(50)	(50)	\$1975	-
\$8.02	(50)	(100)	\$1925	-
\$8.03	(50)	(150)	\$1875	-
\$8.04	(50)	(200)	\$1825	-
\$8.05	(50)	(250)	\$1775	-
\$8.06	(50)	(300)	\$1725	-
\$8.07	(50)	(350)	\$1675	-
\$8.08	(50)	(400)	\$1625	-

¹ A good discussion of arbitrage, speculation and hedging in forward markets can be found in: Roy E. Bailey, *The Economics of Financial Markets*, Cambridge University Press, 2005.

² A very good example explaining the operation of margins in futures contracts (also covered in the lecture) can be found in: John C. Hull, *Options futures and other Derivatives*, Prentice hall, 2002.

\$8.09	(50)	(450)	\$1575	-
\$8.10	(50)	(500)	\$1525	-
\$8.11	(50)	(550)	\$1475	\$550

Question 3

Suppose an oil distributor is planning to sell 100,000 barrels of oil in December and wishes to hedge against a possible decline in oil prices. Assume that the futures oil contract price is \$52.67.

- a. If each futures oil contract is for 1,000 barrels how many contracts does he need to short?
- b. Suppose that the only three possible prices for oil in December are \$50.67, \$52.67, and \$54.67. Show that the oil distributor has completely eliminated risk of loss.

Answer:

a) The futures contract is for 1,000 barrels so the oil distributor will have to short 100 contracts.

b) In December, the oil distributor will sell 100,000 barrels of oil. We know that in December the price of oil per barrel can only take three possible values i.e. \$50.67, \$52.67 and \$54.67. Accordingly, by selling 100,000 barrels of oil in December, the distributor can realize three different possible revenues i.e. \$5,067,000 ($100,000 \times \50.67), \$5,267,000 ($100,000 \times \52.67) or \$5,467,000 ($100,000 \times \54.67). However, he has also adopted a short position by investing in futures contracts. As the delivery month for the futures contract approaches (December) the arbitrage principle implies that the price of the futures contract and the price of oil will converge. As a result, we have three possible values for the futures contract in December. If the price of the futures contract is \$50.67 the investor with the short position will realize a profit of \$2.00 per barrel. Given the number of contracts that he has shorted, this is translated into an additional profit of \$200,000 in December. So, overall, the distributor's total revenue in December will be \$5,267,000 (\$5,067,000 from selling 100,000 barrels plus \$200,000 from his investment in futures contracts). The same reasoning applies for the other two possible prices of oil in December. If the price of oil is \$52.67 the distributor will realize total revenue of \$5,267,000 (this revenue is realized entirely from selling 100,000 barrels of oil in December at a price of \$52.67 per barrel). There are neither profits nor losses from his investment in the futures contracts, since the price of the futures contracts in December is exactly \$52.67). Finally, if the price of oil in December turns out to be \$54.67 per barrel, the distributor will sell his 100,000 barrels at a higher price and he will realize \$5,467,000 but he will suffer a loss of \$200,000 from his investment in the futures contract. Overall, we can see that no matter which price of oil turns out to be in December, the distributor can realize the same total proceed of \$5,267,000. In other words, by shorting 100 futures contracts he can hedge against possible decline in the oil prices.

	Oil Price \$50.67	Oil Price \$52.67	Oil Price \$54.67
Revenue from oil sale	\$5,067,000	\$5,267,000	\$5,467,000
Profit/Loss on Futures	\$200,000	0	-\$200,000
Total Proceeds	\$5,267,000	\$5,267,000	\$5,267,000

Question 4

Suppose that the pension you are managing is expecting an inflow of funds of \$100 million next year and you want to make sure that you will earn the current interest rate of 8% when you invest the incoming funds in long term bonds. How would you use the futures market to do this?

You would buy a \$100 million worth, of long-term bond futures contract with an expiration date of one year in the future. This means that you would be entitled to delivery of the long-term bond at today's price so that the current rate would be locked in. If interest rates increase during the year, the price of bonds will decrease and you will gain from investing in the long-term bonds one year later. However, the price of the futures contract will also decline so the additional gain will be offset from the losses coming from the investment in the futures contracts. On the other hand, if the yield to maturity between now and one year later falls, bond prices and futures prices will rise. As a result, the gain from the futures position will compensate for the higher bond price.
