AGBE 321

Problem Set 5—Solutions

1. In your own words (i.e., in a manner that you would explain it to someone who has not taken this course) explain the concept of offsetting futures contracts. When/why would you offset a futures contract? How would you offset a particular futures market position?

   Offsetting futures contracts is taking an opposite position on an existing futures contract in order to remove the delivery obligations of the contract. For example, if you took a short position on a December 2012 wheat contract, then you would be obligated to deliver 5,000 bushels of wheat at the contract's expiration. In order to rid yourself of these delivery obligations, you can take a long position on another December 2012 contract.

2. What is the difference between a futures contract price and a local cash price? What is the relationship among these two prices? Which price would a Montana farmer/rancher care most about? Why?

   A local cash price is one that occurs in the local market, which is the location where the commodity is actually sold/bought. For example, a cash price might be the price that is offered by a local elevator at the time of sale. On the other hand, futures prices are those associated with futures contracts, which describe the expected price of the commodity at some future point in time. Typically, a Montana farmer/rancher will care primarily about the local price, because it will determine the received revenue.

3. In your own words (i.e., in a manner that you would explain it to someone who has not taken this course) explain the concept of margin accounts and why they are necessary.

   The margin account is a requirement of participating in any futures market. A fractional amount of the value of a futures contract is kept in the margin account and adjusted each market day for fluctuations in futures prices. The margin account is necessary to ensure that market participants have available funds to pay off their debts, in case prices move against the participant.

4. Provide economic intuition for the similar *price movements* and their *timing* observed between August and October. Remember that futures contracts reflect rational expectations about the supply and demand of the commodity.

Corn and wheat are substitutes in consumption, and so when the price of one commodity changes relative to the other, the demand in the markets will change causing both prices to move in a relatively similar manner. When the expected price of wheat is high, the expected price of corn will likely be low. This is the typical movement that is expected.

5. Why doesn't the price of wheat contracts exactly mirror reflection of corn futures prices?

   Although corn is a substitute, it is not the only possible substitute. Consequently, there are other aspects that impact the demand and supply of the two commodities, resulting an imperfect relationship between the prices.

6. Explain the apparent break in similar price movements after October. If you have not been following these markets, then you will need to do some research to dtermine the market events that have caused these divergences to occur.

   Because agricultural markets have become so global, changes in international markets have begun to have a much stronger impact on prices.For example, poor harvest conditions in South America have pushed wheat prices up, resulting in a divergence in prices between corn and wheat.

Suppose that you are a speculator betting on the hard red winter wheat market. You wish to take on a short position with five (5) futures wheat contracts at the price \$7.30/bu. The associated margin requirement is 15%. Respond to the following:

7. Why would it make sense to take on a short position in the wheat market?

   We would expect that wheat prices have hit their highs (especially knowing that corn has dropped in price), and the only way for them to move is down.

8. Argue that taking a short position is the wrong decision.

   We are not certain of what will happen in the future, and because wheat prices are impacted by uncertain global conditions, wheat prices can be especially subject to short run price spikes.

9. What would be the margin requirement for this transaction? That is, how much money would you be required to deposit into your margin account?

   Margin Requirement: \$27,375

10. Currently, you have $10,000 in liquid assets. Using the margin requirement from before, *Reproduce* the following table to describe the following:

    (a) How much money will be added (+) or subtracted (–) from your margin account when the futures contract is marked-to-market (margin call).

    (b) How much is in the margin account after the margin call (assume that you must either get the margin account back to the margin requirement level or maintain all of the positive market returns in the margin account).

    (c) How much money you will have to add from your liquid assets into the margin account to maintain the original margin requirement.

    (d) What the new price of the futures contract when it is marked-to-market.

    (e) At which point, if any, will you be placed out of the futures market and why.

    Make sure to show your work when determining each of the values in the table.

Day	**Price when market opens**	**Price change**	**Margin call**	**Margin account**	**Liquid assets used to replenish margin account**	**Liquid assets remaining**	**Price after marking-to-market**
1	$7.30	$0.10	-$2,500	$24,875	$2,500	$7,500	$7.40
2	$7.40	-$0.20	$5,000	$32,375	$0	$7,500	$7.20
3	$7.20	-$0.15	$3,750	$36,125	$0	$7,500	$7.05
4	$7.05	$0.25	-$6,250	$29,875	$0	$7,500	$7.30
5	$7.30	$0.30	-$7,500	$22,375	$5,000	$2,500	$7.60
6	$7.60	$0.05	-$1,250	$26,125	$1,250	$1,250	$7.65
7	$7.65	-$0.25	$6,250	$33,625	$0	$1,250	$7.40
8	$7.40	-$0.40	$10,000	$43,625	$0	$1,250	$7.00

11. Repeat the above exercise, but assume that you have $25,000 in available liquid assets and the market behaves is as following:

Day	**Price when market opens**	**Price change**	**Margin call**	**Margin account**	**Liquid assets used to replenish margin account**	**Liquid assets remaining**	**Price after marking-to-market**
1	$7.30	$0.10	-$2,500	$24,875	$2,500	$22,500	$7.40
2	$7.40	$0.20	-$5,000	$22,375	$5,000	$17,500	$7.60
3	$7.60	-$0.15	$3,750	$31,125	$0	$17,500	$7.45
4	$7.45	-$0.10	$2,500	$33,625	$0	$17,500	$7.35
5	$7.35	$0.30	-$7,500	$26,125	$1,250	$16,250	$7.65
6	$7.65	-$0.05	$1,250	$28,625	$0	$16,250	$7.60
7	$7.60	-$0.25	$6,250	$34,875	$0	$16,250	$7.35
8	$7.35	-$0.15	$3,750	$38,625	$0	$16,250	$7.20

12. Futures markets intuition.

    (a) Consider two markets—a malt barley market and a spring wheat market. Malt barley does not have an associated futures contract while spring wheat does have a well-established contract traded on the Minneapolis Grain Exchange. This implies that there are no speculators participating in the malt barley market and many speculators affecting spring wheat prices. Which market, malt barley or spring wheat, do you expect to have more price variability/volatility? That is, which market has more uncertainty about prices in the future? Discuss the economics behind your intuition.

    The barley market will likely be subject to more price variability and uncertainty. This is because there is less information available in the barley market, and any fluctuation may be exacerbated by lack of knowledge of how those changes will impact the future. For commodities with futures markets, there are many more participants who bring much more information to the market. Therefore, there is less uncertainty about how a change will affect the short and long term aspects of the market. This reduced heavy price fluctuations.

    (b) Discuss the benefits and costs of partial hedging. When would a partial hedging strategy be appropriate?

    Positive: partial hedging allows the hedger to share some upsides given price movements in their favor. Negative: It also exposes the hedger to some of the risk of loss. The strategy is appropriate when the hedger expects the price to move in a favorable direction for their future operations but still wants to partially hedge their bet in case they are wrong.

    (c) True or false: basis is easier to predict than local cash or futures prices? Justify your answer.

    True. Local and futures prices typically move quite similarly, so the difference between those prices (basis) will always be quite small. If we just wish to price cash or futures prices, it is likely to be a much more difficult endeavor, because many more factors can influence their behaviors.

13. You are a miller. It is currently November and you have forward contracted to deliver 450,000 pounds of flour at \$25 per hundredweight (per 100 lbs.) in March. The extraction rate of flour from wheat is approximately 75%, implying that you will need 600,000 pounds of wheat. There are approximately 60 pounds in each bushel of wheat. After you sell the contracted flour, you wish to immediately replace the wheat for continuing your operations. You will purchase the wheat in your local market, but you wish to hedge away the possible price risk associated with waiting to purchase wheat in March. In November, the March spring wheat futures contract is priced at \$8.10/bu and there is a 5% margin requirement to enter the market.

    (a) If the March spring wheat futures price was the same as in November with 0 basis differential, calculate your expected revenue, costs, and profit.

$$\mathrm{E}[R] = 450,000\cancel{lbs} \cdot \left(\frac{\$25}{100\cancel{lbs}}\right) = \$112,500$$
$$\mathrm{E}[C] = 10,000\cancel{bu} \cdot \left(\frac{\$8.10}{\cancel{bu}}\right) = \$81,000$$
$$\mathrm{E}[\Pi] = \$112,500 - 81,000 = \boxed{\$31,500}$$

(b) What position are you in the local wheat market? Why?
Short. If prices move up, you're worse off.

(c) What position would you need to take in the futures market to offset your local market position?
You would need to take the long position in the futures market to off set price variability risk in the local market.

(d) How much money would you need to pay into the margin account?

$$10,000\cancel{bu} \cdot \frac{\$8.10}{\cancel{bu}} \cdot \frac{5}{100} = \boxed{\$4,050}$$

(e) Suppose that the price of the March spring wheat futures contract in March is \$9.55/bu and the local basis is –\$0.95/bu. Determine:

i. Local market conditions (revenues, costs, net local returns).

$$R = 450,000\cancel{lbs} \cdot \left(\frac{\$25}{100\cancel{lbs}}\right) = \$112,500$$
$$C = 10,000\cancel{bu} \cdot \left(\frac{\$8.60}{\cancel{bu}}\right) = \$86,000$$
$$\Pi = \$112,500 - 86,000 = \boxed{\$26,500}$$

ii. Futures market conditions (net gains or losses).

$$10,000\cancel{bu} \cdot \left(\frac{\$9.55 - \$8.10}{\cancel{bu}}\right) = \boxed{\$14,500}$$

iii. Overall net returns from the local and futures markets.

$$\$26,500 + \$14,500 = \boxed{\$41,000}$$

14. You're a corn farmer. Assume that average corn yields are 134 bushels per acre and you have a 5,000 acre corn farm. You will store 12% of your harvest and sell the remaining crop to your nearby elevator. Your cost to produce a bushel of corn is \$4.00/bu, which you incur on all produced bushels, regardless of whether you decide to sell them immediately or store for later sales. You wish to hedge the expected price risk using futures markets. Respond to the following.

(a) Even though you can use futures markets to hedge away some price risk, you are unable to hedge all of it away. Why are you still subject to some uncertainty?

Basis variability still presents some uncertainty regarding expected profit.

(b) It is currently December, and the September 2015 corn futures contract is trading at \$4.80/*bu*. The following table describes local and futures prices in September, the month during which you will sell your crop, and the current month, December.

Month	**Year**	**Futures Price**	**Local Price**
September	2008	\$ 3.25	\$ 3.14
September	2009	\$ 4.10	\$ 3.98
September	2010	\$ 4.20	\$ 4.01
September	2011	\$ 5.89	\$ 5.77
September	2012	\$ 5.24	\$ 5.11
September	2013	\$ 4.75	\$ 4.61
September	2014	\$ 5.61	\$ 5.48

If the December price of a September 2015 futures contract reflected the *true* price of corn in September 2015, what are your expected total revenues, total costs, and total profits?

$$\mathrm{E}[B] = ((5.11 - 5.24) + (4.61 - 4.75) + (5.48 - 5.61))/3 = -0.13$$

$$\mathrm{E}[R] = 5000\cancel{acres} \cdot \left(\frac{134\cancel{bu}}{\cancel{acre}}\right) \cdot (1 - 0.12) \cdot \left(\frac{\$4.80 - 0.13}{\cancel{bu}}\right) = \$2,753,432$$

$$\mathrm{E}[C] = 5000\cancel{acres} \cdot \left(\frac{134\cancel{bu}}{\cancel{acre}}\right) \cdot \left(\frac{\$4.00}{\cancel{bu}}\right) = \$2,680,000$$

$$\mathrm{E}[\Pi] = \$2,753,432 - 2,680,000 = \boxed{\$73,432}$$

(c) Suppose that you take a position in the futures market to hedge price risk. What position would you take? Why?

You're naturally long in the local market (e.g., if local prices increase, you're better off). You would take a short position in the futures.

(d) When you are ready to sell the corn in September 2015, you offset your futures position at the price of \$4.75. The actual basis in September is –\$0.19/bu. Calculate your actual total net revenues in the local market, total equity in the futures market, and your overall profit.

$$R = 5000\cancel{acres} \cdot \left(\frac{134\cancel{bu}}{\cancel{acre}}\right) \cdot (0.88) \cdot \left(\frac{\$4.75 - \$0.19}{\cancel{bu}}\right) = \$2,688,576$$

$$C = 5000\cancel{acres} \cdot \left(\frac{134\cancel{bu}}{\cancel{acre}}\right) \cdot \left(\frac{\$4.00}{\cancel{bu}}\right) = \$2,680,000$$

$$Equity = 5000\cancel{acres} \cdot \left(\frac{134\cancel{bu}}{\cancel{acre}}\right) \cdot (\$4.80 - \$4.75) = 33,500$$

$$\Pi = \$2,688,576 + 33,500 - 2,680,000 = \boxed{\$42,076}$$

(e) If you had not hedged, what would have been your profit?

$$R = 5000\cancel{acres} \cdot \left(\frac{134\cancel{bu}}{\cancel{acre}}\right) \cdot (0.88) \cdot \left(\frac{\$4.75 - \$0.19}{\cancel{bu}}\right) = \$2,688,576$$

$$C = 5000\cancel{acres} \cdot \left(\frac{134\cancel{bu}}{\cancel{acre}}\right) \cdot \left(\frac{\$4.00}{\cancel{bu}}\right) = \$2,680,000$$

$$\Pi = \$2,688,576 - 2,680,000 = \boxed{\$8,576}$$