Commodity Challenge

Section III: Advanced Pricing Tools

Chapter 16: Buying put options to establish a minimum price

Learning objectives

- Hedging with options
- Buying put options to establish a minimum price
- Delta and the hedge ratio

Key terms

Delta: A measure of how much an option price changes in relation to a change in the futures price.

Hedge ratio: The reciprocal of delta (1/delta).

Hedging with Options

Hedging with options differs from hedging with futures. Futures lock in a specific price but eliminate the chance to benefit from favorable price moves. Options allow hedgers to set a **minimum (floor)** or **maximum (ceiling)** price while keeping upside potential.

For grain sellers, option-based strategies include:

- Buying put options to establish a minimum price on grain in production or storage.
- Selling grain in the cash market and buying call options (“paper farming”).

This chapter focuses on **buying put options**.

Establishing a Minimum Price with Put Options

Buying put options establishes a minimum price, sometimes called a floor price. Here's a simple equation to calculate a minimum price established by buying put options…

put strike price + expected basis - premium - fees = expected minimum price

Again, this is an expected price, based on the expected basis. The actual basis will probably be a little different from expectations. It is also important to remember that basis is often a negative number.

Example: Buying Puts on Stored Corn

A farmer stores corn after harvest. July futures = $4.60. The farmer buys **460 July puts** for a **43¢ premium**. Expected basis next spring = **-20¢**.

Date	Cash	Options	Basis
October	Store corn, cash price $4.00	Buy 460 July puts @ 43¢	expected basis: -0.20 (20 cents under the July contract

Let's show the math on the expected minimum price (ignore brokerage).

$4.60 put + (-$0.20) expected basis - $0.43 premium = $3.97 expected minimum price

Put options gain value as futures fall and lose value as futures rise. Here's a question to ponder: Once you buy puts in this strategy, do you want prices to go higher or lower?

Even though puts increase in value as prices go lower, you want higher prices. Do you want to maximize the value of your puts, or the value of your grain held in storage? Maximizing the value of your puts simply means you are headed towards the minimum price. Clearly your best result comes from much higher prices and maximizing the value of the grain held in storage. The put options simply serve as price insurance and, like auto insurance, a driver is better off without accidents and payouts.

Let's unwind this transaction in mid-June – just days before the July options will expire. We will consider three different scenarios; futures prices nearly unchanged, futures prices higher and futures prices lower. In each scenario, we need to consider our actions in the cash market and in the options market.

Scenario #1: Futures prices nearly unchanged

Cash price in mid-June: $4.50 per bushel

July futures in mid-June: $4.65 per bushel

Basis: -$0.15 per bushel

July 460 put options: $0.02 per bushel

Your exact price may be difficult to calculate because you need to decide what to do with your 460 puts which are five cents out-of-the-money. Do you sell it to make (maybe) a penny after brokerage costs? Or do you hope the market collapses in the next few days to add value to your put?

Let's set aside the final decision on the put option and calculate the final price based on the cash price of corn sold in mid-June and the original cost of the put.

$4.50 cash sale price in June - $0.43 premium = $4.07

Unfortunately, you are close to the minimum price estimated at harvest. Basis was a little stronger than expected but you still need to account for the final action with the 460 put option.

Scenario #2: Futures prices higher

Cash price in mid-June: $5.55 per bushel

July futures in mid-June: $5.80 per bushel

Basis: -$0.25 per bushel

July 460 put options: no value (the 460 puts are 120 cents "out-of-the-money")

Your put options have lost all value. Let's calculate the final price based on the cash price of corn and the original cost of the put.

$5.55 cash sale price in June - $0.43 premium = $5.12

Basis was a little weaker than expected but you benefitted from a strong rally in the futures market.

Scenario 3: Futures prices lower

Cash price in mid-June: $3.60 per bushel

July futures in mid-June: $3.70 per bushel

Basis: -$0.10 per bushel

July 460 put options: $0.90 per bushel (the 460 puts are 90 cents “in-the-money”)

We can say with certainty that your 460 July puts will be worth at least 90 cents per bushel. Let’s calculate the final price based on the cash price of corn and the 47 cent profit made on the 460 put (90 cent sale price less the 43 cent premium cost).

$3.60 cash sale price in June + $0.47 option profit = $4.07

You are close to the minimum price estimated at harvest. A stronger basis helped but it was not near enough to overcome a $0.90 per bushel decrease in the futures price.

Delta and the Hedge Ratio

Delta measures how much an option premium changes relative to futures.

delta = change in option premium / change in futures price

- At-the-money options: delta ≈ 0.5
- Deep in-the-money: delta → 1.0
- Far out-of-the-money: delta → 0.0

Delta also estimates the probability of expiring in-the-money.

Hedge Ratio

hedge ratio = 1 / delta

Example: If delta = 0.5 → hedge ratio = 2. Two option contracts hedge 5,000 bushels.

One common pitfall in the use of options for hedging is a poor understanding of the relationship between futures prices and option premiums, as expressed by delta and the hedge ratio. This pitfall is illustrated by the paper farmer – a grain producer who sells grain and "re-owns" it with the purchase of call options on a one-to-one basis (e.g., sell 25,000 bushels of wheat and buy 5 call option contracts). What if a producer buys call options that are far out-of-the-money (i.e., $8 wheat calls when the futures market is trading at $5 per bushel)? Out-of-the-money call options are much less expensive than options that are at or in-the-money. But if market prices rise by $1, low delta means that the value of the options will increase less than $1/bu.

A common mistake is buying far out-of-the-money options with low delta, which provide little protection.

Further reading and resources from the CME Group

Self-Study Guide to Hedging with Grain and Oilseed Futures and Options (handbook), CME Group, April 2012 http://www.cmegroup.com/trading/agricultural/self-study-guide-to-hedging-with-grain-and-oilseed-futures-and-options.html

Grain and Oilseed Futures and Options (brochure), CME Group, February 2012 http://www.cmegroup.com/trading/agricultural/grain-and-oilseed-futures-and-options-fact-card.html

Exercise #16: Buying put options to establish a minimum price

At harvest you placed unpriced corn into storage. With July futures at $4.95/bu., you buy 490 put options on July corn futures (i.e., the right to sell July corn for $4.90/bu.). The premium paid is 44 cents/bushel. You expect to make final delivery of the corn in June, with an expected corn basis of 25 cents under (-$0.25) the July contract.

Calculate the minimum expected price using this formula.

put strike price + expected basis - premium - fees = expected minimum price

Now complete the hedge in June under three price scenarios. July corn options will expire in days. You sell your cash corn. What will you do with your 490 July puts? Can you calculate a final price for corn?

Scenario #1: Futures prices change little

Cash price in June: $4.72 per bushel

July futures in June: $4.95 per bushel

Basis in June: (-$0.23)

July 490 put options: $0.02 per bushel

Scenario #2: Futures prices rise $1.00 per bushel

Cash price in June: $5.62 per bushel

July futures in June: $5.95 per bushel

Basis in June: (-$0.33)

July 490 put options: no value (the 490 puts are 105 cents “out-of-the-money”)

Scenario #3: Futures fall $1.00 per bushel

Cash price in June: $3.75 per bushel
July futures in June: $3.95 per bushel

Basis in June: (-$0.20)

July 490 put options: $0.95 per bushel (the 490 puts are 95 cents “in-the-money”)