Commodity Challenge

Section III: Advanced Pricing Tools

Chapter 14: Buying call options to establish a maximum price

Learning objectives

- Hedging with options
- Buying call options to establish a maximum 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 the long hedger to set a **maximum (ceiling)** price while keeping open the possibility of lower prices.

For grain buyers, a basic option-based strategy is buying call options to establish a maximum price on grain to be purchased.

Establishing a Maximum Price with Call Options

Buying call options establishes a maximum price, sometimes called a ceiling price. Here's a simple equation to calculate a maximum price established by buying call options…

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call strike price + expected basis + premium + fees = expected maximum price
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Again, this is an expected maximum 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 calls to establish corn costs

Let's consider an example of buying call options to establish a maximum price on corn. A poultry producer in Missouri has a lot of chickens to feed. At $4.00/bu., corn prices at harvest are reasonable but the producer believes prices could fall even further. Buying call options allows the producer to establish a maximum price and while maintaining the opportunity for lower prices. With July corn futures at $4.60/bu., the producer places an order with his broker to buy "at-the-money" 460 July calls ("at-the-money" means the strike price is the same as the futures price, or $4.60/bu.). The premium is 39 cents and the basis is estimated to be 20 cents under July futures by late spring.

Date	Cash	Options	Basis / Minimum Price
October	Local corn is selling for $4.00 per bushel	With July futures trading at $4.60, buy July 460 calls for 39 cents per bushel.	Expected basis next spring is -$0.20, or 20 cents under the July contract.

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

$4.60 call + (-$0.20) expected basis + $0.39 premium = $4.79 expected maximum price

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

Even though calls options increase in value as prices rise, you want lower prices. Do you want to maximize the value of your calls, or minimize the cost of grain? Maximizing the value of your calls simply means you are headed towards the maximum price.

Clearly your best result comes from much lower prices and minimizing the cost of grain. The call 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: $4.40 per bushel

July futures in mid-June: $4.55 per bushel

Basis: -$0.15 per bushel

July 460 call options: $0.02 per bushel

Your exact price may be difficult to calculate because you need to decide what to do with your 460 calls 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 surgea higher in the next few days to add value to your call?

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

$4.40 cash purchase in June + $0.39 premium = $4.79

Unfortunately, you are close to the maximum price estimated at harvest. You still need to account for the final action with the 460 call option.

Scenario #2: Futures prices higher

Cash price in mid-June: $5.35 per bushel

July futures in mid-June: $5.60 per bushel

Basis: -$0.25 per bushel

July 460 call options: $1.00 per bushel (the 460 calls are $1 "in-the-money")

We can say with certainty that your 460 July calls will be worth at least $1.00 per bushel. Let's calculate the final price based on the purchase price of corn and the 61 cent profit made on the 460 call ($1.00 sale price less the 39 cent premium cost).

$5.35 purchase price in June - $0.61 option profit = $4.74

You are close to the maximum price estimated at harvest. A weakerer basis helped but it was not near enough to overcome a $1.00 per bushel increase in the futures price.

Scenario 3: Futures prices lower

Cash price in mid-June: $3.55 per bushel

July futures in mid-June: $3.65 per bushel

Basis: -$0.10 per bushel

July 460 call options: no value (the 460 calls are 95 cents "out-of-the-money")

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

$3.55 cash sale price in June + $0.39 premium = $3.94

Basis was stronger than expected but you benefitted from a collapse in the futures market.

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

$$\text{hedge ratio} = 1 / \text{delta}$$

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 #14: Buying call options to establish a maximum price

At the start of the new year, you decide to pay $0.35 per bushel to buy 440 call options on July corn futures to lock in a maximum price for corn. The July futures contract is trading at $4.40 per bushel. This will lock-in a maximum price for corn to be fed to your dairy herd over the summer months, with the possibility of lower costs, should corn prices trend lower in the months ahead. You are expecting to purchase the physical corn in late June, when you expect a corn basis of 12 cents under the July contract.

Use the following formula to calcaulate your maximum corn price in June.

call strike price + expected basis + premium + fees = expected maximum price

Now complete the hedge in June under three price scenarios. July corn options will expire in days. You buy cash corn. What will you do with your 440 July calls? Can you calculate a final price for corn?

Scenario #1: Futures prices change little

Cash price in June: $4.21 per bushel

July futures in June: $4.30 per bushel

Basis in June: (-$0.09)

July 440 put options: $0.02 per bushel

Scenario #2: Futures prices rise $1.00 per bushel

Cash price in June: $5.21 per bushel

July futures in June: $5.40 per bushel

Basis in June: (-$0.19)

July 440 call options: $1.00 per bushel (the 440 calls are 100 cents “in-the-money”)

Scenario #3: Futures fall $1.00 per bushel

Cash price in June: $3.20 per bushel

July futures in June: $3.40 per bushel

Basis in June: (-$0.20)

July 440 call options: no value (the 440 calls are 100 cents “out-of-the-money”)