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, typically expressed as a percentage.

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

There is a difference between hedging price risks with options instead of futures. Using futures, a hedger can fix a specific price, but they give up the opportunity to benefit from a favorable price move. By purchasing options, hedgers can fix a minimum (floor) or maximum (ceiling) price and retain the opportunity to profit from a favorable price move.

For grain buyers (e.g. livestock producers), an alternative to a basic long hedge is buying call options to establish a maximum price on grain to be purchased. In this segment, we will explore the purchase of call options to establish a maximum price.

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…

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

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.

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.

Buy Call Options to Establish a Maximum Price

Date	Cash	Options	Basis/Min. Price
October	Local corn is selling for $4.00/bu.	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. Maximum expected price next spring: $4.60 strike + (-$0.20) basis + 0.39 premium = $4.79

In this example, brokerage fees of about 1 cent per bushel are ignored.

Call options increase in value as prices rise, and they lose value as prices trend lower. Here’s a question to ponder: Once you buy calls in this strategy, do you want prices to trend higher or lower?

Even though calls 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 corn? 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 corn.

Here is how the purchased option strategy performs at various futures price outcomes. If futures prices rise, the value of the 460 July calls increase, and this increase in value offsets the rising cost of corn and allows you to maintain a maximum price. If futures prices trend lower, the value of the 460 July call decreases, but the cost of corn continues to decline.

Futures Market	- $4.60 call value	+ option premium paid	= net futures	+ basis estimate	= cash estimate
$6.20	1.60	0.39	$4.99	-0.20	$4.79
$5.80	1.20	0.39	$4.99	-0.20	$4.79
$5.40	0.80	0.39	$4.99	-0.20	$4.79
$5.00	0.40	0.39	$4.99	-0.20	$4.79
$4.60	0.00	0.39	$4.99	-0.20	$4.79
$4.20	0.00	0.39	$4.59	-0.20	$4.39
$3.80	0.00	0.39	$4.19	-0.20	$3.99
$3.40	0.00	0.39	$3.79	-0.20	$3.59
$3.00	0.00	0.39	$3.39	-0.20	$3.19

Delta and the hedge ratio

Delta is one of a handful of "Greeks" examined by options traders. Delta is how much an option price changes in relation to a one point move in the futures, typically expressed as a percentage. Knowing delta offers some interesting insights into option values.

delta = change in option premium/change in futures price

In general, at-the-money options have a delta close to 0.5, or 50%. Deep in-the-money options have a delta approaching 1, or 100%. Far out-of-the-money options have a delta approaching 0.

For example, if an option has a delta of 0.5, or 50%, this means that the option premium will move about ½ (50%) of the underlying futures price move (e.g., a 10 cent change in the futures prices will be met with about a 5 cents change in the option premium).

Delta is useful in two different ways. First, delta provides a simple interpretation of the probability of an option expiring in-the-money. For example, a deep in-the-money option with a delta of .80, may be said to have an 80% chance of expiring in-the-money. An out-of-the-money option with a delta of .15 could be said to have a 15% chance of expiring in-the-money.

The second use of delta is in calculating a hedge ratio. The hedge ratio is the reciprocal of the delta, and is critical to estimating the number of option contracts needed to reach a fully hedged position.

hedge ratio = 1/Delta

For example, if the delta of an at-the-money option is .5, then the hedge ratio is 2 (because 1/.5 = 2). In this case, two contracts of options are needed to hedge the full value of 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 livestock producer who buys call options that are far out-of-the-money (i.e., 700 corn calls when the futures market is trading at $4.50/bu.). Out-of-the-money call options are much less expensive than options that are at or in-the-money. But if market prices (and corn costs) rise by $1, low delta means that the value of call options will increase much less than $1/bu., and fail to offset rising corn costs.

Further reading

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

At the start of the new year, you decide to buy 10 call option contracts on September corn to lock in a maximum price on 20,000 bushels of corn. 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.

I want you to complete the transaction next June, under three different scenarios. Fill in the blanks in the T-diagram, showing the corn price paid in $/bushel or in gross sales revenues (price * quantity).

Scenario #1: Futures prices change little from January to June

Date	Cash	Options	Basis
January	You have enough corn in storage to meet the needs of your dairy operation through mid-June.	With July futures trading at $4.40/bu., the producer buys 4 contracts of 440 July call options, at a premium of 35 cents/bu.	Maximum price established* is $4.40 + (-$.12) + $.35 + $.01 = $4.64/bu. * Assumes the basis reaches 12 cents under the July contract
June	Buy 20,000 bushels of corn in the local market for $4.21/bu.	With July corn futures at $4.30/bu., the 440 calls are worth less than 1 cent/bu. Let them expire.	What is the basis in June? ______________
Results	What did you receive in the cash market? $/bu. ______________ $total ______________	What was your gain or loss on the put options? $/bu. ______________ $total ______________	What final price did you receive for your corn? $/bu. ______________ $total ______________

Scenario #2: Futures prices rise $1/bu. from January to June

Date	Cash	Futures	Basis
January	You have enough corn in storage to meet the needs of your dairy operation through mid-June.	With July futures trading at $4.40/bu., the producer buys 4 contracts of 440 July call options, at a premium of 35 cents/bu.	Maximum price established* is $4.40 + (-$.12) + $.35 + $.01 = $4.64/bu. * Assumes the basis reaches 12 cents under the July contract
June	Buy 20,000 bushels of corn in the local market for $5.21/bu.	With July corn futures at $5.40/bu., the 440 calls are worth $1.01/bu. Sell the calls.	What is the basis in June? ______________
Results	What did you receive in the cash market? $/bu. ______________ $total ______________	What was your gain or loss on the put options? $/bu. ______________ $total ______________	What final price did you receive for your corn? $/bu. ______________ $total ______________

Scenario #3: Futures prices fall $1/bu. from January to June

Date	Cash	Futures	Basis
October	You have enough corn in storage to meet the needs of your dairy operation through mid-June.	With July futures trading at $4.40/bu., the producer buys 4 contracts of 440 July call options, at a premium of 35 cents/bu.	Maximum price established* is $4.40 + (-$.12) + $.35 + $.01 = $4.64/bu. * Assumes the basis reaches 12 cents under the July contract
June	Buy 20,000 bushels of corn in the local market for $3.31/bu.	With July corn futures at $3.40/bu., the 440 calls have lost all value. Let them expire.	What is the basis in June? ______________
Results	What did you receive in the cash market? $/bu. ______________ $total ______________	What was your gain or loss on the put options? $/bu. ______________ $total ______________	What final price did you receive for your corn? $/bu. ______________ $total ______________