Risk Management Using Futures

Hedging defined…

Use of the futures market as a temporary substitute for an intended transaction in the cash market which will occur at a later date

Relationship Between Cash & Futures
Critical for Risk Management

• Basis = Cash Price - Futures Price
• Rearrange formula
• Basis + Futures Price = Cash Price
Decomposing A Cash Price

• Cash Price = Basis + Futures Price

• Recall definition of Hedging

• Hedging effectively “locks in” the Futures Price when the hedger sells (for a short hedger) the futures contract

• Hedging does not “lock in” the Basis

• Therefore the Cash Price is not locked in and the hedger is still exposed to basis risk

Evaluating A Hedge

Cash Price = Basis + Futures Price

Hedging “locks in” the futures price

But Basis is not locked in, so

Expected Cash Price = Expected Basis + Futures Price
Evaluating A Hedge

At outset of hedge we can estimate the **Expected Selling Price**

**Expected Selling Price** is what the hedger expects to receive for the commodity net of any gains or losses in the futures, minus the brokerage commission.

Expected Selling Price

<table>
<thead>
<tr>
<th>Futures Price at which futures contract is sold</th>
<th>Expected Basis</th>
<th>Brokerage commission</th>
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</thead>
<tbody>
<tr>
<td>Futures Price</td>
<td>+ Expected Basis</td>
<td>- Brokerage commission</td>
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</table>

Futures Hedge Example

Assume Mar. F.C. are $110.60/cwt. when hedge is initiated (Oct 31)

Expect late Feb. basis will = + $2.70/cwt. (for 770 lb. steer)

Assume brokerage commission = $60/round turn or $0.12/cwt.

What is the Expected Selling Price?

Futures Price at which hedge is initiated $110.60

+ Expected Basis $+ 2.70

- Brokerage commission $- 0.12

**Expected Selling Price** $113.18/cwt.
Basis…

- Generally, basis is more predictable than cash or futures prices due to:
  - Convergence
  - Futures and cash prices move together (same fundamental conditions generally affect both markets)
  - Year-to-year stability implies the ability to rely upon historical data for predictions

How should basis be calculated?

- When thinking about basis for beef cattle, important considerations are:
  - Weight of animal
  - Sex of animal
  - Time of year
  - Cash market location
  - Number of head in lot
Forecasting basis...

- Average over several years (years may vary depending on commodity)
  - Average = expected value

- Measure variability (risk)
  - Historical range (highs and lows), standard deviation
  - Variability measure indication of risk

Basis levels for workshop...

- Cash prices are monthly average prices for Iowa auctions (available on www.BeefBasis.com)
- CME nearby futures prices
- 3-year average
  - 700-800 lb feeder steers in spring (Mar): +$2.70/cwt.
  - Fed steers in summer (Aug): -$0.80/cwt.
At Hedge’s Conclusion

Calculate Actual Sale Price (ASP)

Price received in the cash market
+ Net on futures transaction
- Brokerage Commission

Actual Sale Price

Futures Hedge Example

Assume MAR F.C. are $113.60/cwt. on 2/28 when hedge is concluded
Assume cash 768# steer cash price = $116.30/cwt. when hedge concludes

What is your net gain on the futures trade?

Sold MAR F.C. futures @ $110.60
- Offset (buy) MAR F.C. futures @ $113.60

Net gain on futures transaction -$ 3.00
Futures Hedge Example

So, if MAR F.C. are $113.60/cwt. on 2/28 when hedge concludes
And cash 768# steer price = $116.30/cwt. when hedge concludes

What is Actual Sale Price?

| Price received in cash market | $116.30 |
| Net on futures transaction | $ -3.00 |
| Brokerage commission | -$ 0.12 |

**Actual Sale Price** $113.18/cwt.

Expected = Actual. Why?

Because Expected Basis = Actual Basis

Option Hedging Strategies

- Buying a PUT gives option buyer right but not the obligation to SELL a futures contract at a specified price known as the “strike price”

- So, we can use the purchase of a PUT in place of selling a futures contract

- Therefore, you can buy a PUT to establish a “Minimum Expected Selling Price”
Minimum Expected Selling Price

- Buyer of put establishes “minimum” price, but not maximum
- Reason it’s a minimum: put buyer has right, but not obligation, to sell futures contract
  - If prices go up above the strike price you would simply allow the option to expire
- Calculations are similar to Expected Selling Price, but we must convert the put option’s purchase into a futures price equivalent

Minimum Expected Selling Price

- start with put option strike price
- subtract the put option premium
  This creates a “futures equivalent”
- then add basis forecast
- subtract brokerage commission
  - remember that many brokers charge once to buy an option and once to sell an option
  - have to account for possibility of “double” brokerage commission in calculations
Minimum Expected Selling Price

- Example: Buy CME $108.00 MAR Feeder Cattle Put (when MAR Feeder Futures are @ $110.60)
  - Put option premium = $2.34/cwt.
  - Feb 28 basis forecast = $2.70/cwt. (768 lb. steer)
  - Assume brokerage commission is $30 to buy an option contract and $30 to sell an option contract
  - For buyer of $108.00 MAR FC Put
    What is Minimum Expected Selling Price?

<table>
<thead>
<tr>
<th>Option Strike Price</th>
<th>Put Premium</th>
<th>Expected 2/28 Basis</th>
<th>Max. Possible Commission</th>
<th>Min. Expected Selling Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>$108.00</td>
<td>$2.34</td>
<td>$2.70</td>
<td>$0.12</td>
<td>$108.24/cwt.</td>
</tr>
</tbody>
</table>
Actual Sale Price

- Start with price received in cash market
- Look at futures price and use point on profit/loss diagram to determine “net” on option trade
- Add the “net” from the option trade
- Subtract actual brokerage commission

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Actual Sale Price

- Sell cash cattle on Feb 28 for $116.30/cwt.
- MAR feeder cattle futures are $113.60/cwt.
- Let’s look at the Option Trades Profit/Loss diagram
- Diagram lets us view a range of possible outcomes for the option trade
Actual Sale Price Comparisons

Comparison of Alternatives

<table>
<thead>
<tr>
<th>Ending Futures Price, $/cwt</th>
<th>Cash</th>
<th>Hedge</th>
<th>Put option, ($108)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90</td>
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</tbody>
</table>

Assumes actual basis = Expected basis

Actual Sale Price (for buyer of CME Put Option)

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<table>
<thead>
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<th></th>
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</thead>
<tbody>
<tr>
<td>Cash Market Price</td>
<td>$116.30</td>
</tr>
<tr>
<td>+ Net on Option Trade</td>
<td>- 2.34</td>
</tr>
<tr>
<td>- Brokerage Commission</td>
<td>- 0.06</td>
</tr>
<tr>
<td>Actual Net Sale Price</td>
<td>$113.90</td>
</tr>
</tbody>
</table>

Actual > Expected Minimum. Why?

Prices went up after Put Option purchase and the Put Option buyer retained the right to benefit from future price increases.
Livestock Risk Protection Insurance: What Is It?

- Livestock Risk Protection Insurance (LRP)
- LRP for feeder cattle available
  - Provides protection against a decline in Chicago Mercantile Exchange (CME) Feeder Cattle Price Index while you own cattle
  - CME Feeder Cattle Price Index is a 7 day weighted average of cash feeder cattle prices across the U.S.
- LRP for slaughter cattle is also available
  - Provides protection against a decline in the 5 Area Weighted Average Price reported by USDA

Buying LRP
Similar to Buying Put Options

- Chicago Mercantile Exchange (CME) Feeder Cattle Index is used to cash settle Feeder Cattle Futures
- LRP also uses the CME Feeder Cattle Index to settle
  - So, purchase of LRP for Feeder Cattle is similar (but not identical) to purchasing a CME Feeder Cattle put option
What’s Eligible for Coverage?

- Can insure fed cattle, feeder steers, feeder heifers, Brahma and dairy breeds
- Coverage is now available for 13, 17, 21, 26, 30, 34, 39, 43, 47, or 52 week periods
- Feeder cattle must weigh less than 900 lbs. at the end of the insurance period
- Feeder cattle weighing less than 600 lbs. (at end of insurance period) can be insured and will receive a 10% price adjustment to reflect the fact that lighter weight cattle generally trade at a premium to heavier cattle

Frequency of LRP Coverage Offerings

July 2, 2007 thru November 16, 2007

Based on 96 reported days

Kevin Dhuyvetter, PhD, and James Mintert, PhD - Department of Ag. Economics, Kansas State University
John Lawrence, PhD - Department of Economics, Iowa State University
Price Adjustment Factors for Feeder Cattle

<table>
<thead>
<tr>
<th>Weight Range</th>
<th>Steers</th>
<th>Predominantly Brahman</th>
<th>Predominantly Dairy</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;6.0 cwt</td>
<td>110%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td>6.0-9.0 cwt</td>
<td>100%</td>
<td>90%</td>
<td>80%</td>
</tr>
</tbody>
</table>

How Does LRP Work?

To use LRP to protect against a price decline,

- purchase LRP insurance for a particular set of cattle (# of head & ending weight)

- buyer must choose
  - Coverage Price (this is similar to an option’s Strike Price)
  - End Date (e.g., the date coverage ends)

- Price paid is known as LRP premium
  - This is similar to a premium for a CME traded option
LRP Feeder Cattle Premium

- To calculate actual LRP premium you must know
  - Number of cattle ready for market on End Date
  - Target weight per head
  - Ownership share in cattle

LRP Premium Calculation Example

- An operation has 100 head of steer calves
- Expects to market the feeder cattle at a target weight of 768 pounds (7.68 cwt)
- Insured share is 100 percent
- Assume Expected End Price (updated daily by RMA on its website) is $116.51 per cwt when Mar Feeder Futures are @ $115.87
Premium Calculation Example

- Producer selects a coverage price which is a % of the Expected End Price published by RMA

- Assume producer selects $114.81 per cwt. coverage price (e.g., 98.54% of RMA’s expected ending price)

- For this coverage price, the LRP Premium is $1.835/cwt.

- Which totals $14.09/head (7.68 cwt X $1.835)

Minimum Expected Selling Price

- Start with LRP coverage price
- subtract the LRP premium

This creates a “CME cash index equivalent”

- then add basis forecast
- but is this the same basis forecast we used for futures and options?
How should basis be calculated?

- When thinking about basis for beef cattle, important considerations are:
  - Weight of animal
  - Sex of animal
  - Time of year
  - Cash market location
  - Risk management tool being used

  Futures and options use CME futures
  - Feeder Livestock Risk Protection (LRP) uses CME cash index
    \[(LRP \text{ basis} = \text{Cash} - \text{CME cash index})\]
  - Fed Livestock Risk Protection (LRP) uses the 5 State Weighted Average
    \[(LRP \text{ basis} = \text{Cash} - 5 \text{ State Weighted Average})\]

Minimum Expected Selling Price?

- $114.81/cwt. coverage price (close to $114 CME option strike price)
- Producer Paid Premium = $1.84/cwt.
- LRP Basis forecast = $1.90/cwt.

\[
\begin{align*}
$114.81 & \quad - $\ 1.84 \\
+ $\ 1.90 & \quad \hline \\
$114.87 & \quad \text{cwt. Min. Expected Selling Price}
\end{align*}
\]
Actual Sale Price

- Start with price received in cash market
- Use point on profit/loss diagram to determine “net” on LRP purchase
- Add the “net” from the LRP Insurance purchase

Actual Sale Price (for buyer of LRP Insurance)

- Sell cash cattle on Feb. 28 for $116.30/cwt.
- CME feeder cattle index is $114.40/cwt.
- Let’s look at the LRP Insurance Profit/Loss diagram
- Diagram lets us view a range of possible outcomes for LRP Insurance
### Actual Sale Price

<table>
<thead>
<tr>
<th>$116.30</th>
<th>Cash Market Price</th>
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<tbody>
<tr>
<td>- 1.43</td>
<td>+ Net from LRP Insurance</td>
</tr>
<tr>
<td>$114.87</td>
<td>Actual Sale Price</td>
</tr>
</tbody>
</table>

Actual = Expected Minimum. Why?

Prices went down after LRP purchase and actual basis equaled expected basis.

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### Synthetic Put

(forward contract and buy call option)

- Forward cash contract locks in price and basis
- Call options gives the buyer the right to benefit from price increases with limited downside risk (price of premium)
- Forward contracts used in conjunction with call options provide similar results as put options only without the basis risk
Basis

- Cash price – Futures price = Basis
- Basis + Futures price = Cash price

The Futures Hedge

What is the Expected Selling Price?

- Futures Price at which hedge is initiated: $110.60
- Expected Basis: +$ 2.70
- Brokerage commission: -$ 0.12

Expected Selling Price: $113.18/cwt.
The Put Option

$108.00 Option Strike Price
- $ 2.34 Put Premium
+ $ 2.70 Expected 2/28 Basis
- $ 0.12 Max. Possible Commission

$108.24/cwt. Min. Expected Selling Price

LRP

Similar to Put Option

• Producer Paid Premium = $1.84/cwt.
• LRP Basis forecast = $1.90/cwt.

$114.81
- $ 1.84
+ $ 1.90

$114.87/cwt. Min. Expected Selling Price
Synthetic Put

- Set price floor with a forward contract
- Capture market ups by buying a call option
  - Only premium is at risk

Comparison of Alternatives

<table>
<thead>
<tr>
<th>Ending Futures Price, $/cwt</th>
<th>Net Selling Price, $/cwt</th>
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Cash - Blue
Hedge - Pink
Put, ($116) - Green
FC&Call, ($120) - Orange
LRP, (98.54%) - Blue

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