

Grain Futures & Storage Hedging - Part I

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MAST Lesson Objectives

- A. Review Terminology of **Futures Markets & Storage Hedges**
- B. Define & Review “**Basis**”
- C. Discuss “**Carry Charge**” & “**Inverted**” Markets

Functions of Futures Markets

- Price Discovery
 - **Efficient** markets serve as the best price predictors
 - **Efficient Market Hypothesis**
 - All available information about supply, demand & other market factors are reflected in current prices
- Shifting Price Risk
 - Price risk “**shifted**” to others through futures hedges
 - Reducing financial risk by reducing price risk

Futures Contracts & Exchanges

- Futures Contracts
 - Contracts specifying futures commodity delivery terms
- Futures Exchanges
 - Organized Markets where futures contracts are traded
 - Chicago Board of Trade (CBOT)
 - Chicago Mercantile Exchange (CME)
 - Kansas City Board of Trade (KCBT)
 - Minneapolis Grain Exchange (MGE)
 - New York Mercantile Exchange (NYMEX)
 - New York Board of Trade (NYBOT)

Futures Markets - Delivery

- Delivery on a Futures Contract
 - **Delivering** a commodity to location(s) (i.e., delivery points) at a specified time (delivery month) to fulfill futures contract obligations
- Settlement of Futures Positions (3 ways)
 - 1) Physical Delivery
 - 2) Cash Settlement
 - Settling contract value on a **cash basis** (instead of by physically delivering the commodity)
 - 3) Liquidating Futures Contract Positions...
 - Buy or sell back futures to cancel or “offset” earlier position

Futures Contracts: Settlement

- Physical Delivery of Commodity (least common)
 - **Short (Sell) Positions**
 - **Selling** futures to **deliver** commodity **to** buyers of futures
 - Physically deliver a product to a specified location
 - **Long (Buy) Positions**
 - **Buying** futures to **receive** delivery **from** sellers of futures
 - Taking physical delivery of a product at a location
- Cash Settlement (used where available)
- Contract Liquidation (most common)

Futures Hedgers & Speculators

- Hedgers
 - Own the physical commodity they are trading
 - Hedgers either are or will be making cash market transactions involving the physical commodity
 - Storage &/or Preharvest Hedges
- Speculators
 - Do not own physical commodity they are trading
 - Take on the risk of price changes to make a profit
 - Provide “market liquidity”, i.e. enough buyers & sellers to ensure that market transactions can occur

Hedging Defined

- Using the futures market as a *temporary substitute* for an intended cash market transaction that will occur at a *later date*
 - **Hedging** occurs when economic agents take a position (either buying or selling) in a **futures market** that is **opposite** their position in the underlying **cash** or **spot market**
 - **Hedging** is an attempt to **shift price risk** to another party

Storage Hedge Examples

- WHEAT Storage Hedge:
 - MARCH 2010 KCBT Wheat Futures are **sold now** to hedge prices for a planned cash sale of wheat in **February 2010**
 - Wheat is stored till **February 2010**, when MARCH 2010 KCBT Wheat futures contract(s) will be **bought** back
 - Wheat that had been **in storage** since harvest is then **sold**
- CORN Storage Hedge:
 - MAY 2010 CBOT Corn Futures are **sold now** to hedge prices for a planned cash sale of corn in **April 2010**
 - Corn stored till **April 2010**, when MAY 2010 CBOT Corn futures contract(s) will be **bought** back
 - Corn that had been **in storage** since harvest is then **sold**

Calculating “Basis”

- **Basis = Cash Price – Futures Price**
 - Rearranging the basis formula algebraically allows for the decomposition of the cash price
 - **Basis + Futures Price = Cash Price**
- **Local Cash Basis**
 - Difference between local cash price & futures contract price for a specific delivery month
 - Differs from basis at **local delivery point** due to transportation costs, local supply-demand conditions, local buyer-seller competition & other market factors

Evaluating a Hedge

- At the outset, when considering whether to Hedge or not...
 - ⇒ Compute the **Expected Cash Price**
- Doing so requires that we be able to accurately forecast **local basis**

Expected Prices From a Hedge

- **Cash Price = Basis + Futures Price**
- If you do carry out the hedge, are dealing with **expected** basis & cash prices
 - *Expected Cash \$ = Expected Basis + Futures \$*
- For “Short” Hedges this is referred to as **Expected Sale Price**
- For “Long” Hedges this is referred to as **Expected Purchase Price**

Keeping Track of Basis

- Construct a Historic Basis Table
 - Spreadsheet or written records
- Several Time-Period Choices Available
 - Daily, Weekly or Monthly
- K-State Online Sources
 - Grain Basis:
 - <http://www.agmanager.info/marketing/basis/>
 - Cattle Basis
 - <http://www.beefbasis.com/>

Weekly Grain Basis Tables

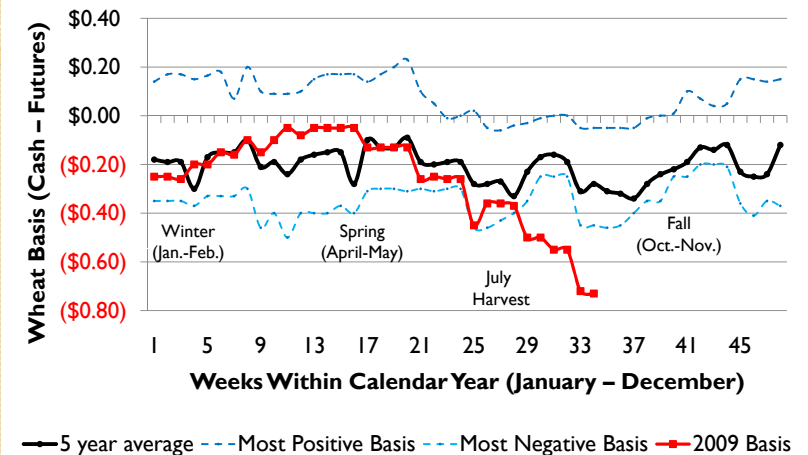
- Select one day per week
 - “Wednesday” mid-week grain basis data typically chosen
 - Industry Standard
 - Avoids disruptions from Holiday Market Closures
 - Holiday closures on Monday-Tuesday or Thursday-Friday
- “Wednesday” Grain Price Data’s represented in www.AgManager.info grain basis records

Choice of Futures Contract for Grain Basis Calculations

- Preharvest Forward Pricing Hedges
 - Use **Harvest** futures contract
- Postharvest Storage Hedges
 - Use **Deferred** postharvest futures contract
 - Expiration at or near the end of the grain storage season (*at or near targeted date of future grain sales*)
- Current Cash Grain Sales
 - Use **Nearby** futures contract

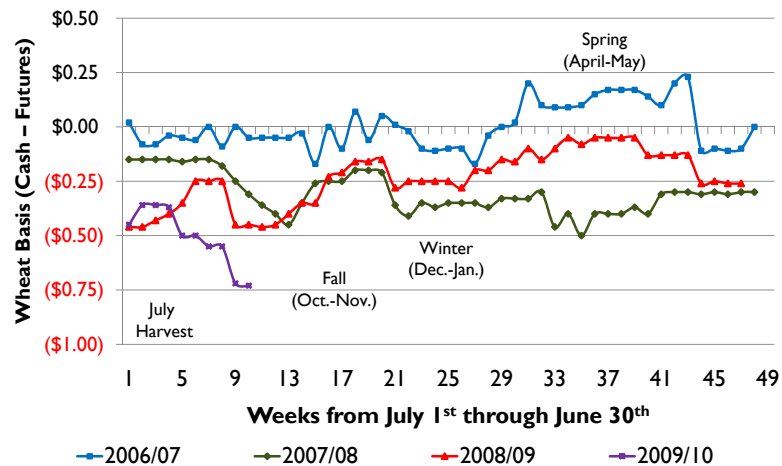
Wheat Basis, Salina, Kansas

Using Nearby KC HRW Wheat Futures (by Calendar Year)



Wheat Basis, Salina, Kansas

Using Nearby KC HRW Wheat Futures (beginning at Harvest)



Purpose of Grain Storage

- 1) Grains are seasonally produced
- 2) Annual average cash price is a function of supply & demand factors
- 3) But how do we allocate supply over the course of the consumption season?
 - By storage of grain until the time it is needed by the market

Storage & Carrying Charges

- What is the expected price path for a seasonally produced storable commodity?
 - 1) Price will rise enough over the course of the storage season to induce some people to store the commodity
 - 2) Generally, expect price to rise enough to cover most, if not all, storage costs
 - “Carrying Charges” in grain prices serve to allocate or distribute grain supplies over time

Grain Storage Costs

- 1) Physical cost of storage
 - On farm or commercial storage
- 2) Opportunity cost of money invested in unsold grain in storage
 - If you sold the grain what would you do with the cash?
 - Pay off a bank loan
 - Invest in a bank account or Certificate of Deposit

I. Physical Storage Cost Example

- Store wheat commercially for 6 months
- Commercial storage charge rate
 - \$0.03 per bushel per month
- Physical Storage Cost = \$0.18 per bushel
 - 6 months x \$0.03 /bu./month

Calculating Opportunity Costs

Example: Storing Grain for 6 Months

1. Outstanding Loan Balance @ 8% Interest
2. Monthly Interest Rate
 - $8\% / \text{year} \div 12 \text{ months} = 0.67\% \text{ interest / month}$
3. Monthly Opportunity Cost
 - $8\% / \text{yr.} \div 12 \text{ mo.} \times \$4.00 / \text{bu.} = \$0.027 / \text{bu./month}$
4. Total Opportunity Cost
 - $6 \text{ mo.} \times \$0.027 / \text{bu./mo.} = \$0.16 / \text{bushel}$
5. Total Storage Cost = \$0.34 /bu (\$0.05 ^{2/3} /mo)
 - $\$0.16 / \text{bu. Opportunity} + \$0.18 / \text{bu. Physical}$

Basis & Gross Returns to Storage

- The change in Basis over the storage period provides the “**gross return to storage**” in a storage hedge
- To evaluate potential gross returns to storage...
 - Calculate basis off of deferred futures contracts

Basis Changes & Returns to Storage

1. If Basis becomes **more positive** over the course of the storage season...
 - ⇒ It provides a **positive** “gross return to storage” for a storage hedger
2. If Basis becomes **more negative** over the course of the storage season...
 - ⇒ It provides a **negative** “gross return to storage” for a storage hedger

Carrying Charge Markets

- Each successive futures contract for a commodity is priced **higher** than the **preceding contract**
- KCBT Wheat Futures (Sept. 11, 2009)
 - September '09 \$4.66 ³/₄ ---
 - December '09 \$4.77 ³/₄ \$0.05 ¹/₂ /bu carry /mo.
 - March '10 \$4.94 ¹/₂ \$0.05 ⁵/₈ /bu carry /mo.
 - May '10 \$5.05 ³/₄ \$0.05 ⁵/₈ /bu carry /mo.

“Full” Carrying Charge Market

- If successive futures contracts are priced such that the price difference across contracts equals the **estimated carrying charge**, then it is called a “**full carrying charge market**”

Example of a Futures Market with a “Full” Carrying Charge

- Situation during 2010 Wheat Harvest (early July)
 - July 2010 KCBT Wheat = \$4.50 / bu
- **If** calculated total carrying charge / month = \$0.06 /bu
- **If** the market is at “full carry”, what would the price be for **March 2011 KCBT Wheat**?
- Total carrying charge
 - 8 months x \$0.06 /bu./month = \$0.48 /bushel
- March 2011 KCBT = \$4.98 /bu.
 - \$4.50 /bu. (July '10 Futures) + \$0.48 /bu. (total carry charge) = \$4.98

Arbitrage Effect on Carrying Charges

- **Arbitrage Effect**
 - Limits the maximum premium of deferred futures prices over the nearby futures to the full carrying charge
- If Monthly \$ Premiums > Carrying Charges, then what can-will traders do? (**Arbitrage the market!**)
 1. Buy the nearby contract
 2. Simultaneously sell the deferred contract
 3. Accept delivery of grain on the nearby contract
 4. Store grain until deferred contract's delivery period
 5. **Then**, deliver against the deferred contract at expiration

Inverse Carrying Charge Market

- Futures markets have an “Inverse” carrying charge when....
 - Nearby futures contract prices are above the succeeding deferred contract futures prices
 - Inverse carrying charge markets provide a strong **disincentive** to store grain

- **CBOT Soybean Futures (Sept. 11, 2009)**

- September '09 \$9.84 ½ ---
- November '09 \$9.03 (\$0.40 ¾) /bu carry /mo.
- January '10 \$9.10 \$0.03 ½ /bu carry /mo.
- May '10 \$9.15 ½ \$0.02 ¾ /bu carry /mo.

Storage Hedging - Part 2

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Storage Hedging

1. Goal of a Storage Hedge
 - To anticipate & successfully speculate on changes in grain basis
2. Relying on the seasonal tendency of grain basis to become more positive as the storage season progresses
 - Net Return to Storage = Basis Change – Costs
 - $\text{Net\$} = \text{Basis } \Delta_{(\text{Starting} - \text{Ending})} - \text{Costs}_{\text{Futures Hedging}}$

Salina KS Wheat Farmer Case

- Wheat basis is wide (i.e., very negative) at harvest
 - Wheat basis typically narrows by late fall
- Farmer wants to capture the expected basis increase (from harvest through late fall)
 - Farmer does not want to speculate on wheat futures prices

Salina KS Wheat Farmer Case (more)

- Solution \Rightarrow Practice Storage Hedging
- How to do a Storage Hedge
 - Place wheat in storage
 - Hedge the future sale of cash wheat
 - \Rightarrow Place a “Short” sell position in the wheat futures market
- Wheat farmer retains the ability to gain if cash basis narrows
 - Has eliminated exposure to the risk of wheat futures prices declining

Salina KS Wheat Storage Hedge

- On July 1st, 2010
 - Local cash price (on July 1, 2010) = \$3.75 /bu
 - Basis = \$0.40 /bu ↓ \$4.15 July '10 Wheat
 - December 2010 KCBT Wheat = \$4.50 /bu
- Farmer decides to store wheat **on farm** until December 2, 2010 (5 months)
 - On farm Storage Cost: \$0.01 /bu/mo = \$0.05 /bu/mo
 - 8% Opportunity Cost on loaned funds = \$0.02⁵ /bu/mo
- Brokerage cost @ \$50 /round turn = \$0.01 /bu

Computing Carrying Charge

Opportunity Cost /month
+ Storage Charge /month
Total Carrying Charge /month

- Opportunity Cost /month
 - 8% / year ÷ 12 months × \$3.75 /bu = \$0.02⁵ /bu/mo
- On Farm Storage Charge /month
 - \$0.01 /bu/month (vs ≈ \$0.03 - \$0.03⁵ /bu/mo commercial storage)
- Total On Farm Carrying Charge per Month
 - \$0.02⁵ /bu (Oppty\$) + \$0.01 (On farm\$) = \$0.03⁵ /bu/mo

Computing Carrying Charge (more)

- Total **On Farm** Carrying Charge / Month
 - \$0.02⁵ /bu (Oppty\$) + \$0.01 (On farm\$) = \$0.03⁵ /bu/mo
- Total **On Farm** Carrying Charge
 - 5 months × \$0.03⁵ / month = \$0.17⁵ /bushel

- Total **Commercial** Carrying Charge / Month
 - \$0.02⁵ /bu (Oppty\$) + \$0.03 (Commercial\$) = \$0.05⁵ /bu/mo
- Total **Commercial** Carrying Charge
 - 5 months × \$0.05⁵ / month = \$0.27⁵ /bushel

Futures Brokerage Commissions for Storage Hedges

- Brokerage Cost
 - Brokers charge fees on a per contract basis to execute futures trades for clients
- Brokerage Cost per Bushel
 - (Brokerage Cost) ÷ (# bushels / contract)
- Example
 - \$50 Brokers Fee to trade a 5,000 bu KCBT wheat futures contract
 - ⇒ \$50 fee ÷ 5,000 bushels = \$0.01 fee per bushel

Expected Storage Hedge Net Sale \$

Futures Price (DEC '10 Futures on 7/1/10)
+ Expected Basis on Delivery Date
– Brokerage Commission (per bushel)
Expected Net Sale Price

Futures Price (DEC '10 KCBT Wheat)	=	\$4.50 /bu
+ Expected Basis @ Delivery	=	–\$0.25 /bu
– Brokerage Commission (per bushel)	=	–\$0.01 /bu
Expected Net Sale Price	=	\$4.24 /bu

Expected Gross Return to Storage

Expected Net Sale Price (Brokerage fee not included)
– Cash Price when Grain Placed in Storage
Expected Gross Return to Storage

Expected Net Sale Price	=	\$4.25 /bu
– Cash \$ when Grain was Stored	=	–\$3.75 /bu
Expected Gross Return to Storage	=	\$0.50 /bu

Alternative View of “Expected to Gross Return to Storage”

- Expected Gross Return to Storage also equals the **change in basis** during storage period
 - Basis relative to selling period futures
- Actual basis on 7/1/10 was \$0.75 /bu under
 - \$3.75 cash \$ (7/1/10) vs \$4.50 DEC Wheat (12/1/10)
- Expected nearby basis on 12/1/10 is \$0.25 /bu under
- Difference between Actual Basis (7/1-12/1): \$0.50 /bu
⇒ **Expected Gross Return to Storage = \$0.50 /bu**

Expected Net Return to On Farm Storage of Wheat

Expected Net Sale Price
– Cash Price on Date Placed in On Farm Storage
– Total Carrying Charge (7/1 to 12/1)
Expected Net Return to On Farm Storage

Expected Net Sale Price	=	\$4.24 /bu
– Cash Price on Storage Date	=	–\$3.75 /bu
– Total Carrying Charge (7/1 - 12/1)	=	–\$0.17 ⁵ /bu
Expected Net Return to Storage	=	\$0.31⁵ /bu

Expected Net Return to Commercial Storage of Wheat

Expected Net Sale Price

– Cash \$ on Date Placed in Commercial Storage

– Total Carrying Charge (7/1 to 12/1)

Expected Net Return to Commercial Storage

Expected Net Sale Price	=	\$4.24 /bu
– Cash Price on Storage Date	=	–\$3.75 /bu
– Total Carrying Charge (7/1 - 12/1)	=	–\$0.27 ⁵ /bu
<hr/>		
Expected Net Return to Storage	=	\$0.21 ⁵ /bu

Storage Hedge Results: Falling Futures Prices

- Assume that Futures Prices Decline
 - December 2010 KCBT Wheat futures decline to \$3.85 /bu. on December 1st, 2010
 - Originally, had been “Short” sold at \$4.50
- Assume that Basis is –\$0.27 /bu (under) on December 1st, 2010
 - Back on July 1st, wheat basis was –\$0.75 (under) DEC 2010 futures
 - Expected to narrow to –\$0.25 (under) by early December 2010

Wheat Storage Hedge Example

Date	Cash Market Transactions	Futures Market Transactions	Basis
July 1	Place 5,000 bu cash wheat in storage Price = \$3.75 /bu	Sell DEC 2010 KCBT Wheat Futures at \$4.50 /bu ?????	7/1 Basis = – \$0.75 /bu vs DEC 2010 KCBT Wheat (–\$0.40 under July 2010 nearby futures)
Dec 1	Sell 5,000 bu cash wheat (out of storage) Price = \$?.?? /bu	Buy Back Futures ?????	Actual 12/1 basis = \$?.?? /bu
	<u>Net on Cash Transactions:</u> \$?.?? – \$3.75 = +/- \$?.?? /bu	<u>Net on Futures Transactions:</u> \$?.?? – \$?.?? = +/- \$?.?? /bu	<u>Basis Change</u> +/- \$?.?? /bu

Actual Net Return to Storage:

\$?.?? Cash +/- \$?.?? Futures +/- \$?.?? Broker – \$?.?? Carry Charge = \$?.?? /bu

A. Wheat Storage Hedge: Falling Prices

Date	Cash Market Transactions	Futures Market Transactions	Basis
July 1	Place 5,000 bu cash wheat in on farm storage Price = \$3.75 /bu	Sell one (1) 5,000 bu contract of DEC 2010 KCBT Wheat @ \$4.50 /bu	7/1 Basis = – \$0.75 /bu vs DEC 2010 KCBT Wheat (–\$0.40 under July 2010 nearby futures)
Dec 1	Sell 5,000 bu cash wheat (out of on farm storage) Price = \$3.58 /bu	Buy one (1) 5,000 bu contract of DEC 2010 KCBT Wheat @ \$3.85 /bu	Actual 12/1 basis = – \$0.27 /bu
	<u>Net on Cash Transactions:</u> \$3.58 – \$3.75 = – \$0.17 /bu	<u>Net on Futures Transactions:</u> \$4.50 – \$3.85 = + \$0.65 /bu	<u>Basis Change</u> + \$0.48 /bu

Actual Net Return to Storage (Falling Price Scenario):

\$3.58 Cash + \$0.65 Futures – \$0.01 Broker – \$0.17⁵ Carry Charge = \$4.04⁵ /bu

Actual Storage Hedge Net Sale \$ Falling Wheat Price Scenario

Actual Cash Price Received
 + Net on Futures Hedge
– Brokerage Commission (per bushel)
 Actual Net Sale Price

Actual Cash Price Received	=	\$3.58 /bu
+ Net on Futures Hedge	=	+\$0.65 /bu
<u>– Brokerage Commission (per bushel)</u>	=	<u>–\$0.01 /bu</u>
Actual Net Sale Price	=	\$4.22 /bu

Actual Net Return to Storage Falling Wheat Prices – On Farm Storage

Actual Net Sale Price
 – Cash Price on Date Placed in On Farm Storage
– Total Carrying Charge (7/1 to 12/1)
 Actual Net Return to On Farm Storage

Actual Net Sale Price	=	\$4.22 /bu
– Cash Price on Storage Date	=	–\$3.75 /bu
<u>– Total Carrying Charge (7/1 - 12/1)</u>	=	<u>–\$0.17⁵ /bu</u>
Actual Net Return to Storage	=	\$0.29 ⁵ /bu

Actual Net Return to Storage 2 Equal Ways to Calculate

A. Actual Net Sale Price
 – Cash Price on Date Placed in Storage
– Total Carrying Charge
 Actual Net Return to Storage

B. Actual Basis Change
 – Total Carrying Charge
– Brokerage Commission
 Actual Net Return to Storage

Actual Net Return to Storage (Alternative) Falling Wheat Prices – On Farm Storage

Actual Basis Change
 – Total Carrying Charge (On Farm Storage)
– Brokerage Commission
 Actual Net Return to On Farm Storage

Actual Basis Change	=	+\$0.48 /bu
– Total Carrying Charge (7/1 - 12/1)	=	–\$0.17 ⁵ /bu
<u>– Brokerage Commission</u>	=	<u>–\$0.01 /bu</u>
Actual Net Return to Storage	=	\$0.29 ⁵ /bu

B. Wheat Storage Hedge: Rising Prices

Date	Cash Market Transactions	Futures Market Transactions	Basis
July 1	Place 5,000 bu cash wheat in on farm storage Price = \$3.75 /bu	Sell one (1) 5,000 bu contract of DEC 2010 KCBT Wheat @ \$4.50 /bu	7/1 Basis = – \$0.75 /bu vs DEC 2010 KCBT Wheat (–\$0.40 under July 2010 nearby futures)
Dec 1	Sell 5,000 bu cash wheat (out of on farm storage) Price = \$4.88 /bu	Buy one (1) 5,000 bu contract of DEC 2010 KCBT Wheat @ \$5.15 /bu	Actual 12/1 basis = – \$0.27 /bu
	<u>Net on Cash Transactions:</u> \$4.88 – \$3.75 = + \$1.13 /bu	<u>Net on Futures Transactions:</u> \$4.50 – \$5.15 = – \$0.65 /bu	<u>Basis Change</u> + \$0.48 /bu

Actual Net Return to Storage (Rising Price Scenario):

\$4.88 Cash – \$0.65 Futures – \$0.01 Broker – \$0.17⁵ Carry Charge = **\$4.04⁵** /bu

Points to Remember from the Wheat Storage Hedge Example

- The storage hedge successfully captured grain basis improvement (narrowing) over time
- The net return to storage was less than expected
 - Because grain basis did **not** narrow or improve quite as much as expected
- Net return to storage is over & above all costs
 - Physical storage costs
 - Opportunity cost on money invested stored grain