9. Non-Convergence and Variable Storage Rates in Futures Markets

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Daniel O'Brien was raised on a grain and livestock farm in south central Nebraska. He received bachelors and masters degrees in Agricultural Economics from the University of Nebraska-Lincoln. After completing his Ph.D. at Iowa State, he worked as the Extension Agricultural Economist at the Northwest Research and Extension Center in Colby and was Northwest Area Extension Administrative Director starting in 2003 before returning to his Extension Agricultural Economist position in January 2007. His ongoing extension and applied research interests and efforts are in the areas of a) grain market supply-demand analysis, bioenergy impacts and risk management strategies, b) grain industry market structure, conduct and performance – focusing on grain handling and transportation issues, and c) economic analysis of irrigated and dryland cropping systems, and associated cropland leasing.

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Elizabeth Yeager joined the Dept. of Agricultural Economics at Kansas State University in January 2015 as an Assistant Professor. She obtained her Ph.D. from KSU in December 20011 and was an Assistant Professor in the Dept. of Agricultural Economics at Purdue University from January 2012 to December 2014. Beth's current efforts are primarily devoted to a range of integrated teaching and research activities in finance and farm management with a focus on firm repayment capacity, efficiency, and productivity. Beth teaches grain and livestock marketing, agricultural finance, and farm and ranch management at the undergraduate level. She is originally from Cottonwood Falls, KS.

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Dr. Art Barnaby was raised on a diversified farm, located in Elk County, Kansas. Art received his B.S. degree from Fort Hays State University, M.S. from New Mexico State University and a Ph.D. in Agricultural Economics from Texas A&M University. Art joined the Agricultural Economics faculty in 1979. He currently holds the rank of Professor. Art conducts national extension education programs on market risk, government commodity programs, crop insurance and public policy. In 2016, Art was named one of Farm Credit's Fresh Perspectives Top 100 Honorees. In 2013, Art was 1 of 30 people who were named on Top Producer Editors' list of "Brave Thinkers: 30 Leaders Who Made a Difference" and on their list of "7 Economists, Bankers Who Challenged the Status Quo". He has authored several research projects on crop insurance issues and their impacts on farmers. His research work with the private sector was the basis for the first revenue insurance contract.

Art is a past winner of the Excellence in Extension Award presented by the National Association of Public and Land Grant Universities. He is also a three time winner of the American Agricultural Economics Association Distinguished Extension Program Award. Art was a member of the 2015 Western Agricultural Economics Association's Group Extension Project Award for the OSU-KSU 2014 Farm Bill Decision Tool and Education Program. Art is a frequent speaker at professional, farmer-producer, ag lender, and insurance industry meetings. Art's wife, Nancy, holds a B.S. degree from Fort Hays State University in Nursing. Art and Nancy have two sons and five granddaughters.

Karly Shull **<k.shull3896@gmail.com>**

Karly Shull is a senior at Fort Hays State University majoring in Agribusiness - intending to graduate in Spring, 2018. Karly served an internship with Kansas State University in summer 2017 at the Northwest Research Extension Center in Colby, Kansas, focusing intensively on grain marketing, farm finance, and in-field farm management issues. Karly Shull is from a family farm operation near Colby in Thomas County, Kansas.

9. Non-Convergence and Variable Storage Rates in Futures Markets

Abstract/Summary

During futures contract delivery periods in years 2016-mid 2017, repeated events of "non-convergence" occurred between CME (Chicago Merchantile Exchange) Kansas hard red winter (HRW) winter wheat futures contracts and cash wheat prices at designated futures contract delivery elevator locations in Kansas and Missouri. Rather than "converging" to near par (i.e., $0.00 per bushel basis) or the determined differential basis values at these designated delivery locations in Kansas City, Missouri, and Wichita ($0.06 under futures), Hutchinson ($0.09 under futures), Salina-Abilene ($0.12 under futures) in Kansas during the delivery period, cash wheat prices of deliverable quality were markedly lower.

Non-convergence during the 2016-2017 period followed a prolonged time during 2009-2010 that caused the Kansas City Board of Trade (KCBT) at that time to initiate an increase in seasonal fixed storage rates in the KC HRW wheat future contract to help convergence to occur. These seasonal rates are figured on an accumulated daily basis, and approximate $0.09 per bushel per month during July-November, and $0.06 per bushel per month during December-June. The intent was that these seasonal storage rates were set high enough on held or unsold 5,000 bushel warehouse receipts that had been delivered by short (sell) position holders on longs (buy positions), that they would discourage the holding the warehouse receipts for later sale instead cash market sales (or "load out"). In other words, the intent was to cause convergence between futures and cash prices by making it unprofitable to pay storage on and hold warehouse receipts.

The recent bout with non-convergence with CME Kansas HRW wheat futures was caused by several factors. First, a large increase in wheat and other grain inventories held at designated delivery elevators and the broader Kansas grain storage system occurred in late 2016 through early-mid 2017. Lack of commercial storage space is the primary causal factor for the reluctance of designated grain elevators to issue properly designated warehouse receipts. They have a motivation to not allow their grain elevators to be "overtaken" by wheat under warehouse receipt that is waiting to be sold. Second, as just alluded to, there was a lack of availability of properly designated 5,000 bushel warehouse receipts from the designated delivery elevators. Wheat producer / sellers require access to these warehouse receipts to be able to execute "short position" delivery actions against CME KS HRW wheat futures contracts.

Third, a relatively small number of businesses within the grain handling system actually did have access to these properly designated warehouse receipts and were able to make delivery. However, the cost of holding these warehouse receipts and paying storage was not enough to motivate "load out", i.e., the sale of wheat under these 5,000 bushel warehouse receipts into the cash market. Fourth, the key issue in regards to non-convergence is that in such periods of large, overwhelming grain inventory levels, commercial grain storage space is highly valued. In this situation, the actual value of commercial storage space in the Kansas grain market was higher than the cost of storage represented in the fixed seasonal storage rates in the CME Kansas HRW wheat futures contract. Therefore, the delivered warehouse receipts were "held" with storage charges being paid instead of being sold into the cash market. As a result, convergence of cash and futures markets for HRW wheat did not occur.

The failure of this futures contract deliver mechanism that was intended to cause convergence in 2016-2017 motivated the CME to adopt a dynamic Variable Storage Rate (VSR) mechanism for the Kansas HRW wheat futures contract. This change will take effect on March 18, 2018 and first impact the CME MARCH 2018 Kansas HRW wheat futures contract. The CME has also changed the form of the futures contract itself, from warehouse receipt to shipping certificates – the form of futures contract used by nearly all other major futures traded commodities.

In this session, an explanation will be given of how this situation of non-convergence between HRW cash and futures developed, how the new VSR on Kansas HRW wheat will work, and what market impacts may occur as a result of these futures contract changes. In particular, there will be a focus on how Kansas HRW wheat futures spreads between upfront and deferred futures contracts may be affected, and what Kansas wheat farmers and the wheat industry may do to effectively manage their wheat price risk under this new futures contract specification.

Non-Convergence & Variable Storage Rates in CME Kansas HRW Wheat Futures

KSU Risk & Profit Conference, August 17-18, 2017

D. O'BRIEN, E. YEAGER & A. BARNABY - KANSAS STATE UNIVERSITY

K. SHULL – FORT HAYS STATE UNIVERSITY

Non-Convergence & VSR Issues

A. If the market is working perfectly, no one will want to deliver!

B. When futures are a dollar higher than cash, is when farmers would like to deliver wheat – as occurred in 2016. This caused the non-convergence.

C. <u>Actions by the CME</u> on Kansas HRW Wheat Futures

From Fixed Seasonal Storage Rates ➲ **Variable Storage Rate (VSR)**

From Electronic Warehouse Receipt ➲ **Shipping Certificates**

➔ Changes effective **March 18, 2018** on the **MARCH 2018 Contract**

Non-Convergence & VSR Issues

D. VSR will be applied to Kansas HRW Wheat Futures

- **Key factors in VSR**
  - Daily grain storage rates
  - Interest Rates
  - Daily KS HRW Wheat futures prices & upfront "*spread*"

Figure 1. HRW Wheat Truck Bids & Basis for Ord Protein Wheat in KC-MO

For MARCH 2009 through JULY 2017 CME HRW Contract Delivery Periods

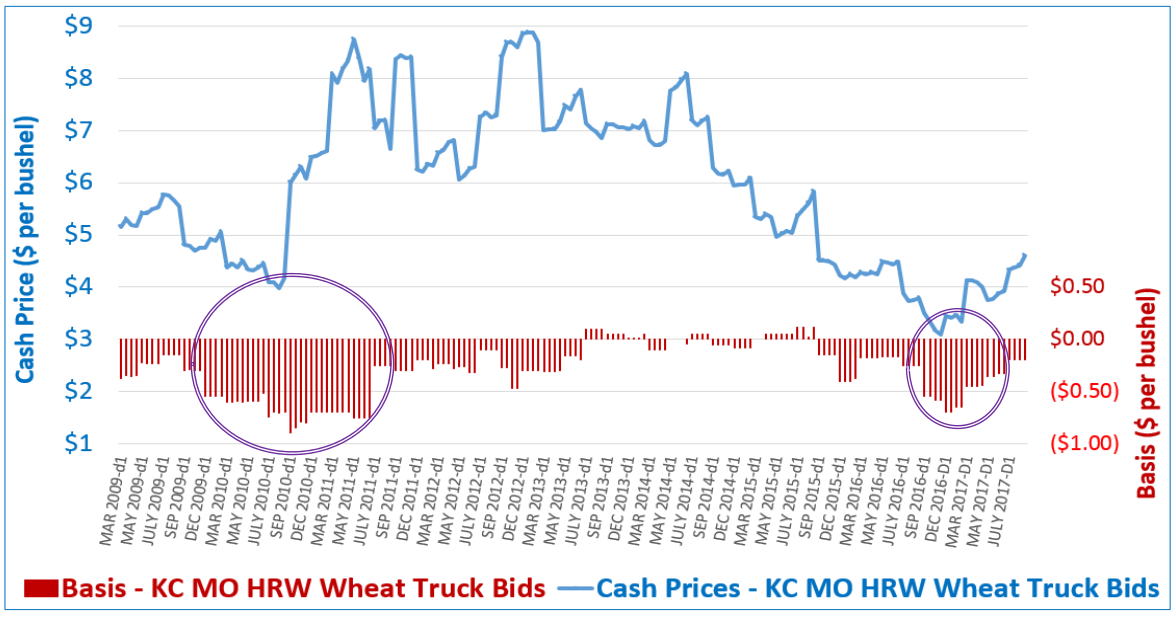
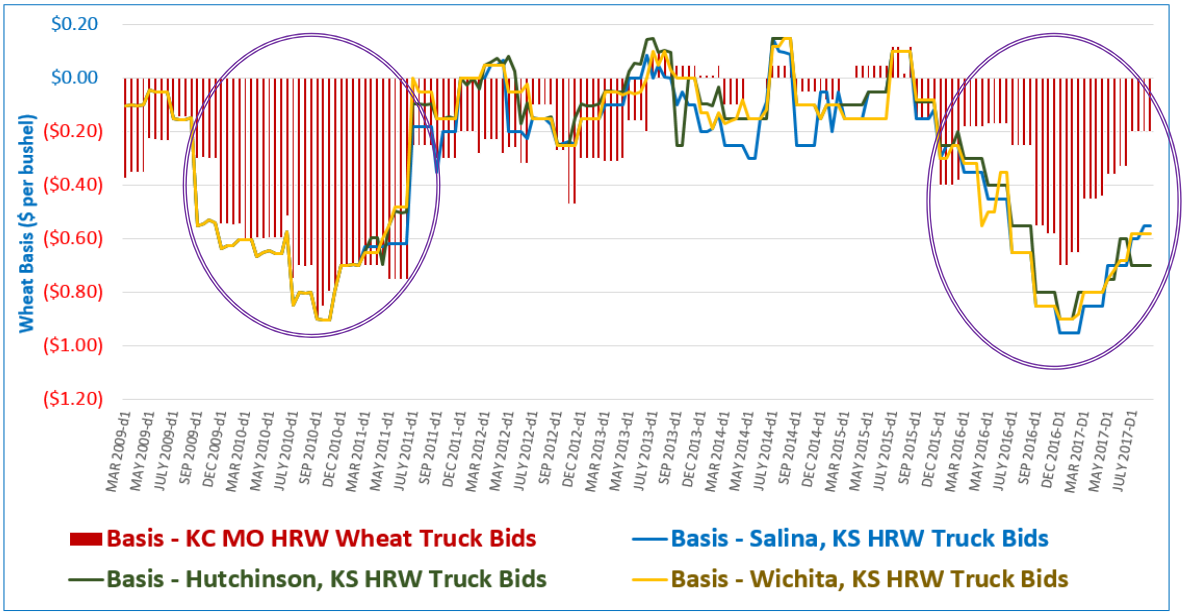


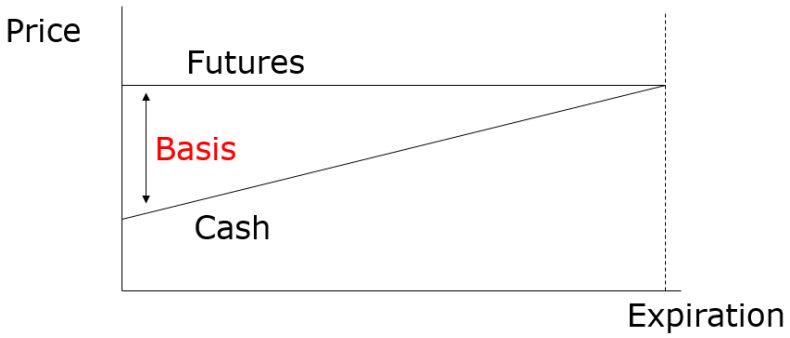
Figure 2. HRW Wheat Ord Protein Basis Bids in KC-MO & Central KS

For MARCH 2009 through JULY 2017 CME HRW Contract Delivery Periods



Convergence of Grain Futures & Cash $'s

- "***Convergence***" is the market pattern of cash & futures prices tending to "*come together*" at contract expiration
  - Grain basis approaches **zero ($0.00)** at the delivery market as the futures contract *expires*



Convergence of Grain Futures & Cash $'s

- **"Convergence" is necessary for….**
  - Effective futures hedging
  - Efficient discovery of storage returns (i.e., "the carry")
  - Performance of crop insurance revenue contracts

Non-Convergence in a HRW Wheat Hedge

- **Pre-harvest - on February 1st**

JULY HRW futures	=	$4.00	
Expected basis	=	$0.40 under	
Expected net price	=	$3.60	

- **THEN at harvest - on July 1st**

JULY HRW futures	=	$5.00	(**JULY futures up $1.00 / bu**)
Actual basis	=	$1.00 under	(**Basis $0.60 / bu *wider* than expected**)
Loss on futures	=	$1.00	
Actual net price	=	$3.00	(**Net price $0.60 *lower* than expected**)

Non-Convergence in a HRW Wheat Hedge

- **Pre-harvest - on February 1st**

JULY HRW futures	=	$4.00	
Expected basis	=	$0.40 under	
Expected net price	=	$3.60	

- **THEN at harvest - on July 1st**

JULY HRW futures	=	$3.50	(**JULY futures down $0.50 / bu**)
Actual basis	=	$1.00 under	(**Basis $0.60 / bu *wider* than expected**)
Gain on futures	=	$0.50	
Actual net price	=	$3.00	(**Net price $0.60 *lower* than expected**)

Non-Convergence in a HRW Wheat Hedge

- **Key to understanding non-convergence**
  - Realizing that physical grain is not deliverable by farmers on futures contracts
- **Delivery Instruments used to make/take futures delivery**
  - Only CME approved elevators can create warehouse receipts / shipping certificates
  - ⇨ *Takers of delivery must **pay storage** on these "paper" delivery instruments **IF** they "hold" rather than "sell" them (i.e., "load out")*
  - Takers of the delivery will receive a margin call for the full value of the contract ($5.00 wheat would create a margin call of $25,000/contract)
- **Non-Convergence** results when the "***value of the delivery instrument***" diverges from the "***value of cash grain***" at the delivery point

Actions by the Chicago Mercantile Exchange:

From Fixed Seasonal Storage Rates ➲ **Variable Storage Rate (VSR)**

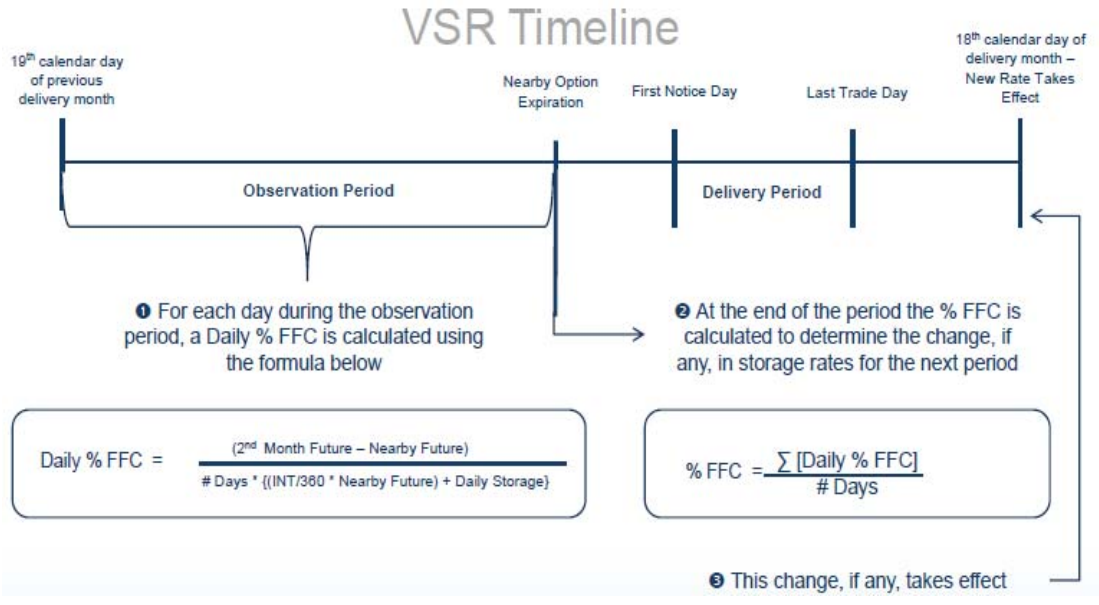
From Electronic Warehouse Receipt ➲ **Shipping Certificates**

➔ *Changes effective* ***March 18, 2018*** *on the* ***MARCH 2018 Contract***

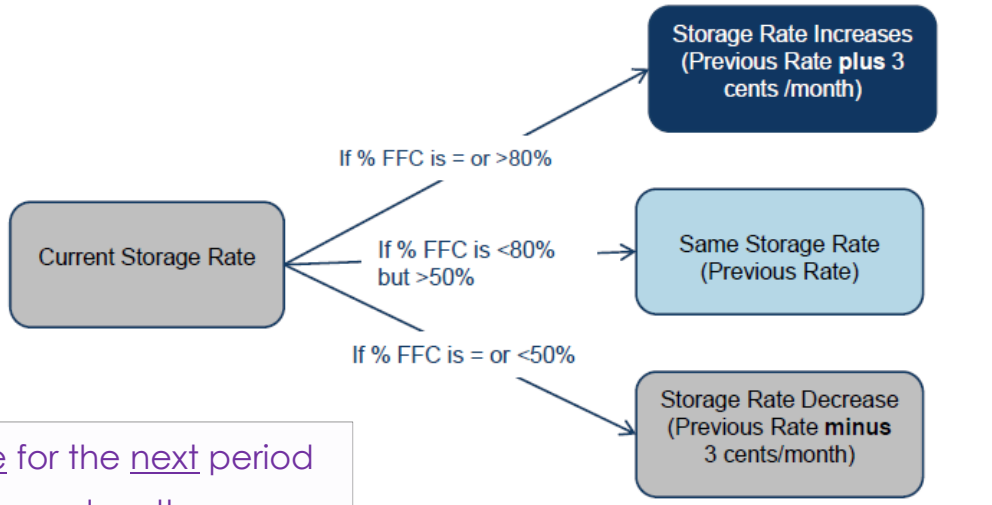
VSR Storage Rates – Timeline & Calculation

CME Group
A CME/Chicago Board of Trade/NYMEX Company

VSR Timeline



VSR Adjustments – Based on % Financial Full Carry



The Storage Rate for the next period will be adjusted based on the **percent of Financial Full Carry (% FFC)**

VSR: "Financial Full Carry" (FFC)

Calculating Financial Full Carry (FFC)

⇨ The cost to…

1) **Take delivery** of a wheat ***shipping certificate***
2) **Carry it** to the *next delivery period* - *and* -
3) **Re-deliver it** during the *next delivery period*

Figuring "Financial Full Carry" (FFC)

$$\#\,Days * \left[\left(Interest/360 * Futures\ \ Price\right) + Daily\ \ Storage\right]$$

Where:

Days = Number of calendar days from first delivery day in the nearby contract to first delivery day in the contract following the nearby contract

Interest = 3-Month LIBOR rate + 200 basis points

Futures Price = Settlement price for the nearby contract

Daily Storage = Current daily premium charge

FFC Example: SEPT 2010 CHI Wheat *(1 day)*

- **62 days** between 1st delivery day for JULY 2010 & SEPT 2010
- **Daily Storage Rate = $0.00165 /day** (≈ $0.05 /month) ***(minimum $)***
- **3-Month LIBOR rate = 0.50%** ⇨ 0.5% +2.0% base = 2.5% interest
- **JULY 2010 Futures = $5.75 /bu**

➢ **FFC $/bu =** $62 * \left[\left(.025/360 * \$5.75\right) + .00165\right] = 12.70\,cents$

VSR Calculator:

CME worksheet

KS HRW Wheat

SEPT 2017

thru 8/8/2017

*****KSU Estimate*****

8/8/2017 - Modified for Kansas HRW Wheat futures by D. O'Brien (KSU)

Variable Storage Rate September 2017 - December 2017 Calculation Period

September 2017 First Delivery Day	9/1/2017	
December 2017 First Delivery Day	12/1/2017	
Number of Carry Days	91	
** Storage Rate Used in Calculation**	$0.00365/bu/day	$0.00365
Running Average Percent of Full Carry	73.04%	

Date	September 2017 Contract Price	December 2017 Contract Price	3M LIBOR Plus 200 Basis Points	Financial Full Carry	Sep17-Dec17 Spread	Sep-Dec Spread as % of Full Carry
7/19/2017	$5.0025	$5.2675	3.30694	$0.3740	$0.2650	70.9%
7/20/2017	$5.0375	$5.3025	3.30722	$0.3743	$0.2650	70.8%
7/21/2017	$4.9600	$5.2275	3.31250	$0.3737	$0.2675	71.6%
7/24/2017	$4.8740	$5.1450	3.31444	$0.3730	$0.2710	72.7%
7/25/2017	$4.7275	$4.9950	3.31389	$0.3718	$0.2675	72.0%
7/26/2017	$4.7550	$5.0250	3.31667	$0.3720	$0.2700	72.6%
7/27/2017	$4.8100	$5.0800	3.31389	$0.3724	$0.2700	72.5%
7/28/2017	$4.8100	$5.0825	3.31111	$0.3724	$0.2725	73.2%
7/31/2017	$4.7475	$5.0200	3.31056	$0.3719	$0.2725	73.3%
8/1/2017	$4.6525	$4.9275	3.31056	$0.3711	$0.2750	74.1%
8/2/2017	$4.6450	$4.9200	3.31056	$0.3710	$0.2750	74.1%
8/3/2017	$4.5975	$4.8750	3.31278	$0.3706	$0.2775	74.9%
8/4/2017	$4.5950	$4.8725	3.31167	$0.3706	$0.2775	74.9%
8/7/2017	$4.6675	$4.9450	3.31194	$0.3712	$0.2775	74.8%
8/8/2017	$4.6050	$4.8775	3.31139	$0.3707	$0.2725	73.5%
8/9/2017						

Calculation of Carry

- **Calculation of carry will be posted on CME Group website**
- **Agmanager.info will either link to CME or calculate this value that will determine the amount of increase or decrease in the VSR**

Questions re: VSR for Kansas HRW Wheat Futures

A. How will the relationship between "lead" & "deferred" HRW wheat futures be affected?

- Likely to affect profitability of cash sales versus storage hedges for Kansas wheat producers

B. Will VSR in HRW Wheat futures cause profits to increase dramatically for Designated Delivery Elevators?

- At first – yes, but eventually VSR takes away incentive to store
- Shipping certificates may "*ease pressure*" on delivery elevators

Summary

1. **HRW wheat futures are not trading the value of wheat, they are trading the value of a warehouse receipt / shipping certificate, that currently has a fixed storage rate.**
   - Corn & soybean shipping certificates also have a fixed storage rate; this could change in the future.
2. **When there is a big crop, the VSR storage rate should increase & ration out the available supply of storage. Currently for HRW wheat the fixed storage rate prevents the market adjustment.**
   - The VSR will allow the market to find the real value of storage & the resulting value of wheat.

Summary

3. **As the contracts roll over & the VSR drives the storage rate higher, at some point it will no longer be profitable for the long to pay the storage cost.**
   - Then they will convert the "***paper***" into real wheat – causing futures & cash prices at delivery points to converge.

4. **Farmers can't ship 5 truck loads of real wheat to Salina & deliver to offset a futures position.**
   - Effectively famers can't make delivery on futures – BUT they can be delivered on.

Summary

5. **The only "people" who can make delivery on HRW wheat are the large multi-national elevators.**
   - In a normal market, only a few deliveries are required to cause convergence.

6. **These same designated delivery elevators must have a strong *balance sheet* combined with "*adequate storage*" to be approved for delivery by CME** (i.e., to be "*declared regular*").

Summary

7. **Famers should NOT carry a short futures position into the delivery period thinking they have the leverage of delivery – because they DON'T.**
   - The only way out of short futures is to buy back their contract.
8. **The academic argument is "*a farmer might find an elevator that would be willing to take delivery IF the farmer were to purchase a warehouse receipt in the secondary market.*"**
   - ***However*** – after paying par value for the receipt, it prevents the farmer from arbitraging the non-convergence.

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