Poor Convergence Performance of CBOT Corn, Soybean, and Wheat Futures Contracts: Causes and Solutions

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Delivery Location Basis on the First Day of Delivery for CBOT Corn Futures, Illinois River North of Peoria, March 2000 - May 2009
Delivery Location Basis on the First Day of Delivery for CBOT Soybean Futures, Illinois River North of Peoria, January 2000 – May 2009
Delivery Location Basis on the First Day of Delivery for CBOT Wheat Futures, Toledo, March 2000 - May 2009

![Graph showing the delivery location basis for CBOT wheat futures in Toledo from March 2000 to May 2009. The graph has a horizontal axis labeled 'Contract Expiration Month' with months from March 2000 to March 2009. The vertical axis is labeled 'Basis (cents/bu.)' with values ranging from -250 to 50. The graph indicates the basis varies over time, with some months showing positive and negative values.]
Problems Created by Non-Convergence

- Wedge between futures and cash prices indicates out-of-balance contracts
  - Hieronymus (1977, p. 340) warns, “When a contract is out of balance the disadvantaged side ceases trading and the contract disappears.”

- Increased basis uncertainty and loss in hedging effectiveness
  - Long-run viability of markets is threatened
Outline of Presentation

- Causes of non-convergence
- Explaining the large carry in futures markets
- Potential solutions
Major Factors Contributing to Non-Convergence

- Spreads reflecting a relatively high percent of full carry
  - Corn, soybeans, and wheat
- Structural issues related to the delivery process
  - Wheat
CBOT Delivery Instruments

- **Corn and Soybeans**
  - Shipping certificates since March 2000
  - Provides taker the right to load out barge on Illinois river within 3 days of notification
  - No expiration date

- **Wheat**
  - Warehouse receipt before July 2008
  - Shipping certificate starting in July 2008
% Full Cost of Carry Calculation

\[
% = \left(\frac{F2 - F1}{\text{Storage} + \text{Interest Costs}}\right) \times 100
\]

- \(F2\) = Price of next nearest to expiration futures contract
- \(F1\) = Price of nearest to expiration futures contract
- Storage = CBOT contract rate \times \# days
- Interest = \((3 \text{ mo. LIBOR rate})/365 \times \# \text{ days})

100% of Full Carry occurs when:
\[(F2 - F1) = (\text{Storage} + \text{Interest Costs})\]
**Full Carry and the Decoupling of Cash and Futures Markets**

- Spreads Go to 100% of Full Carry
- Delivery Takers Hold Certificates and Sell Deferred Futures
- No Load Out to Cancel Certificates

Bottom line: Arbitrage link between cash and futures broken
Spread on the First Day of Delivery between Prices of the Expiring and Next-to-Expire Contracts for CBOT Wheat Futures, March 2000- May 2009
Daily Total of Registered Shipping Certificates or Warehouse Receipts for CBOT Wheat Futures, July 2003 - May 2009
Basis and Percent of Full Carry on First Day of Delivery for CBOT Wheat Futures, Toledo, March 2000 – May 2009
Explaining the Large Carry

1. CBOT maximum storage rates below actual commercial storage costs
2. Presence of large “long-only” index funds
3. Risk premium due to increased uncertainty
### Mid-2008 Comparison of Commercial Storage Costs and CBOT Contract Rates

<table>
<thead>
<tr>
<th></th>
<th>CBOT Survey</th>
<th>Contract Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>4.3 cents</td>
<td>4.5 cents</td>
</tr>
<tr>
<td>Soybeans</td>
<td>4.6 cents</td>
<td>4.5 cents</td>
</tr>
<tr>
<td>Wheat</td>
<td>7.1 cents</td>
<td>4.5 cents</td>
</tr>
</tbody>
</table>
“Goldman Roll” Effect on the Nearby Futures Spread

\[ F_2 - F_1 \]

Expiration of Contract 1

Beginning of Roll Window

Expiration of Contract 1
Average Nearby Spreads for CBOT Wheat Futures during the Roll Window of Long-Only Index Funds, March 1995 – March 2009 Contracts

Risk Premium in the Carry – Craig Pirrong

- Positive shock to volatility of fundamental uncertainty increases the precautionary demand for grain inventories
  - Like increased demand for cash in uncertain times
- Leads to an increase in the expected price of storage, as reflected in the spreads between near and deferred futures
  - Adds a risk premium component to spreads

Spread = Storage + Interest - Convenience + Risk Premium
Proposed Solutions to Convergence Problems

- Address the carry
  - Increase contract storage rates

- Address decoupling of cash and futures markets
  - Cash settle
  - Forced load out/demand certificates
  - Limit speculative ownership of certificates

- Address structural issues
  - Additional delivery locations
Revised CBOT Wheat Delivery System (starting with July 2009 contract)

- Seasonal storage rates
- Added delivery locations in Northwest Ohio (shuttle trains)
- Added selected Ohio and Mississippi River barge shipping stations as delivery locations
- Key: “safety-valve” pricing differentials relative to Chicago and Toledo
Ideal Physical Delivery System

“Delivery on futures contracts is a sampling of value process. The objective is to get a representative sample. There must be a sufficient amount of the commodity move to and through the delivery points that no one can control and distort the price. The amount must be large enough that the price is representative of the value of the commodity generally so that the relationship with prices at other points of commerce are rational.”

Hieronymus (1977, p. 341)
Annual Shipments at Facilities Regular for Delivery of CBOT Corn Futures, 1975 - 2008
Annual Shipments at Facilities Regular for Delivery of CBOT Soybean Futures, 1975 - 2008
Annual Shipments at Facilities Regular for Delivery of CBOT Wheat Futures, 1975 - 2008
Perfect Basis Predictability

Slope = -1
Intercept = 0
R2 = 1

\[ y = \text{Change in Basis (cents/bu.)} \]

\[ x = \text{Initial Basis (cents/bu.)} \]
Predictability of CBOT Wheat Basis Change to First Day of Delivery, Toledo, March 1980 – December 1989

\[ y = -0.56x - 3.37 \]

\[ R^2 = 0.55 \]

\( x = \text{Initial Basis (cents/bu.)} \)

\( y = \text{Change in Basis (cents/bu.)} \)
Predictability of CBOT Wheat Basis Change to First Day of Delivery, Toledo, March 1990 – December 1999

\[ y = -0.55x - 6.99 \]

\[ R^2 = 0.30 \]

\( y = \) Change in Basis (cents/bu.)

\( x = \) Initial Basis (cents/bu.)
Predictability of CBOT Wheat Basis Change to First Day of Delivery, Toledo, March 2000 – May 2009

\[ y = -0.14x + 2.32 \]

\[ R^2 = 0.08 \]

\[ x = \text{Initial Basis (cents/bu.)} \]

\[ y = \text{Change in Basis (cents/bu.)} \]
Maine Potato Futures

"Few traders are likely to use a bad market, and the market could very well die of natural causes." (p. 177)

Committee on Agriculture, Nutrition, and Forestry, United States Senate, "Potato Futures Study", November 5, 1979

1959-72: $y = 1.03x - 0.83$, $R^2 = 0.92$
1973-78: $y = 0.35x - 0.57$, $R^2 = 0.30$

Source: Paul, Kahl, and Tomek, 1981
Proposal: Mississippi River Waterway Delivery System for Wheat

- Eliminate Chicago and Toledo as delivery locations
- Add NOLA as par
- Shipping certificates
- Barge shipping locations on Mississippi River deliverable from Illinois River to NOLA
- Differentials from NOLA based on barge shipping rates
U.S. Wheat Production

SRW Production is concentrated around Northwestern Ohio, Southern Illinois and the Mississippi River Valley.

- **Hard Red Winter**
- **Hard Red Spring**
- **Soft Red Winter**
- **White**
- **Durum**

1 dot = 5,000 acres at the county level (counties with less than 5,000 acres do not appear)

Source: Economic Research Service, USDA.
### Shipments of Wheat Through the Mississippi Gulf, 2003/04 - 2007/08 Marketing Years

<table>
<thead>
<tr>
<th>Marketing Year</th>
<th>Hard Red Winter</th>
<th>Soft Red Winter</th>
<th>Hard Spring</th>
<th>Hard Soft White</th>
<th>Durum</th>
<th>Total ---mil. bu.---</th>
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<tbody>
<tr>
<td>2003/04</td>
<td>58</td>
<td>114</td>
<td>74</td>
<td>1</td>
<td>10</td>
<td>257</td>
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<tr>
<td>2004/05</td>
<td>65</td>
<td>106</td>
<td>60</td>
<td>1</td>
<td>8</td>
<td>240</td>
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<tr>
<td>2005/06</td>
<td>55</td>
<td>52</td>
<td>37</td>
<td>0</td>
<td>6</td>
<td>150</td>
</tr>
<tr>
<td>2006/07</td>
<td>46</td>
<td>91</td>
<td>27</td>
<td>0</td>
<td>4</td>
<td>168</td>
</tr>
<tr>
<td>2007/08</td>
<td>47</td>
<td>130</td>
<td>35</td>
<td>0</td>
<td>6</td>
<td>217</td>
</tr>
<tr>
<td>Average</td>
<td>54</td>
<td>99</td>
<td>47</td>
<td>0</td>
<td>7</td>
<td>206</td>
</tr>
</tbody>
</table>
Terminal Elevators in the Proposed Delivery System

- 77 terminal elevators
- 181 mil. bu. of storage
- 10 mil. bu. of barge loading capacity/day
- Largest 4 firms control 69% of loading capacity (80% in corn and soybeans)
We Have Been Here Before!

“The Chicago wheat futures market has been criticized from time to time for not keeping contract terms current with the changing commerce in wheat. There have been major changes during the past 20 years. Formerly, the predominant movement of wheat was from west to east for flour milling and eastern states were more important than they now are in wheat production. At this time, a higher proportion of U.S. wheat is produced west of the Mississippi River and exports are now about two-thirds of total use. The bulk of exports move through Texas Gulf ports and New Orleans. These changes have reduced the representativeness of Chicago as a pricing and delivery point.”

Tom Hieronymus
May 1978
1974 CBOT Gulf HRW Contract

Monthly Trading Volume, April - December 1974

# of Contracts (thousands)