AN ANALYSIS OF HARD RED WINTER WHEAT CONVERGENCE IN LOCAL DELIVERY POINTS

Nicholas J. Pates\(^1\) and Elizabeth A. Yeager\(^2\)


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INTRODUCTION

- Many agricultural stakeholders hedge with commodity futures to control price risk. Federal crop insurance programs also use futures to estimate expected profits in their underlying contracts. The applicability of futures for these broad uses relies on the idea their prices accurately reflect the value of the underlying commodity at some date in the future.
- Convergence is an important concept for how well futures relate to cash prices and states that:

\[
\lim_{\text{time to maturity} \to 0} (p_{\text{futures}}) = p_{\text{cash in delivery market}}
\]

In perfect markets, the threat of arbitrage theoretically supports convergence in futures markets.
- Futures contracts require the delivery of warehouse receipts as opposed to the physical commodity. Convergence problems can occur when warehouse receipts become difficult to obtain (e.g. storage capacity scarcity).
- Hard red winter wheat (HRW) is a unique farm commodity since it retains several delivery markets in high-production areas. We test for long and short-run convergence of HRW futures and cash prices to examine convergence property differences and explore reasons why they differ. Johansen tests indicate that cash and futures prices exhibit long-run cointegration (convergence) but short-run tests give mixed evidence for the responsiveness to arbitrage opportunities.

RESEARCH OBJECTIVE

Examine short and long-run convergence properties of hard red winter wheat futures contracts between local delivery points in Kansas.

MODELS

Short-Run Convergence Model:

\[
\frac{\Delta C_t}{\Delta F_t} = \alpha + \beta \left( F_{t-1} - C_{t-1} \right) + \varepsilon_t
\]

where \( C_t \) is log cash and futures prices at time \( t \).

Long-Run Convergence Model:

\[
\frac{C_t - C_{t-1}}{F_t - F_{t-1}} = \alpha + \beta \frac{C_{t-1}}{F_{t-1}} + \varepsilon_t
\]

DATA

- Daily cash price data for HRW from 2012 to 2016 collected from Cash Grain Bids for local markets Abilene, Hutchinson, Kansas City, Salina, and Wichita.
- Daily HRW futures prices for contracts deliverable in Mar, May, Jul, Sep, Dec.
- “Nearby” futures identified as those that are closest to maturity (maturity date is the first business day prior to the 15th of the month on the contract.)

DELIVERY MARKET LOCATIONS

- Many of the delivery markets are close (in neighboring counties).
- If basis patterns are similar, we would expect the similar basis patterns in Abilene and Salina, and Hutchinson and Wichita.

BASIS PATTERNS BY YEAR

- Vertical lines indicate the 15th of the delivery month (approximate delivery month) for futures contracts.
- Year-to-year Kansas City markets tended to have the strongest basis
- Dramatic drop in the basis levels in every market starting with the December 2015 contract and continuing into 2016.

ECONOMETRIC RESULTS

Short-Run Convergence

<table>
<thead>
<tr>
<th>Year</th>
<th>Abilene</th>
<th>Hutchinson</th>
<th>Kansas City</th>
<th>Salina</th>
<th>Wichita</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>0.286 ***</td>
<td>0.034</td>
<td>0.894</td>
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<tr>
<td>2013</td>
<td>0.054</td>
<td>0.025</td>
<td>0.684</td>
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<td>0.042</td>
<td>0.176</td>
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<tr>
<td>2015</td>
<td>0.110 **</td>
<td>-0.030</td>
<td>1.000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2016</td>
<td>-0.001</td>
<td>0.022</td>
<td>0.000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

LR Convergence: Johansen (Single Coint.)

<table>
<thead>
<tr>
<th>Year</th>
<th>Location</th>
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<th>Hutchinson</th>
<th>Kansas City</th>
<th>Salina</th>
<th>Wichita</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td>19.02 ***</td>
<td>8.84</td>
<td>10.48</td>
<td>12.28</td>
<td>9.68</td>
<td>5.87</td>
</tr>
<tr>
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<td>8.84</td>
<td>10.48</td>
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<td>9.68</td>
<td>5.87</td>
</tr>
</tbody>
</table>

RESULTS

- Models performed better if we controlled for structural breaks in the futures contracts (maturity dates).
- Johansen test indicates strong evidence of LR equilibrium relationships.
- Some evidence that presence of nearby markets improve the short-run convergence properties.

KEY FINDING

While results indicate that there is some evidence of LR cointegration, results do not show arbitrage response. The LR relationship indicates that futures are still an adequate tool for predicting cash prices at a future date, there is somewhat mixed evidence this relationship is due to responses to SR price fluctuations.