Archie Flanders
University of Arkansas
Northeast Research and Extension Center
Keiser, AR

Stocks-To-Use Ratios and Factors of Equilibrium Price Determination for Corn, Soybeans, and Wheat

Delta States Farm Management Meeting
Vicksburg, MS
May 26, 2016
Background

- Corn, soybeans, and wheat are primary components of U.S. crop production.
- As food grains, oil crops, and feed crops these three crops are associated with meat, poultry, and dairy production in the national food supply.
- Domestic circumstances for corn, soybeans, and wheat have international implications as the U.S. has a major role in production for the global food supply.
Supply and Demand

• Commodity price is the signal that determines market conditions for decision making by producers and consumers.

• The interaction of supply and demand is fundamental for understanding current market prices and investigating the nature of price volatility.

• Technology impacts productivity and production costs.

• Global macroeconomic conditions impact international trade.
Model

(1) \[ S = D + K \]
   
   \[ S = \text{Beginning Stocks} + \text{Production} + \text{Imports} \]
   
   \[ D = \text{Consumption} + \text{Feed Use} + \text{Exports} \]
   
   \[ K = \text{Ending Stocks} \]

(2) \[ \frac{K}{D} = \text{SUR} \]

(3) \[ p_t = f^{-1}(K_t) \]

(4) \[ P_t = \beta_0 + \beta_1 \text{SURUS}_t + \beta_2 \text{SURROW}_t \]
   
   \[ + \beta_3 \text{Cost}_t + \beta_4 \text{Yield}_t + \beta_5 \text{Dollar}_t \]
   
   \[ + \beta_6 T_t + \beta_7 D_{2006-2014} + \mu_t \]
Price (Real) = log f(x), 1975-2014

*Statistically Significant

<table>
<thead>
<tr>
<th>Variable</th>
<th>Corn</th>
<th>Soybean</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.649</td>
<td>7.292*</td>
<td>-1.598*</td>
</tr>
<tr>
<td>SURUS</td>
<td>-0.185*</td>
<td>-0.217*</td>
<td>-0.210*</td>
</tr>
<tr>
<td>SURROW</td>
<td>-0.238*</td>
<td>-0.003</td>
<td>0.056</td>
</tr>
<tr>
<td>Cost</td>
<td>1.142*</td>
<td>0.480*</td>
<td>1.562*</td>
</tr>
<tr>
<td>Yield</td>
<td>-0.629*</td>
<td>-0.938*</td>
<td>-0.559*</td>
</tr>
<tr>
<td>Dollar</td>
<td>-0.317*</td>
<td>-0.732</td>
<td>-0.400</td>
</tr>
<tr>
<td>Trend</td>
<td>-0.019*</td>
<td>-0.024*</td>
<td>-0.025*</td>
</tr>
<tr>
<td>Year =&gt; 2006</td>
<td>0.284*</td>
<td>0.487*</td>
<td>0.286*</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.937</td>
<td>0.904</td>
<td>0.906</td>
</tr>
</tbody>
</table>
Acreage Response to Supply and Demand

• Commodity price is the signal that determines market conditions for decision making by producers and consumers.

• $P = f(SUR)$ is demonstrated by $P=f(x)$ results

Since, Acreage Planted = $f(P)$, $\rightarrow$ Acreage Planted = $f(SUR)$

• A national policy objective is to maintain equilibrium of production with supply and demand (SUR).

• $Acreage_t = \beta_0 + \beta_1SURUS_t + \beta_6T_t + \beta_7D_{2006-2014} + \mu_t$

(Acreage planted is reported in the subsequent marketing year, $Acreage_{t+1}$)
Acreage = log f(x), 1975-2014
*Statistically Significant

<table>
<thead>
<tr>
<th>Variable</th>
<th>Corn</th>
<th>Soybean</th>
<th>Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.572*</td>
<td>4.321*</td>
<td>4.829*</td>
</tr>
<tr>
<td>SURUS</td>
<td>-0.098*</td>
<td>-0.088*</td>
<td>-0.105*</td>
</tr>
<tr>
<td>Trend</td>
<td>-0.001</td>
<td>0.005*</td>
<td>-0.013*</td>
</tr>
<tr>
<td>Year =&gt; 2006</td>
<td>0.149*</td>
<td>-0.006</td>
<td>0.031</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.698</td>
<td>0.622</td>
<td>0.841</td>
</tr>
</tbody>
</table>
Summary of Analysis

- Price (Real) = $\log f(x)$: Prices maintain long-term equilibrium with supply and demand.
- Acreage = $\log f(x)$: Producers make planting decisions to maintain long-term equilibrium with supply and demand.
Corn Price (Nominal), 1950-2015

$/Bu. Year

Soybean Price (Nominal), 1950-2015
Soybean Price (Nominal), 1950-2015
Wheat Price (Nominal), 1950-2015
Summary of Analysis

• Supply and demand achieve long-term equilibrium with prices that have periodic means.
Implications

• How can producers maintain profitability with crop prices that have periodic means and increasing input prices?
• Increased productivity allows producers to increase revenue relative to increased production costs.
• Yield coefficients from Price (Real) = log f(x): Corn (-0.629), Soybean (-0.938), Wheat (-0.559)
• Producers give most of the profitability from yield increases back to consumers.
• Producers increase whole farm profitability by increasing scale of production.
• Real Price: negative trend variable → ↓ profit margins
Farm Cash Receipts, 2014

- Cattle & Hogs: 23%
- Feed Crops: 18%
- Oil Crops: 11%
- Dairy Products: 10%
- Poultry & Eggs: 11%
- Other Animals & Products: 2%
- Other Crops: 7%
- Fruits & Nuts: 7%
- Vegetables & Melons: 5%
- Food Grains: 4%
- Cotton, Lint: 2%
## Farm Cash Receipts, 2014

<table>
<thead>
<tr>
<th>Category</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field Crops (Consumption &amp; Feed) + Animal Products</td>
<td>79%</td>
</tr>
<tr>
<td>Cotton, Lint</td>
<td>2%</td>
</tr>
<tr>
<td>Vegetables, Melons, Fruits, Nuts, Horticulture, &amp; Other Crops</td>
<td>19%</td>
</tr>
</tbody>
</table>
From 1960-1975, prices received kept pace with prices paid.

Since 1975, prices paid have increased at a greater rate than prices received.
Prices Received for Agricultural Commodities and Prices Paid for Production Items, 1975-2015, Real Indexes

The difference between prices paid and prices received is widening.

Is this sustainable?

--- Prices Received --- Prices Paid

Year

Price Index

0.40 0.50 0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40

Conclusion

• There is sustained downward pressure on field crop prices.
• Favorable prices revert to lower prices.
• This is good for buyers of agricultural products.

• Questions?
aflanders@uaex.edu

• Comments?