Policy Options for Integrated Energy and Agricultural Markets

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Market Integration

• In the past, agricultural markets have been well integrated.
• Markets for different energy commodities, especially liquid energy products, also have been tightly linked.
• But agricultural markets and energy markets have not been closely correlated.
Agricultural and Energy Historic Price Correlations

<table>
<thead>
<tr>
<th>Data Pair</th>
<th>Correlation Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crude-gasoline</td>
<td>0.98</td>
</tr>
<tr>
<td>Crude-ethanol</td>
<td>0.88</td>
</tr>
<tr>
<td>Gasoline-ethanol</td>
<td>0.86</td>
</tr>
<tr>
<td>Ethanol-corn</td>
<td>0.25</td>
</tr>
<tr>
<td>Crude-corn</td>
<td>0.16</td>
</tr>
<tr>
<td>Crude-soybeans</td>
<td>0.13</td>
</tr>
<tr>
<td>Corn-soybeans</td>
<td>0.72</td>
</tr>
</tbody>
</table>

Breakeven Corn and Crude Prices with Ethanol Priced on Energy Basis with and without Federal Subsidy
Model Integrating Corn and Energy Markets

- Partial equilibrium model encompassing corn, ethanol and by-products, crude oil and gasoline
- Endogenous variables:
  - Gasoline supply, demand, and price
  - Ethanol supply, demand, and price
  - Corn supply and price
  - Corn use for ethanol, domestic use, and exports
  - DDGS supply and price
  - Operating costs of corn production

Model Description

- The model is driven and solved by market clearing conditions that corn supply equal the sum of corn demands and that ethanol production expands to the point of zero profit
- Exogenous variables include crude oil price, corn yield, ethanol conversion rate, ethanol subsidy rate and mechanism, and gasoline demand shock
Policy Simulations

• For each demand scenario, we simulate the following policies:
  – Fixed subsidy of 45 cents/gallon
  – No ethanol subsidy
  – A variable ethanol subsidy beginning at $70 oil and increasing $0.0175 for each dollar crude falls below $70
  – A renewable fuel standard of 15 billion gallons for corn, such as contained in the energy bill
  – Combination of the RFS and subsidy

Simulation Assumptions

• We assumed a 5% gasoline demand shock to account for income and population growth between now and 2015 – a bit higher demand at any given oil price
• We assumed a 40% export demand shock to account for the fall in value of the US$
• These shocks were not applied to $40 and $60 oil price cases
Retail E10 Price
5% demand shock

Policy Costs
Sensitivity to 30% Corn Yield Increase
(compared with the base cases)

- Ethanol production up substantially
- Corn price down 15-39% depending on the case
- Corn production up 7-22% depending on the case
- Larger share of corn used for ethanol in all cases except RFS at lower oil prices
- Sensitivity results conform to expectations – yield increase means lower corn price, more corn produced, more profitable ethanol, and more ethanol production

Conclusions

- Model results clearly illustrate the linkage between crude oil prices and corn prices and therefore with most agricultural commodities.
- There are substantial differences among the policy alternatives evaluated.
- At high oil prices, oil price trumps policy.
- At high oil prices, the RFS generally is not binding, but the subsidy still has an impact.
- When the mandate is binding, the subsidy serves to reduce the price of blended fuel.
- These model results are consistent with the firm level results illustrated earlier.
Thanks very much!

Questions and Comments

For more information:
http://www.ces.purdue.edu/bioenergy
http://www.agecon.purdue.edu/papers/