FAPRI US biofuels analysis

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Austin, Texas
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Agenda

- Biofuels, energy markets, and policies

- Impacts of current policies
  - EISA (2007 energy bill)
  - Tax credits and tariffs
  - How the various provisions interact

- Trying to keep up with current events
A few words about FAPRI

- Food and Agricultural Policy Research Institute
  - Joint institute of University of Missouri and Iowa State University
  - Working with colleagues at AFPC and a number of other institutions around the world
  - Mission: provide objective analysis of issues related to agricultural markets and policies
  - Funding: grants from Congress, federal agencies, universities, and other institutions
Biofuels in the FAPRI system

- Biofuel components integrated into FAPRI models of US and world agricultural markets
- FAPRI global system
  - Deterministic estimates for grains, oilseeds, cotton, sugar, livestock, poultry and dairy
  - Ethanol and biodiesel components for US, EU, Brazil and other countries
- FAPRI-MU US system
  - For US only, stochastic estimates
  - Draws from petroleum prices, crop yields, other exogenous supply and demand shifters
  - Generates 500 outcomes for US agricultural and biofuel markets
Petroleum price
(West Texas Intermediate)
Rack (wholesale) prices for ethanol and gasoline

Source: Nebraska government website: http://www.neo.ne.gov/statshtml/66.html
Futures prices for ethanol and gasoline, June 6, 2008

- July 2009 contracts
  - Ethanol: $2.50
  - Gasoline: $3.50

- Ratio: $2.50/$3.50 = 71%

- To blenders: ($2.50 - $0.45 tax credit in 2009)/ $3.50 = 58%

- To consumers: ($2.50 - $0.45 + $0.62 taxes & markup)/ ($3.50 + $0.62 taxes and markup) = 65%

- Ethanol BTU content/gal.: ~67% that of gasoline
Biofuel demand

- Distinguish 3 components of ethanol demand
  - “Additive” or “mandatory” demand to meet oxygenate requirements, state mandates, etc.
  - “Voluntary” 10% blend demand
  - E-85 demand

- These three have very different drivers
- EISA and other federal mandates further complicate
Ethanol consumption
Jan. 2008 FAPRI baseline

Billion gallons

September-August marketing year

Additive & mandatory  Voluntary 10% blends  E-85
US ethanol plant capacity, Jan. 1

Source: Renewable Fuel Association. May 28, 2008 totals: 151 plants with 8.69 bil. gal. of capacity; 4.91 bil. gal. under construction (51 plants) or expansion (7 plants)
## Dry mill ethanol plant returns
(Dollars per gallon of ethanol)

<table>
<thead>
<tr>
<th></th>
<th>2005/06</th>
<th>2006/07</th>
<th>July 08 futures*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of ethanol</td>
<td>2.61</td>
<td>2.32</td>
<td>2.45</td>
</tr>
<tr>
<td>Value of distillers grains</td>
<td>0.27</td>
<td>0.34</td>
<td>0.52</td>
</tr>
<tr>
<td>Cost of corn</td>
<td>-0.74</td>
<td>-1.12</td>
<td>-2.21</td>
</tr>
<tr>
<td>Cost of fuel, electricity</td>
<td>-0.27</td>
<td>-0.27</td>
<td>-0.29</td>
</tr>
<tr>
<td>Other operating costs</td>
<td>-0.31</td>
<td>-0.32</td>
<td>-0.32</td>
</tr>
<tr>
<td><strong>Net return over operating costs</strong></td>
<td><strong>1.56</strong></td>
<td><strong>0.95</strong></td>
<td><strong>0.15</strong></td>
</tr>
</tbody>
</table>

*Based on CBOT July 2008 futures prices for ethanol and corn, 6/6/08*
EISA provisions

- Minimum levels of use of various classes of biofuels
  - Overall total grows to 36 billion gallons by 2022
  - Corn-based ethanol can only contribute 15 bil. gallons toward meeting the mandate

- Authority for waivers of the mandates

- Does NOT change pre-existing biofuel tax credits and tariffs
EISA mandates: the simple version

- **Advanced biofuels**
- **Other**

<table>
<thead>
<tr>
<th>Calendar year</th>
<th>Billion gallons</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>2</td>
</tr>
<tr>
<td>2007</td>
<td>3</td>
</tr>
<tr>
<td>2009</td>
<td>5</td>
</tr>
<tr>
<td>2011</td>
<td>8</td>
</tr>
<tr>
<td>2013</td>
<td>12</td>
</tr>
<tr>
<td>2015</td>
<td>18</td>
</tr>
<tr>
<td>2017</td>
<td>25</td>
</tr>
</tbody>
</table>
EISA: a few of the complications

- “Advanced biofuels” include biodiesel, cellulosic ethanol, and other fuels that meet greenhouse gas reduction and other criteria
- Sub-mandates
  - Biodiesel: 1 billion gallons by 2012
  - Cellulosic ethanol: 1 billion gallons by 2013, 7 billion gallons by 2018
- If not waived, each mandate must be met
  - Trading scheme—to use less than mandated amount, must buy credit from those with surplus
  - Could result in different producer prices for three types of ethanol—corn-based, cellulosic, and other advanced (e.g., sugar-based ethanol imports)
EISA: some of the finer points

- Rollover provisions
  - If use more biofuels than required in one year, can carry some credits forward to next year
  - Thus if exceed mandate in 2009, may use less than EISA amount in 2010 (incorporated in model)

- Cellulosic mandate and waivers
  - If expect insufficient supply to meet cellulosic mandate, can waive
  - But if waive, must offer subsidy = max($0.25/gallon, ($3.00/gallon minus wholesale gasoline price)), with inflation adjustments
  - Has interesting implications—lower gasoline prices may increase returns to cellulosic production
  - Still some questions about how this and other provisions of bill will work—alternative readings of bill are possible
Conventional ethanol consumption

Source: Means of FAPRI 2008 stochastic baseline
Biodiesel consumption

Source: Means of FAPRI 2008 stochastic baseline; assumes no mandate increase after 2012
Cellulosic ethanol consumption

Source: Means of FAPRI 2008 stochastic baseline
Other “advanced” biofuel consumption and ethanol imports

Source: Means of FAPRI 2008 stochastic baseline; assumes 1 gal. of biodiesel = 1.5 gal. of advanced biofuel
Ethanol production

![Graph showing ethanol production with and without EISA. The graph plots billion gallons of ethanol production from September to August marketing years from 2007/08 to 2017/18. The blue line represents production with EISA, and the red line represents production without EISA. The production increases over the years with a noticeable upward trend.]
Corn used for ethanol

![Graph showing corn used for ethanol over the years with and without EISA. The graph plots billion bushels on the y-axis and the September-August marketing year on the x-axis. The data shows a steady increase in corn used for ethanol over the years, with a higher trend when EISA is included.](image-url)
Biofuel market results with and without EISA mandates

Biofuel mandates, 2017

- Renewable Fuel Standard: 0.0 (With) 24.0 (Without)
- Advanced biofuels: 0.0 (With) 9.0 (Without)
- Biodiesel: 1.0 (With) 0.0 (Without)

Biofuel supply and use, 2011-2017 average

- Ethanol production: 15.6 (With) 12.4 (Without)
- Ethanol net imports: 1.3 (With) 0.4 (Without)
- Ethanol domestic use: 16.8 (With) 12.8 (Without)
- Biodiesel production: 1.1 (With) 0.6 (Without)
Impacts of removing EISA mandates
2011-2017 average effects

Change in prices

- Ethanol: -12.8%
- Corn: -6.2%
- Soybeans: -6.7%
- Wheat: -3.3%

Farm income and consumer effects

- Crop receipts: -6.6 billion dollars
- Production costs: -2.0 billion dollars
- Net farm income: -3.8 billion dollars
- Food expenditures: -2.0 billion dollars

Without mandates
Other US biofuel policies

- Blender’s tax credit (pre farm bill)
  - $0.51 per gallon for ethanol, expires end of 2010
  - $1.00 per gallon for biodiesel from pre-consumer oils, expires end of 2008

- Ethanol specific tariff (ad valorem of 2.5%)
  - $0.54 per gallon on imports not from Caribbean
  - Specific tariff was due to expire at end of 2008

- Farm bill
  - Reduces ethanol credit to $0.45 per gallon
  - Extends ethanol tariff through 2010
  - $1.01/gallon tax credit for cellulosic ethanol
Removing current policies: effect on corn prices, 2011-17 avg.
Starting from no biofuel policy baseline: effect on corn prices, 2011-17 avg.

- EISA: 8%
- Tax credit: 6%
- Tariff: 1%
- Add all 3: 16%

Percentage change from base
2008/09 ethanol, gasoline rack prices

Source: FAPRI 2008 stochastic baseline
2008/09 ethanol, gasoline rack prices

Source: FAPRI 2008 stochastic baseline

Futures, 6/6/08, March 2009 contracts
NYMEX gasoline: $3.37, CBOT ethanol: $2.50
2008/09 corn, petroleum prices

Source: FAPRI 2008 stochastic baseline
2008/09 corn, petroleum prices

Futures, 6/6/08, March 2009 contracts:
NYMEX petroleum: $136.93-$5.00 basis;
CBOT maize: $6.92-$0.40 basis

Source: FAPRI 2008 stochastic baseline
### Dry mill ethanol plant returns, again  
(Dollars per gallon of ethanol)

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*Based on CBOT futures prices for ethanol and corn, 6/6/08*
What’s happened since January?

- Petroleum and ethanol prices much higher
  - But in “right” relationship to each other
- Corn supply and use much tighter
  - “News” is not ethanol—we had that built in
  - Fewer planted acres in 2008, yield concerns
  - Very strong non-ethanol demand, low stocks
- Narrow ethanol plant margins
  - Normally expect higher margins at higher petroleum/ethanol prices
  - But tight corn situation means margins narrow
Petroleum price revisited
2011-2017 average

- Current market and futures for petroleum are far above stochastic baseline mean
- Sort stochastic results by 2008/09-2017/18 average petroleum price
- Compare top 50 oil price outcomes to average of all 500 outcomes
Ethanol production
2011-2017 average

- With no mandates, credits or tariffs, ethanol production very sensitive to oil price
- By mandating use, EISA results in much ethanol production even at low oil prices
- Interaction effects are important
  - Oil prices matter more without EISA mandates
  - Mandates matter more at low oil prices
Corn prices
2011-2017 average

- With no mandates, credits or tariffs, corn price very sensitive to oil price
- Corn price about the same with
  - No support policies but high oil price
  - Current support policies but average oil price
- Interaction effects again important
Corn price effects
2011-2017 average

- Ranking of policy effects on corn prices depends on oil price
  - Removing mandates has little or no impact at high oil prices
  - Removing credits and tariffs matters more at high oil prices (when mandates do not bind)
For more information

- Visit the FAPRI-MU website
  - [http://www.fapri.missouri.edu/](http://www.fapri.missouri.edu/)
  - US 2008 stochastic baseline: click on the March 5 “FAPRI US Baseline Briefing Book”
  - Watch for report on biofuel policy options later this week, and for other reports related to biofuel and agricultural markets

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