The Impact of the Ethanol Boom on Rural America

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The views expressed are those of the author and do not necessarily reflect the positions of Federal Reserve Bank of Kansas City or the Federal Reserve System.
The Impact of Ethanol

• Today’s Outline:
  – Farm sector impacts are mixed.
  – Nonfarm impacts are probably not as large as people think.
  – The future of ethanol.
A Surge in U.S. Ethanol Production

U.S. Ethanol Production, Mandates, and Corn Use

Source: USDA and Renewable Fuels Association
Ethanol demand helped fuel a crop price boom.

U.S. Crop Prices

Dollars per bushel

Source: Wall Street Journal
How Much of an Impact Did Ethanol Have on Crop Prices?

- National impacts
  - 1% increase in ethanol yields a 0.16% increase in corn prices. (Fortenberry and Park 2008)
  - From 2006 to 2008, ethanol production rose 197.2% yielding a 31.6% increased in corn prices.
  - With $2.00 per bushel corn in 2005, 2005 to 2008 corn price increase attributed to ethanol = 63 cents.
    \((197.2 \times 0.16 = 31.6 \times $2.00 = $0.63 \text{ cents per bushel})\)
Ethanol Plant Impacts on Corn Prices

- **Farm A = 10 miles**
  - National Impact: +63 cents

- **Farm B = 30 miles**
  - National Impact: +63 cents

- **Farm C = 100 miles**
  - National Impact: +63 cents

- **Farm D = 60 miles**
  - National Impact: +63 cents

Photos courtesy of USDA
Ethanol Impacts Less than Expected

Returns to U.S. Corn Production

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008f</th>
<th>2008f Without Ethanol expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Production Costs</td>
<td>$410</td>
<td>$444</td>
<td>$567</td>
<td>$567</td>
</tr>
<tr>
<td>Total Revenues</td>
<td>$478</td>
<td>$659</td>
<td>$748</td>
<td>$651</td>
</tr>
<tr>
<td>Market Revenues</td>
<td>$453</td>
<td>$635</td>
<td>$724</td>
<td>$627</td>
</tr>
<tr>
<td>Yield (bushel/acre)</td>
<td>149.1</td>
<td>151.1</td>
<td>154.0</td>
<td>154.0</td>
</tr>
<tr>
<td>Farm Price (bushel)</td>
<td>$3.04</td>
<td>$4.20</td>
<td>$4.70</td>
<td>$4.07</td>
</tr>
<tr>
<td>Government Receipts</td>
<td>$24</td>
<td>$24</td>
<td>$24</td>
<td>$24</td>
</tr>
<tr>
<td>Net Returns (per acre)</td>
<td>$68</td>
<td>$215</td>
<td>$181</td>
<td>$84</td>
</tr>
</tbody>
</table>

Calculations based on USDA and FAPRI data
How Much of an Impact Did Ethanol Have on Crop Prices?

• National impacts
  – 1% increase in ethanol yields a 0.16% increase in corn prices.  
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  – From 2005 to 2008, ethanol production rose 197.2% yielding a 31.6% increased in corn prices.
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    \((197.2 \times 0.16 = 31.6 \times $2.00 = $0.63\) cents per bushel)

• Local impacts
  – Corn prices rose 12.5 cents with an ethanol plant within 150 square miles.  
    (McNew and Griffith, 2005)
  – Corn prices fall 0.2361 cents per bushel for every mile from an ethanol plant.  
    (Gallagher, Wisner, and Brubaker, 2005)
Ethanol Plant Impacts on Corn Prices

Farm A = 10 miles
National Impact: +63 cents
Local Impact: -2.4 cents
(-0.2361*10)

Farm B = 30 miles
National Impact: +63 cents
Local Impact: -7.1 cents
(-0.2361*30)

Farm C = 100 miles
National Impact: +63 cents
Local Impact: -23.6 cents
(-0.2361*100)

Farm D = 60 miles
National Impact: +63 cents
Local Impact: -14.2 cents
(-0.2361*60)

Photos courtesy of USDA
Non-irrigated Cropland Value Gains by Distance to an Ethanol Plant

Nonirrigated Cropland Value Gains
(Tenth Federal Reserve District)

Percent change year ago

Source: Federal Reserve Bank of Kansas City

Photos courtesy of USDA
# Ethanol Transportation Issues

## Rail Summary:
2006-2008, and 2016 Marketing Years

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethanol Production (billion gallons)</td>
<td>5.8</td>
<td>9.4</td>
<td>11.2</td>
<td>15.0</td>
</tr>
<tr>
<td>Number of Projected Rail Carloads:</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethanol Production</td>
<td>119,347</td>
<td>190,816</td>
<td>227,755</td>
<td>306,122</td>
</tr>
<tr>
<td>Distiller’s Dried Grains with Solubles</td>
<td>26,338</td>
<td>41,650</td>
<td>49,533</td>
<td>66,576</td>
</tr>
</tbody>
</table>

The Livestock Industry Struggles with Feed Costs

U.S. Feed Costs

Index (1990-1992 = 100)

Source: USDA
Will the Livestock Industry Locate Near Ethanol Plants?

Cattle on Feed: Placements

Monthly Average (Thousand head: YTD through September)

Source: USDA
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Nonfarm Impacts of Ethanol

• Construction phase
  – In Missouri, 4 plants 2098 jobs
    (Pierce, Horner, and Milhollin 2007)
  – Challenge
    • Jobs are temporary
    • Use out-of-area workers
    • Use out-of-area materials
  – Boon to the hotel and restaurant industry
Ethanol Plant Impacts on Local Economy

- Direct
- Indirect
- Industry Spending
- Household Spending
- Induced
## Economic Impacts of 100 Million Gallon Plant

<table>
<thead>
<tr>
<th></th>
<th>Output (million $)</th>
<th>Jobs (number)</th>
<th>Value-Added (million $)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direct</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Ethanol Plant)</td>
<td>227.0</td>
<td>46</td>
<td>35.5</td>
</tr>
<tr>
<td><strong>Indirect</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Industry)</td>
<td>25.3</td>
<td>95</td>
<td>11.0</td>
</tr>
<tr>
<td><strong>Induced</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Households)</td>
<td>2.0</td>
<td>29</td>
<td>1.2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>254.2</td>
<td>170</td>
<td>47.7</td>
</tr>
</tbody>
</table>

Economic Benefits Vary by Community Size

Economic Impacts of 100 Million Gallon Plant

<table>
<thead>
<tr>
<th></th>
<th>Hamilton, Illinois</th>
<th>Kankakee, Illinois</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Output (million $)</td>
<td>Jobs (number)</td>
</tr>
<tr>
<td>Direct (Ethanol plant)</td>
<td>214.6</td>
<td>39</td>
</tr>
<tr>
<td>Indirect (Industry)</td>
<td>14.6</td>
<td>97</td>
</tr>
<tr>
<td>Induced (Households)</td>
<td>1.6</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>230.8</td>
<td>153</td>
</tr>
</tbody>
</table>

Source: Low and Isserman, forthcoming.
Multipliers of Ethanol Plants

- Ethanol plants locate in places with lots of corn.
- Leads to crop switching (more corn, less soybeans)
- Do these locations have available acres?
- Over time, what does the market do?
  - Raises the price of soybeans
  - Boosts input costs, especially those to corn.
  - Equalizes net returns at a higher level.

Source: Swenson 2008, Low and Isserman forthcoming
Perceived Economic Benefits Have Declined.

Industry and Household Economic Multipliers

Source: Petersan (2002), Swenson (2008) and Low and Isserman (forthcoming)
Job Impacts of Ethanol Plants

50 million plants
Approx. 35 workers

100 million plants
Approx. 40 workers

With economies of scale, what happens to the job impacts?

Source: Swenson 2008, Low and Isserman forthcoming
The Impact of Ethanol

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  – The future of ethanol.
Ethanol Supply is Greater than Demand.

U.S. Ethanol Production, Mandates, and Corn Use

Billion gallons

Percent of Corn Production

Source: USDA and Renewable Fuels Association
Profit Margins Fall.

**Ethanol and Corn Prices**

- **Ethanol Price (Left Scale)**
- **Corn Price (Right Scale)**
- **Ethanol/Corn Price Spread (Left Scale)**

Spread is equal to ethanol price – (corn price/2.8 gallons per bushel)
Who Will Operate Ethanol Plants in the Future?

Farmer-Owned Ethanol Investment

Percent of Capacity

Source: Renewable Fuels Association
Ethanol is a Policy Driven Industry

- MTBE bans fueled 2006 boom
- Blenders credit drops from 51 to 45 cents.
- Tariff on Brazilian ethanol.
- Renewable Fuels Standard is driving future growth for corn-based and cellulosic ethanol.

Where is Market-Driven Demand?
Ethanol Market Truths

- Ethanol is a commodity.
- The low-cost producer will survive.

1. *Is the U.S. the low-cost producer of ethanol?*
2. *Who has lower fixed costs?*
   - Fixed costs depreciated in older plants, but plants are smaller.
   - Larger plants can spread fixed costs, but fixed costs are not depreciated.
3. *Will new technologies make ethanol efficient?*
   - Enzymes to boost yields
   - Transportation and distribution networks
   - Disposal of distilled grains
Conclusions

- Ethanol has provided mixed farm impacts.
- The farm and non-farm benefits are not as large as some people tout.
- A short-term shake-out in the industry.
- Ethanol is a policy-driven industry.
- New technological innovations are needed.

*A viable ethanol industry is one that can stand the market test.*