Investing in Global Farm Productivity

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Thesis: Future profitability of U.S. agriculture will depend on balance of...
  - local and global productivity gains relative to
  - expansion of global demand for food, feed, fuel and fiber

Outline
  - Where we are and how we got here
  - Future prospects
World population growth

Source: U.S. Census Bureau International Data Base, June 2013
Global crop yields

<table>
<thead>
<tr>
<th></th>
<th>2010-12 average</th>
<th>Annual growth rate</th>
<th>Percent growth rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn</td>
<td>5.06 mt/ha</td>
<td>0.07 mt/ha</td>
<td>1.4%</td>
</tr>
<tr>
<td>Rough rice</td>
<td>4.35</td>
<td>0.04</td>
<td>0.9%</td>
</tr>
<tr>
<td>Wheat</td>
<td>3.07</td>
<td>0.03</td>
<td>0.9%</td>
</tr>
<tr>
<td>Soybeans</td>
<td>2.45</td>
<td>0.02</td>
<td>0.9%</td>
</tr>
<tr>
<td>Corn</td>
<td>81 bu/a</td>
<td>1.1 bu/a</td>
<td>1.4%</td>
</tr>
<tr>
<td>Rough rice</td>
<td>3,878 lb/a</td>
<td>33 lb/a</td>
<td>0.9%</td>
</tr>
<tr>
<td>Wheat</td>
<td>46 bu/a</td>
<td>0.4 bu/a</td>
<td>0.9%</td>
</tr>
<tr>
<td>Soybeans</td>
<td>36 bu/a</td>
<td>0.3 bu/a</td>
<td>0.9%</td>
</tr>
</tbody>
</table>

Source: author calculations from PSD Online data. Trend is simple linear trend fit over 1990-2012.
Global crop use, lbs./capita

For corn, increases in per-capita feed use account for about 39% of the increase in per-capita use since 1990. Ethanol and other uses account for the rest. For soybeans, increased use of soymeal in livestock rations and soyoil in both food and industrial uses contributed to the growth in per-capita use.

Source: author calculations from PSD Online data. Trend is simple linear trend fit over 1990-2012.
World crop area harvested

Source: USDA PSD Online data, June 2013

Increase between 2002 and 2012: 78 mil. ha (193 mil. a.)

India, Brazil, China & U.S. accounted for 59% of the increase in 4-crop area
Corn and soybean yields

**Corn**

- U.S.
- Argentina
- China
- Brazil

**Soybeans**

- U.S.
- Argentina
- China
- Brazil

Source: Author calculations based on USDA PSD Online data, June 2013
U.S. livestock and dairy yields

Source: Author calculations based on MU Agricultural Markets and Policy (AMAP) database, Jan. 2013
U.S. research and development and multifactor productivity growth

<table>
<thead>
<tr>
<th></th>
<th>Annual growth in real, total agricultural research &amp; development spending</th>
<th>Annual growth in multifactor productivity in the agricultural sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-1970</td>
<td>3.77%</td>
<td></td>
</tr>
<tr>
<td>1970-1990</td>
<td>2.66%</td>
<td></td>
</tr>
<tr>
<td>1990-2009</td>
<td>1.20%</td>
<td></td>
</tr>
<tr>
<td>1949-1990</td>
<td>2.02%</td>
<td></td>
</tr>
<tr>
<td>1990-2007</td>
<td>1.18%</td>
<td></td>
</tr>
</tbody>
</table>

Notes: Research and development spending includes both public and private spending, in real, inflation-corrected terms. Multifactor productivity is a measure of outputs obtained relative to inputs used.

Source: Pardey, et al., “Public Food and Agricultural Research in the United States,” AGree, April 2013, Table 1 and text on page 3.
U.S. agricultural research and development spending, 2009

Industry: 57.2%
SAES: 27.1%
Federal Gov't: 11.3%
Other Univ.: 4.4%

Note: 2009 total: $11.1 billion
Source: Pardey, et al., Figure 3
U.S. private agricultural research and development spending

World agricultural research and development spending

Private, 2006, total $8 bil.

- United States: 35%
- Europe & Middle East: 50%
- Asia-Pacific: 12%
- Canada & Latin Amer.: 3%

Public, 2005, total $27 bil.

- United States: 16%
- Other higher income: 28%
- Other lower income: 31%
- China: 14%
- Japan: 11%

Sources: Private data is from Fuglie, et al., Table 4. Public data is from Pardey et al., Figure 5.
World agricultural research and development spending, 2007

*Crop and animal science
Source: Fuglie et al., Table 11
U.S. corn yields

Note: these stochastic estimates allow weather, oil prices and several other factors to vary—but they assume a steady underlying rate of technology gain.

Source: USDA NASS for history; FAPRI-MU baseline, Jan. 2013.
U.S. corn prices

Dollars per bushel

Agricultural productivity has increased here and around the world.

Future rate of growth will depend on public and private investments.

Balance of U.S. and foreign productivity growth and global growth in demand for food, feed, fuel and fiber will determine future U.S. farm profitability.
Thanks!

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  - Jarrett Whistance
  - Peter Zimmel
- **Other major sources:**